SECTION 000110
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END OF SECTION

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A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

1. Less Than 12 Inches Square: Secure with sash locks.
2. Up to 18 Inches Square: Provide two hinges and two sash locks
3. Up to 24 x 48 Inches: Three hinges and two compression latches.
4. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.2 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.3 FIRE DAMPERS

A. Manufacturers: Ruskin, Louvers & Dampers Inc, Ventco.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Curtain Type Dampers: Type B galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades completely out of air stream.

E. Multiple Blade Dampers: 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 per sq yd
2. Net Fabric Width: Approximately 2 wide.
3. Metal: 3 inch wide, 24 gage galvanized steel.

C. **Furnish flexible connectors for all RTU's and roof mounted and in line exhaust fans. Duct shall be supports independently on each side of the flex connector. Duct straps shall not be permitted to span the flexible connector.**

2.5 VOLUME CONTROL DAMPERS.

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

2.6 SPIN-IN FITTINGS:

A. Furnish and install spin in fittings at each round diffuser takeoff.

B. Fitting for supply shall have scoop and damper with locking handle. Return and exhaust takeoffs shall have damper only. Where located above a hard ceiling, the damper is not required. Diffuser takeoffs may also be forty five degree rectangular fitting with square to round and manual volume damper.

C. Spin-ins shall be equal to Shipman S-4. Acceptable manufacturers are Crown and Clevaflex.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15890 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install fire dampers in accordance with NFPA 92A.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.

I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 59 10

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: New Kent, VA Carmax.

B. Project Type:

C. Owner's Name: CarMax Auto Superstores, Inc., a Virginia Corporation..

D. Architect's Name: Charles J. O'Brien III, in Association with Pieper O'Brien Herr Architects, Ltd..

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price.

1.03 WORK UNDER OTHER CONTRACTS

A. Separate Contract: Owner will award separate contracts for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract. These contracts may include, but not limited to the following, and as identified on the Contract Documents:
   1. Fuel for the fuel dispensing system.
   2. Safe located in the Cash Room.
   3. Automobile lfts.
   4. Signage
   5. Security system.
   6. Security gate equipment.
   7. Office Furniture.
   8. Retail Fixtures/Laminate casework
   9. Car Wash Equipment.
   10. Sanding Station.
   11. Paint Booth.

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.

C. The Owner retains the right to enter into additional future separate contracts beyond those identified above.

1.04 OWNER FURNISHED, CONTRACTOR INSTALLED PRODUCTS

A. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

B. Schedule the Work to accommodate Owner occupancy.

C. Owner will furnish certain products, materials, and equipment. The Work includes providing support systems to receive Owner's equipment and plumbing, mechanical, and electrical connections.
   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
   2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
   3. After delivery, Contractor shall inspect delivered items for damage. Contractor shall report any damage to the Owner within 48 hours after receipt of Owner-furnished products.
   4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
   6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.

7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.Contractor is responsible for obtaining all MSDS (Material Safety Data Sheets) information regarding handling, fabrication, and installation of Owner-furnished materials. The Owner shall supply any information reasonably requested in a timely manner by Contractor as required for installation procedures for materials.

1.05 OWNER FURNISHED, OWNER INSTALLED PRODUCTS

A. Owner or separate vendors will install various fixtures and other items prior to the Date Of Substantial Completion, in accordance with a Grand Opening Timeline schedule to be published by Owner. Contractor shall be responsible for the preparation of all areas to receive such fixtures and other items, including (but not limited to) the requirements listed below. Contractor shall report to Owner on a weekly basis the status of all areas to receive this work using the “Vendor Checklist” forms provided in these specifications.
   1. Voice and Data Cabling – Partition studs must be complete at the time voice and data cabling work starts. All conduit, boxes, and pull strings for voice and data cabling must be complete in accordance with the agreed construction schedule. The PBX Room (see Item below) shall be as listed below prior to the start of low voltage cabling.
   2. Climate Conditions – Buildings are to be completely closed in and climate-controlled in a timely manner prior to receiving Owner-installed items.

1.06 CONTRACTOR USE OF SITE AND PREMISES

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

1.07 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 32-division format and CSI/CSC's "MasterFormat" numbering system.
   1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

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

1.08 CORRELLATION AND INTENT OF CONTRACT DOCUMENTS

A. The drawings and specifications are complementary. If Work is shown or referenced only on one but not on the other, the Contractor shall perform the Work as though fully described on both consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

B. Information identified in one Contract Document and not identified in another shall not be considered to be a conflict or inconsistency. Where a conflict occurs within the Contract Documents, and is not claried by written response from either Owner or Architect, the more expensive or time consuming requirement shall be provided.

C. The Contractor shall provide all material and labor required to produce a completed, finished project. Failure to include items indicated to be provided, though not detailed, shall not constitute the basis for a change order.

D. Any doubt as to whether any Work is within the scope of the contract shall be resolved in favor of an interpretation that the Work is within the scope of the contract.

E. Notify the Architect in writing immediately upon discovery of a conflict with the Contract Documents.

1.09 SITE VISIT SCHEDULE

A. The Architect and their consultants will visit the site periodically based on the outline below:
   1. Site – Civil, monthly throughout construction period
   2. Landscape & Irrigation – Landscape Architect, staking and installation
   3. Footing and foundations (slab) and masonry mockup – Architectural & Structural
   4. Utility stub-in (slab) – Architectural & MEP
   5. Structural steel (including metal deck) – Architectural & Structural
   6. Exterior fenestration (progress) – Architectural
   7. Mechanical rough (RTU's set and duct work hanging) – Architectural & Mechanical / Plumbing
   8. Electrical rough (prior to cover-up) – Architectural & Electrical
   9. Drywall finishing (prior to painting), ceiling grid and the tile being installed – Architectural
   10. Fuel System – installation of tank and underground piping
   11. Punchlist – All
   12. Follow-up – All
   13. Final site work complete – Landscape & Irrigation only

B. The General Contractor shall provide the Architect, and adjust as the project progresses, a date for each of the scheduled visits based on the General Contractor's schedule. The General Contractor shall notify the Architect no less than 2 weeks prior to a scheduled trip if the project has not reached the specified level of completeness in order to have the trip rescheduled. If the project is not ready and notice has not been provided, then the General Contractor shall be responsible for the additional services requested by the design team as well as any non-refundable reimbursable costs incurred

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 011400
WORK RESTRICTIONS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

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

1.02 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1.03 OCCUPANCY REQUIREMENTS

A. Partial Owner Occupancy: Owner reserves the right to occupy and to place and install equipment in all areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. The Contractor shall obtain a Certificate of Occupancy from authorities having jurisdiction before full Owner occupancy.
   2. If substantially complete at the time of occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building that have been inspected and issued a Certificate of Substantial Completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 01600 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.03 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.04 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form provided at the end of this Section.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from [ICC-ES] .
      j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's

letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

k. Cost information, including a proposal of change, if any, in the Contract Sum.

l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.

m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor directly through extranet specifically established for Project of acceptance or rejection of proposed substitution within fifteen days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

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

1.06 PROCEDURES

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

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

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

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

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Requested substitution provides sustainable design characteristics that specified product provided.

c. Substitution request is fully documented and properly submitted.

d. Requested substitution will not adversely affect Contractor's construction schedule.

e. Requested substitution has received necessary approvals of authorities having jurisdiction.

f. Requested substitution is compatible with other portions of the Work.

g. Requested substitution has been coordinated with other portions of the Work.

h. Requested substitution provides specified warranty.

i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: **Not allowed**.

PART 3 EXECUTION (NOT USED)

PART 4 FORMS

4.01 REQUEST FOR SUBSTITUTION FORM

A. Request for Substitution

1. This form must be completely filled in with all relevant data by the Subcontractor and submitted to the Project Manager for consideration before any request to change the drawing or specification requirements will be considered. Contractor requests for substitutions will be considered upon timely receipt of this completed Substitution Approval Request Form and all required supporting documentation. Substitutions made without completion of this form and the Architect's approval will be considered defective work.
2. Substitution requests shall be made separately from, and outside of, any request for information submissions. Substitution requests made via request for information will be rejected entirely, or not responded to.
3. Utilize form shown in Section 012501.

END OF SECTION

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SECTION 012501
SUBSTITUTION REQUEST FORM

PART 1 SUBSITUTION REQUEST

1.01 REQUEST FOR SUBSTITION

A. This form must be completely filled in with all relevant data by the Subcontractor and submitted to the Architect for consideration before any request to change the drawing or specification requirements will be considered. Contractor requests for substitutions will be considered upon timely receipt of this completed Substitution Approval Request Form and all required supporting documentation. Substitutions made without completion of this form and the Architect's approval will be considered defective work.

1.02 REFERENCE DATA

A. Project Name: _____ Date of Request:_____

B. Request by (Firm): _____

C. Address: _____

D. Contact Person: _____ Phone: _____

1.03 SUBSTITUTION REQUEST DATA:

A. Substitution requested is for (Circle One):
   1. Named Product
   2. Product type, material, finish, or formulation
   3. Fabrication or installation methods

B. Reason for request: _____

PRODUCT/MATERIAL/METHOD FOR WHICH SUBSTITUTION IS REQUESTED IS SHOWN ON THE FOLLOWING DOCUMENTS:

C. Specification: Section No: _____ Page(s): _____ Clause No.(s):_____

D. Drawings (List No.'s of Drawings affected): _____
_____

1.04 COST/BENEFIT ANALYSIS

A. Describe in detail any alteration to any other part of the Works required by use of the requested substitution: _____
_____
_____

B. Total Net Cost of any such other required alterations, including overhead and profit:
   1. $_____

C. Cost of Builder's Administration (to be filled in by the Builder):
   1. $_____

D. Cost of Architect’s documentation and administration (to be filled in by Architect)
   1. $_____

E. Total cost savings achieved (from page 2, to be filled in by Architect):
   1. $_____

F. Benefits to Owner other than financial: _____
_____
_____

1.05 ADDITIONAL INFORMATION REQUIRED

A. Complete the second page as applicable. Attach the following information:
   1. Manufacturer’s technical data sheets on proposed products.
   2. Manufacturer’s standard form of warranty.
   3. Letter on manufacturer’s letterhead stating that manufacturer will warrant products as specified, if specification.

1.06 COMPARISON OF OPTIONS

A. Fill in the following blanks as are applicable to the product, material or method type. As a guide, if the item is mentioned in the Specification as a performance or materials replacement, then information about the proposed substitution is required by the Architect to evaluate the proposed substitution. Requests lacking relevant information will be returned without action.

SPECIFIED PRODUCT, MATERIAL OR METHOD	PROPOSED SUBSTITUTION
Description:_____	Description:_____
_____	_____
_____	_____
_____	_____
_____	_____
Product Name:_____	Product Name:_____
Type:_____	Type:_____
Model No.:_____	Model No.:_____
Fire rating (hours):_____	Fire rating (hours):_____
Thickness:_____	Thickness:_____
Country of manufacture:_____	Country of manufacture:_____
Substrate preparation required:_____	Substrate preparation required:_____
_____	_____
_____	_____
_____	_____
Length of warranty available (years):_____	Length of warranty available (years):_____
Sound transfer coefficient (STC):_____	Sound transfer coefficient (STC):_____
Exposure class:_____	Exposure class:_____
Resistance to chemicals (list):_____	Resistance to chemicals (list):_____
_____	_____
_____	_____
Other specified criteria (list):_____	Other specified criteria (list):_____
_____	_____
_____	_____
_____	_____
_____	_____
UNIT COST OF PRODUCT / MATERIAL (Must be completed):	UNIT COST OF PRODUCT / MATERIAL (Must be completed):
$_____What:_____	$_____What:_____
Units required:_____Total value: $_____	Units required:_____Total value: $_____

1.07 BUILDER'S REVIEW

A. I certify that I have checked the above documentation for the proposed Request for Substitution and warrant it to be substantially complete and accurate.

B. Signed by:_____ Date:_____

1.08 ARCHITECT'S RESPONSE

A. Approved Approved as Noted Approved ind Part

B. Revise and Resubmit Rejected Returned Without Review

C. Comments/Clarifications: _____
_____
_____

D. Approved By: _____ Date: _____

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Requests for Interpretation (RFI) procedures.

D. Submittal procedures.

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

F. Number of copies of submittals.

1.02 RELATED REQUIREMENTS

A. Section 013220 - Photographic Documentation: Additional documentaiton requirements.

B. Section 016000 - Product Requirements: General product requirements.

C. Section 017000 - Execution Requirements: Additional coordination requirements.

D. Section 017700 - Closeout Procedures: Project record documents; operation and maintenance data; warranties and bonds.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps.
   5. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   6. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. CarMax Procore.

3.02 REQUESTS FOR INTERPRETATION (RFI)

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

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

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare using software provided by the Electronic Document Submittal Service.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 016000 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.
      a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

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

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

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.

3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

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

3.03 SUBMITTAL PROCEDURES

A. General: At Contractor's written request, electronic copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. Execution of an Electronic File Transfer Agreement.
2. Drawing files will be transmitted only after agreement is executed and approvedy by Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 15 working days for initial review of each submittal.
3. Direct Transmittal to Consultant: When agreed upon between all parties that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Contractor.
4. Allow 10 working days for processing each resubmittal.
5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

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 Architect.
   3. Include the following information on label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of subcontractor.
      d. Name and address of supplier.
      e. Name of manufacturer.
      f. Unique identifier, including revision number.
      g. Number and title of appropriate Specification Section.
      h. Other necessary identification.

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

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

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

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and 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 in connection with construction.

J. The Construction Agreement has set a time period for the submission of all submittals. Failure to comply to may cause the Owner to use other means of producing compliance with the provisions of the Agreement.

3.04 NUMBER OF COPIES OF SUBMITTALS

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

B. Extra Copies at Project Closeout: See Section 017800.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. Retained samples will not be returned to Contractor unless specifically so stated.

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

3.06 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Coordinate with Contractor's construction schedule and schedule of values.

2. Format schedule to allow tracking of status of submittals throughout duration of construction.
3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.

3.07 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.
   1. Submit electronic submittals directly to extranet specifically established for Project.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's written recommendations.
      b. Manufacturer's product specifications.
      c. Manufacturer's installation instructions.
      d. Standard color charts.
      e. Manufacturer's catalog cuts.
      f. Standard product operating and maintenance manuals.
      g. Compliance with recognized trade association standards.
      h. Compliance with recognized testing agency standards.
      i. Application of testing agency labels and seals.

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: Include the following information, as applicable:
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.
      d. Roughing-in and setting diagrams.
      e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      f. Shopwork manufacturing instructions.
      g. Templates and patterns.
      h. Schedules.
      i. Design calculations.
      j. Compliance with specified standards.
      k. Notation of coordination requirements.
      l. Notation of dimensions established by field measurement.
   2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
   3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

D. Samples: Prepare physical units of materials or products, including the following:
   1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
   2. 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.
   3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the 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.

4. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
    a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
    b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
5. Number of Samples for Initial Selection: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Number of Samples for Verification: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned. Retain one returned Sample set as a Project Record Sample.
7. 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 are the property of Contractor.

3.08 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
    1. Submit electronic submittals directly to extranet specifically established for this project.
    2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. 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.

C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. 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 and, where required, is authorized for this specific Project.

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

G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

H. 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.

I. 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.

J. 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.

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

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

M. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."

N. 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.

O. 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.

P. 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 whether conditions, products, and installation will affect warranty.
   4. Other required items indicated in individual Specification Sections.

Q. 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.

R. Material Safety Data Sheets: Submit information directly to Owner. **If submitted to Architect, Architect will not review this information and will not return it.**

3.09 CONTRACTOR'S REVIEW

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

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

3.10 ARCHITECT'S ACTION

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

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

C. Final Unrestricted Release: When the Architect marks a submittal "**No Exceptions Taken**", the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

D. Final-But-Restricted Release: When the Architect marks a submittal "**Exceptions as Noted**", the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

E. Returned for Resubmittal: When the Architect marks a submittal "**Revise and Resubmit**", do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

F. Rejected: When the Architect marks a submittal "**Rejected**", do not proceed with Work covered by the submittalinc purchasing, fabrication, delivery, or other activity. Submitted items are unacceptable and not approved for use on project. Prepare a new submittal according to the requirements of the construction drawings and specifications; resubmit without delay. Repeat if necessary to obtain different action mark.

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

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

END OF SECTION

SECTION 013220
PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for the following:
   1. Periodic construction photographs.
   2. Final Completion construction photographs.

1.03 SUBMITTALS

A. Construction Photographs: Post images of each photographic view within one day of taking photographs.
   1. Identification: Provide each image with the following information:
      a. Name of Project.
      b. Date photograph was taken if not date stamped by camera.
      c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.04 COSTS

A. All costs for photographic images as herein specified are part of the Contract Sum.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
   1. Date and Time: Include date and time in filename for each image.

C. Periodic Construction Photographs: Take digital photographs as follows:
   1. Weekly photographs (to be posted to the CarMax Procore site each Friday) from mobilization through the Date of Substantial Completion. Include date in filename for each image. See other sections below for image requirements after substantial completion.
      a. North, south, east and west exterior building elevations, including FQC.
      b. Site signage.
      c. Entry vestibule canopies with close-up of ACM.
      d. Roof photographs, including penetrations.
      e. Cable crash beam barricade system/roadway barrier.
      f. Dumpster enclosure.
      g. Site Walls.
      h. Storm water outfall locations.
      i. Domestic water and sanitary sewer connections.
      j. Fuel tank installation.
      k. Customer, sales and WIP lots.
      l. All four interior elevations in Showroom, PBX Rooms, FQC, Presentation Lanes and Parts Room.
      m. Finish flooring systems in Showroom, FQC, Presentation Lanes and Service Bays.
      n. Low partition Business Office and Kids Room at rough-in to indicate tube columns supports.
      o. Entry vestibules.
      p. All restrooms.

q. Voice, data and power floor boxes.
r. Overhead door installation in FQC, Presentation and Service Bays.
s. Overhead shutters in Business Office and Parts, including counters. Include voice, data and power locations.
t. Junction boxes in ceiling showing camera locations in the Business Office and Cashier's Office.
u. All three elevations in the Central Printing area, including under counters to show voice, data and power locations. Include photo to illustrate wall height variation.
v. All three elevations in the Business Office Manager's including under counter voice, data and power locations.
w. Counters in the Cashier's Office, including voice, data and power locations.
x. Paint Booth
y. Detail Room
z. Sanding Station
aa. Power Wash Bay
bb. Detail Bay
cc. Air and Water drops for Owner-Furnished equipment.

D. Four (4) monthly aerial photographs (to be posted to the CarMax Procore site on the first Friday of each month), one from each compass point. Images should start from mobilization through the Date of Substantial Completion. The final aerials are for marketing purposes and the photos should be taken when the job-site is clean, paving and striping complete and all construction equipment removed from the site. Owner will direct photographer for desired vantage points. In addition to the standard required aerials, at Project Completion a fifth aerial is required. This image is to include but not limited to: boundary of the entire property (including surplus property) at an elevation to only include adjacent major road (s) for reference points, showing what is immediately adjacent to the property and any major developments immediately around the property. If the property includes surplus property, a sixth aerial is required to show only the property boundaries including surplus and only adjacent road taken at a vantage point directly over the site. Please contact Construction manager before this series of final aerial shots are taken to ensure the photograph will meet all requirements.

E. Defined event photographs (to be posted to the CarMax Procore site after completion of task).
1. Include date in filename for each image and label as described below:
a. Before starting construction, take photographic images of the site and surrounding properties from different points of view as selected by the Owner/Architect. Take photographic images in sufficient number to show existing conditions adjacent to the property before starting work.
1) Take photographic images of existing buildings either on or adjoining the property in sufficient detail to record accurately the physical conditions at the start of construction.
2) Masonry Cleaning (before and after).
3) Masonry Painting (same for tilt-up) – during prime, 1st finish, and 2nd finish coats.
4) Installation of rigid and batt insulation prior to covering by other construction.
5) Seals, labels or certification of materials that will subsequently be covered by other construction.
6) Emergency Situations: Additional photographic images will be taken within 24 hours of the Owner's requests.
7) Substantial completion of a major phase or component of work.
8) Special events planned at project site.
9) Immediate follow-up when onsite events result in construction damage or losses.
10) Photographic images to be taken at fabrication locations away from project sites.
11) Steel erection.
12) Foaming of masonry block wall insulation.

F. Punchlist Inspection Construction Photographs: No fewer than twenty (20) images reflecting the status of completion taken on the date of the punchlist inspection by the design team. Images shall include a minimum of all four major building elevations as well as all pylon and monument signage. The Owner will direct photographer for desired vantage points.
   1. Include date in filename for each image with the exception of the exterior elevations.

G. Final Inspection Construction Photographs: Images as required to demonstrate the completion of any remaining punchlist items determined to be incomplete at the time of the follow-up inspection after the Date of Substantial Completion. Include date in filename for each image.

H. Final Completion Photographs: Take images listed below after date of Substantial Completion for submission as Project Record Documents. These images are for marketing purposes and the photos should be taken when the job-site is clean, paving and striping complete and all construction equipment removed from the site. Owner will direct photographer for desired vantage points. In addition, provide an aerial image to include but not limited to: boundary of the entire property (including surplus property) at an elevation to only include adjacent major road (s) for reference points, showing what is immediately adjacent to the property including any major developments immediately around the property. If the property includes surplus property, a sixth aerial is required to show only the property boundaries including surplus and only adjacent roads taken at a vantage point directly over the site.
   1. Do not include date stamp or allow any construction equipment to be visible.
      a. Finished Building Elevations.
      b. Parking lot areas – C/E, WIP, Sales.
      c. Pylon Signs.
      d. Monument Signs.
      e. Sales area.
      f. Presentation Lanes.
      g. Service area.

I. Warranty Inspection and Completion Photographs: Take images of each item requiring remedial work at the time of the Eleven-Month Walk-Through. Follow-up with images of corrected work upon completion. Include date in filename for each image.

END OF SECTION

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SECTION 014000
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 1 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. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-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. Divisions 2 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 ensure that proposed construction complies with requirements.

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

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

1.04 SUBMITTALS

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

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient 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.

1.05 QUALITY ASSURANCE

A. 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.

B. 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.

C. 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.

D. 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.

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

F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

1.06 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.

B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
   1. Engage a qualified testing agency to perform these quality-control services.
   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. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
   1. Testing agency will notify Architect 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.

D. 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.

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

F. Testing Agency Responsibilities: Cooperate with Owner, Owner’s Representative, Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Owner, Owner’s Representative, Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit five (5) certified written reports, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

G. 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.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 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 Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 1 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

SECTION 014200
REFERENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

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

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

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.

D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

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

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

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

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

1.03 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

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

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

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 015000
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 1 Specification Sections, apply to this Section.

1.02 SUMMARY

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

1.03 DEFINITIONS

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

1.04 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. Owner's construction forces.
   2. Occupants of Project.
   3. Architect.
   4. Testing agencies.
   5. Personnel of authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

E. Natural Gas Service: Pay natural gas service use charges for usage, by all parties engaged in construction, at Project site.

F. The Contractor is responsible for the cost of all temporary and permanent utility usage until Substantial Completion of the entire project.

1.05 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.

1.06 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. 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.

B. 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 Architect. Provide materials suitable for use intended.

2.02 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).

E. Heating Equipment: Unless Owner authorizes use of permanent heating 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, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

2.03 TEMPORARY FACILITIES

A. Field Office: Of sufficient size to accommodate needs of construction personnel. Must include space for a minimum of two private offices, and conference area. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including three desks, file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 15 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.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Provide a separate, lockable, weather tight storage enclosure for storage of Owner supplied materials.
   2. Store combustible materials apart from building.

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.

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.

C. Provide Owner full time, unlimited access, to temporary 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 cannot be used for that purpose.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

C. 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.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

E. 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 from that specified that will not have a harmful effect on completed installations or elements being installed.

F. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.

G. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions. Temporary lighting within the building shall provide an average of 20 foot-candles with a minimum foot-candle level of 5.

I. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install three separate telephone lines. One dedicated for CarMax use and two for GC use.
   1. Provide additional telephone lines for the following:
      a. Provide a dedicated telephone line for facsimile machine
      b. Provide a dedicated telephone line for high-speed DSL point of service with wireless network availability.
   2. At each telephone, post a list of important telephone numbers.
   3. GC is responsible for providing the line capacity and coordinating with CarMax for the installation of the dedicated CarMax telephone line.

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.

B. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Owner has an agreement with Architectural Graphics, Inc. (AGI). to provide two (2) printed announcement signs (Coming Soon & Development sign). Each sign will have an overall printed image size of 4’-0” x 8’-0” digitally printed 4-color process on 13 oz. inkjet flexible vinyl material. Signs will have sufficient extra material for contractor to wrap and staple sign over GC erected backer board. Contact Architectural Graphics, Inc. (AGI). for a quote on the two (2) vinyl printed. Complete the Coming Soon and Development Signs – Order Form in this specification and forward to Architectural Graphics, Inc. (AGI) with GC issued Purchase Order within five (5) days of signing contract with Owner. Pay Architectural Graphics, Inc. (AGI) directly for the two (2) signs. Receive signs and mount to GC supplied backer board and posts as shown in detail. Mounting of the signs to consist of wrapping around the backer board and stapling. Comply with details indicated.
   a. Architectural Graphics, Inc. (AGI)
      Attention: Blake Denis / Richard Johnson
      2655 International Parkway
      Virginia Beach, VA 23452
      T: 757-427-1900
      F: 757-427-6112
2. Prepare temporary signs to provide directional information to construction personnel and visitors.
3. Paint sign panel and posts with exterior-grade alkyd gloss enamel “New Reflex Blue” by Sherwin Williams over exterior primer.

C. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" and “Construction Waste Management” for progress cleaning requirements.

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. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

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

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

E. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

F. 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.

G. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

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. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION

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SECTION 015001
BANNER ORDER FORM

CARMAX

COMING SOON AND DEVELOPMENT SIGNS

ORDER FORM

++

(PLEASE PRINT ALL INFORMATION LEGIBLY)

FORM COMPLETED BY: _____

PHONE NUMBER: _____

++

PROJECT NAME: _____ PROJECT NUMBER: _____

PROJECT LOCATION: _____

DEVELOPMENT MANAGER'S NAME: _____

DEVELOPMENT MANAGER'S PHONE NUMBER: _____

ARCHITECTURAL FIRM: _____

ARCHITECTURAL FIRM CITY AND STATE: _____

GENERAL CONTRACTOR COMPANY NAME: _____

GENERAL CONTRACTOR CITY AND STATE: _____

GENERAL CONTRACTOR PHONE NUMBER: _____

++

SHIPPING INFORMATION

PLEASE SHIP THE ANNOUNCEMENT PACKAGE TO THE FOLLOWING:

COMPANY NAME: _____

ATTENTION: _____

ADDRESS: _____

CITY/STATE/ZIP: _____

PHONE: _____

PLEASE SEND COMPLETED FORM TO CARMAX@AGI.NET OR REACH OUT TO THE CARMAX PROJECT MANAGER AT 757-301-7008.

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SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

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

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

B. Section 011000 - Summary: Identification of Owner-supplied products.

C. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

D. Section 014000 - Quality Requirements: Product quality monitoring.

E. Section 014200 - References: Applicable industry standards for products specified.

F. Divisions 2 through 32 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 SUBMITTALS

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

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

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

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

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 016116.
   2. If wet-applied, have lower VOC content, as defined in Section 016116.

2.02 PRODUCT OPTIONS

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

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

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

2.03 MAINTENANCE MATERIALS

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

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 011000 - Summary for identification of Owner-supplied products.

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

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

3.03 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to

excessive materials handling and misapplication. See Section 017419.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

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

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

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

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

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

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

J. Do not store products directly on the ground.

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

L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

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

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

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

END OF SECTION

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SECTION 017000
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. General installation of products.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

B. Related Sections include the following:
   1. Section 011000 - Summary.
   2. Section 013000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
   3. Section 014000 - Quality Requirements: Testing and inspection procedures.
   4. Section 015000 - Temporary Facilities and Controls.
   5. Section 017310 - Cutting and Patching: for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work
   6. Section 017419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
   7. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, bonds, and for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   8. Individual Product Specification Sections:
      a. Advance notification to other sections of openings required in work of those sections.
      b. Limitations on cutting structural members.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

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

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

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
      a. Description of the Work.
      b. List of detrimental conditions, including substrates.
      c. List of unacceptable installation tolerances.
      d. Recommended corrections.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 CONSTRUCTION LAYOUT

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

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

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

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and

electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.04 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Owner. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: The Owner will establish a minimum of two permanent benchmarks on Project Site. The Contractor shall protect and maintain benchmarks established by the Owner.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

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

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

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

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

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.

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

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

3.06 OWNER-INSTALLED PRODUCTS

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

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

3.07 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. At a minimum, all work areas are to be left in a “Broom Clean” condition at the end of each work week. The Owner reserves the right to supplement the Contractor’s forces, if areas are deemd by the Owner not in a “Broom Clean” condition. All cost associated with the supplement fo the Contractor’s forces will be credited against the Contract Sum. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

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

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

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

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
   1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

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

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

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

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

3.08 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

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

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

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

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

END OF SECTION

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SECTION 017310
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1.03 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

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

1.04 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. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

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

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.

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

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. 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.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang 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

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SECTION 017410
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes administrative and procedural requirements for the following:
   1. Recycling nonhazardous construction waste.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.

B. Section 012500 - Substitution Procedures.

C. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

D. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

E. Section 016000 - Product Requirements: Waste prevention requirements related to product substitutions, storage, and hauling.

F. Section 311000 - Site Clearing: Handling and disposal of land clearing debris.

G. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.03 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. 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.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.04 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight 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:
   1. Construction Waste:
      a. Masonry and CMU.
      b. Lumber.
      c. Wood sheet materials.
      d. Wood trim.
      e. Metals.
      f. Roofing.
      g. Insulation.
      h. Gypsum board.
      i. Piping.
      j. Electrical conduit.
      k. Packaging: Regardless of salvage/recycle goal indicated in "General" 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.

1.05 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

1.06 INFORMATIONAL SUBMITTALS

A. 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.

B. 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.

C. Submit waste record reports monthly with the Application for Payment.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. 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 waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation 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.

1.08 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. 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 site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
   3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

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. Include the following:
   1. Total quantity of waste.

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 recycled materials.
5. Savings in hauling and tipping fees by donating materials.
6. Savings in hauling and tipping fees that are avoided.
7. Handling and transportation costs. Include cost of collection containers for each type of waste.
8. Net additional cost or net savings from waste management plan.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PLAN IMPLEMENTATION

A. PLAN IMPLEMENTATION

B. General: Implement approved waste management plan. 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 operation, termination, and removal requirements in Division 01 Section "Temporary Facilities and Controls."

C. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

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.

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

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

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. 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.

D. Procedures: 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 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.
   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.
   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 from Owner's property and transport to recycling receiver or processor.

3.03 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. 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 32 Section "Plants." for use of clean sawdust as organic mulch.

C. 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.

3.04 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: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Project Record Documents.
   3. Operation and maintenance manuals.
   4. Warranties.
   5. Instruction of Owner's personnel.
   6. Final cleaning.
   7. Project Closeout Checklist.

1.02 RELATED REQUIREMENTS

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

B. Section 017000 - Execution Requirements: for progress cleaning of Project site.

C. Divisions 2 through 32 Sections for specific closeout and special cleaning requirements for products of 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. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   7. Complete startup testing of systems.
   8. Submit test/adjust/balance records.
   9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   10. Advise Owner of changeover in heat and other utilities.
   11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
   12. Complete final cleaning requirements, including touchup painting.
   13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. 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 certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list). The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   3. Submit pest-control final inspection report and warranty.
   4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected. Cost incurred by the Owner for reinspections performed by the Architect and their consultants shall be deducted from the contract sum via change order.

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 items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.06 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 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. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
      d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
   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. Mark important additional information that was either shown schematically or omitted from original Drawings.
   4. Note Change Order numbers, and similar identification where applicable.
   5. 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 substitutions and product options selected.
3. Note related Change Orders, Record Drawings, where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, where applicable.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Assemble one 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:
   a. Emergency instructions and procedures.
   b. System, subsystem, and equipment descriptions, including operating standards.
   c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
   d. Description of controls and sequence of operations.
   e. Piping diagrams.
2. Maintenance Data:
   a. Manufacturer's information, including list of spare parts.
   b. Name, address, and telephone number of Installer or supplier.
   c. Maintenance procedures.
   d. Maintenance and service schedules for preventive and routine maintenance.
   e. Maintenance record forms.
   f. Sources of spare parts and maintenance materials.
   g. Copies of maintenance service agreements.
   h. Copies of warranties and bonds.

B. Organize operation and maintenance data into suitable sets of manageable size.

C. Provide electronic version of the operation and maintenance data.

D. Format: PDF

1.08 WARRANTIES

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

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

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

D. Provide an electronic version of all Warranties.

E. Format: PDF

F. Provide each PDF Warranty with a coverpage identifying the following:

G. Product or Installation

H. Description of product or installation.

I. Name of the Product

J. Name, address, and telephone number of the Installer.

PART 2 - NOT USED

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. Include instruction for the following:
   1. System design and operational philosophy.
   2. Review of documentation.
   3. Operations.
   4. Adjustments.
   5. Troubleshooting.
   6. Maintenance.
   7. 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. Pressure wash paved areas clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      h. Sweep concrete floors broom clean in unoccupied spaces.
      i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
      j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.
t. 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.

3.03 PROJECT CLOSEOUT CHECKLIST

A. Complete and submit the following project closeout checklist:

CARMAX CONSTRUCTION DEPARTMENT

PROJECT CLOSE OUT CHECKLIST

GENERAL CONTRACTOR: _____

DEVELOPMENT MANAGER: _____

STORE LOCATION: _____

DATE OF SUBSTANTIAL COMPLETION: _____

9.01 THE GENERAL CONTRACTOR IS RESPONSIBLE FOR THE CONTENTS AND TIMELY DELIVERY OF THE CLOSEOUT ITEMS. CHECK OFF ALL ITEMS AS THE WORK IS COMPLETED AND PAPERWORK IS RECEIVED. ANY ITEM THAT IS LISTED THAT DOES NOT PERTAIN TO THIS PROJECT SHOULD BE MARKED N/A, NOT APPLICABLE. A COMPLETED COPY OF THIS CHECKLIST SHALL BE INCLUDED WITH THE SUBMITTAL OF THE CLOSE OUT DOCUMENTS.

AS-BUILT, RED LINED PLANS SHALL INCLUDE, BUT NOT BE LIMITED TO:

____ Civil

____ Landscape

____ Irrigation

____ Architectural

____ Structural

____ Fuel System

____ Plumbing

____ Fire Protection

____ Mechanical

____ Electrical, including site lighting

Note: Plans must be stamped “AS-BUILT PLANS”.

9.02 WARRANTY MANUALS (1) SHALL INCLUDE, BUT NOT BE LIMITED TO:

A. ____Temporary Certificate of Occupancy (if applicable)

B. ____Certificate of Occupancy

____General Contractor’s Warranty Letter (One Year plus twenty days from the Date of Final Completion)

C. ____List of Subcontractors (see attached form)

D. ____Subcontractor’s General Warranty Letters, each indicating one-year plus twenty days from the Date of Final Completion.

E. ____The following extended warranties:

31316 – TERMITE CONTROL

Name of Subcontractor: _____

_____Installer’s Warranty Period: Five (5) years from the Date of Final Completion

02764 – PAVEMENT JOINT SEALERS

Name of Subcontractor: _____

_____Installer’s Warranty Period: Two (2) years from the Date of Final Completion

07131 – SELF-ADHERING SHEET WATERPROOFING

Name of Subcontractor: _____

Name of Manufacturer: _____

_____Manufacturer’s Warranty Period: Five (5) years from Date of Final Completion.

_____Installer’s Warranty Period: Two (2) years from Date of Final Completion.

07241 – EXTERIOR INSULATION AND FINISH SYSTEM – CLASS PB

Name of Subcontractor: _____

Name of Manufacturer: _____

____Manufacturer's Warranty Period: Three (3) years from Date of Final Completion.
____Installer's Warranty Period: Three (3) years from Date of Final Completion.

07410 – METAL WALL PANELS
Name of Subcontractor: _____
____Manufacturer's Warranty Period: Two (2) years from Date of Final Completion.
____Manufacturer's Finish Warranty Period: Twenty (20) yrs from Date of Final Completion.

07411 – METAL ROOF PANELS
Name of Manufacturer: _____
____Manufacturer's Warranty Period: Two (2) years from Date of Final Completion.
____Manufacturer's Finish Warranty Period: Twenty (20) years from Date of Final Completion.
____Manufacturer's Warranty Period: Ten (10) years from Date of Final Completion.

07531 – EPDM MEMBRANE ROOFING
Name of Subcontractor: _____
Name of Manufacturer: _____
____ Roof Warranty, Manufacturer _____ Type _____ Serial # _____
____ Manufacturer's Warranty Period: Ten (10) years from Date of Final Completion.
____ Installer's Warranty Period: Two (2) years from Date of Final Completion.

07540 – THERMOPLASTIC MEMBRANE ROOFING
Name of Subcontractor: _____
Name of Manufacturer: _____
____ Roof Warranty, Manufacturer _____ Type _____ Serial # _____
____ Manufacturer's Warranty Period: Ten (10) years from Date of Final Completion.
____ Installer's Warranty Period: Two (2) years from Date of Final Completion.

07710 - MANUFACTURED ROOF SPECIALTIES
Name of Subcontractor: _____
____ Manufacturer's Warranty Period: Twenty (20) years from Date of Final Completion.

07920 – JOINT SEALANTS
Name of Subcontractor: _____
____Installer's Warranty Period:Two (2) years from Date of Final Completion.

08410 – ALUMINUM ENTRANCES AND STOREFRONT
Name of Manufacturer: _____
____Manufacturer's Warranty Period: Two (2) years from Date of Final Completion.

08620 - UNIT SKYLIGHTS
Name of Manufacturer: _____
____Manufacturer's Warranty Period: Five (5) years from Date of Final Completion.

08800 – GLAZING
Name of Manufacturer: _____
____Manufacturer's Warranty Period for Coated-Glass Products: Ten (10) years from Date of Final Completion.
____Manufacturer's Warranty Period for Insulated Glass Products: Ten (10) years from Date of Final Completion.

10801 - TOILET AND BATH ACCESSORIES
Name of Manufacturer: _____
____Manufacturer's Warranty Period on Mirrors: Fifteen (15) years from Date of Final Completion.

15010 – MECHANICAL GENERAL PROVISIONS
____Start-up Certification / Report form ENTEK

15495 – UNDERGROUND FUEL TANKS AND ACCESSORIES
Name of Manufacturer: _____
____Manufacturer's Warranty Period for Fuel Tank – Thirty (30) years from the Date of Final Completion.

____Warranty Period for tank monitoring system, including leak detection system – Two (2) years limited warranty from the date of the installation, which shall cover materials and workmanship or 15 months from date of invoice.

____Tank monitoring system, including leak detection system – Manufacturer shall offer a one (1) year extension on the standard warranty for an additional cost to the end user. The end user may have until the expiration date of the original system warranty to purchase the option of the extended warranty.

15496 - ABOVEGROUND FIRE RESISTIVE FUEL SYSTEMS AND ACCESSORIES

Name of Manufacturer: _____

____Warranty Period – One (1) year and twenty days from Date of Final Completion, or 15 months from the date of the invoice.

15500 - FIRE PROTECTION SYSTEM

Name of Installer: _____

____Fire Alarm Section, Type _____ Model # _____

____Fire Sprinkler NFPA Certifications (Underground and Aboveground Certificates)

9.03 PRODUCT DATA, AND OPERATION AND MAINTENANCE MANUAL – ONE (1) COPY SHOULD INCLUDE, BUT NOT BE LIMITED TO:

A. The following is a list of GC supplied equipment that will require paperwork and pertinent information.

B. *This paperwork and information is defined as, Brand, Type, Size, Serial Number, Suppliers, all Manufacturer's Warranty and Operation Materials.

C. *It is realized that all equipment will not necessarily have Warranty paper but all other needed information should readily be available for insertion into the Manuals.

1. ____ RTU #01 Type _____ Serial Number _____
2. ____ RTU #02 Type _____ Serial Number _____
3. ____ RTU #03 Type _____ Serial Number _____
4. ____ RTU #04 Type _____ Serial Number _____
5. ____ RTU #05 Type _____ Serial Number _____
6. ____ RTU #06 Type _____ Serial Number _____
7. ____ RTU #07 Type _____ Serial Number _____
8. ____ RTU #08 Type _____ Serial Number _____
9. ____ RTU #09 Type _____ Serial Number _____
10. ____ RTU #10 Type _____ Serial Number _____
11. ____ RTU #11 Type _____ Serial Number _____
12. ____ RTU #12 Type _____ Serial Number _____
13. ____ RTU #13 Type _____ Serial Number _____
14. ____ RTU #14 Type _____ Serial Number _____
15. ____ RTU #15 Type _____ Serial Number _____
16. ____ RTU #16 Type _____ Serial Number _____
17. ____ RTU #17 Type _____ Serial Number _____
18. ____ RTU #18 Type _____ Serial Number _____
19. ____ RTU #19 Type _____ Serial Number _____
20. ____ RTU #20 Type _____ Serial Number _____
21. ____ RTU #21 Type _____ Serial Number _____
22. ____ RTU #22 Type _____ Serial Number _____

D. ____The above equipment is to be marked with 3" Decal numbers to be seen from the roof hatch or ladder, (To identify unites without walking the entire roof).

E. ____Breakers in the panel box for these units must be correctly identified.

9.04 EQUIPMENT TO BE IDENTIFIED AND TO HAVE PROPER AND COMPLETE PRODUCT DATA, INCLUDES, BUT IS NOT LIMITED TO THE ITEMS LISTED BELOW. PRODUCT DATA SHALL BE THE "RECORD PRODUCT DATA" AS DESCRIBED IN PARAGRAPH 1.6.D OF THIS SECTION. ALL ITEMS SHALL BE INDENTIFIED UNDER A SEPARATE TAB WITHIN THE OPERATION AND MAINTENANCE MANUALS:

A. ____Section 02510 - Site Utilities – Valves, Back Flow Devices, Etc.
B. ____Section 02511 - Asphalt Mix Design
C. ____Section 02813 - Irrigation
D. ____Section 02900 - Landscaping
E. ____Section 03300 - Cast-in place concrete
F. ____Section 03471 - Tilt-up panels
G. ____Section 04810 – Unit Masonry Assemblies
H. ____Section 04810 - Block Foam Insulation
I. ____Section 06402 - Plastic Laminate Millwork
J. ____Section 07115 – Bituminous Dampproofing
K. ____Section 07131 – Sheet Membrane Waterproofing
L. ____Section 07190 – Water Repellants
M. ____Section 07241 - EIFS
N. ____Section 07410 - Metal wall panels
O. ____Section 07412 - Aluminum Composite Panels
P. ____Section 07531 – EPDM Membrane Roofing
Q. ____Section 07540 – Thermoplastic Membrane Roofing
R. ____Section 07720 – Roof Accessories
S. ____Section 07920 - Joint Sealants
T. ____Section 08410 and 08920 - Storefront
U. ____Section 08800 - Glass (Tempered, Spandrel and Insulated)
V. ____Section 09310 - Paver Tile - Showroom
W. ____Section 09310 - Ceramic Tile – Toilets
X. ____Section 09912 and 09960 - Painting
Y. ____Section 09950 - Wall Covering
Z. ____Section 10155 - Toilet Partitions
AA. ____Section 10801 - Toilet Accessories
BB. ____Section 12491 and 12492 - Window Blinds
CC. ____Section 15020 - Cabinet Heater Unit
DD. ____Section 15405 - Reclaim Tank
EE. ____Section 15405 - Oil / Water Separator
FF. ____Section 15450 - Water Heaters
GG. ____Section 15450 - Electric Water Coolers
HH. ____Section 15450 - Plumbing Fixtures
II. ____Section 15781 - Air Handling Units
JJ. ____Section 15870 - Exhaust Fans
KK. ____Section 16050 - Electrical including, Panel boxes, Contactors, Transformers & other devices

LL. ____Section 16720 - Fire Alarm System

MM. ____Other

NN. ____Unusual Equipment
1. ____Elevators/Escalators
2. ____Water Meter
3. ____Sewage Ejection Pumps / Lifts Stations
4. ____Emergency Lighting-Inverter System

9.05 ADDITIONAL INFORMATION NEEDED, PERTAINING TO THE FIRE SPRINKLER SYSTEM:

A. System Number: _____

B. Contract Number: _____

C. Area: _____

D. Drawing number:_____

E. Date: _____

F. The Sprinkler System is designed to provide a density of _____ GPM/SQ. FT. over the Hydraulically most remote _____ SQ. FT. while flowing _____ GPM at _____ PSI at the base of the riser, with _____ GPM reserved for hose streams, in accordance with NFPA 13, based on a water flow test:

G. Effective at: _____

H. As tested by: _____

I. Dated: _____

J. STATIC: _____ PSIG

K. RESIDUAL: _____PSIG

L. FLOW: _____ PSIG

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes and includes the following:

1. Foundations and footings.
2. Slab-on-grade.
3. Structural slabs.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.
3. Division 9 Section “Decorative Concrete Polished Flooring”

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For proprietary materials and items, including admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Provide drawing reflecting pouring schedule for concrete slabs. Concrete slabs shall be poured parallel to short dimension of the building. Include dimensioned layout for all construction and control joints.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Waterstops.
6. Curing materials.
7. Curing/Sealing materials.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Joint-filler strips.
13. Hardener/Sealer (See Spec Section 09625)

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Field quality-control test and inspection reports.

I. Provide a measured and dimensioned as-built plan after completion of the pour showing final locations of all construction and control joints demonstrating compliance with the Drawings and layout of approved pour schedule. Architect will review this plan for compliance with project requirements.
   1. Construction and control joints that are not located in accordance with the Drawings are subject to the following measures:
      a. Additional joints may be required to be cut into slabs at discretion of the Architect and Structural Engineer at Contractor’s expense.
      b. Entire sections of slabs-on-grade may be required to be removed and replaced at contractor’s expense to ensure that final joint locations are in compliance with the Drawings.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

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

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 302.1R, Guide, “Guide to Concrete Floor and Slab Construction.
4. ACI 318, Building Code Requirements for Structural Concrete.
5. Concrete Reinforcing Steel Institute (CRSI), “Manual of Standard Practice.”

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. At least 15 days prior to submittal of design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Review construction and control joint layout submittal. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Request that representatives of each entity directly concerned with cast-in-place concrete attend conference, including, but not limited to, the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Concrete subcontractor.
e. Independent testing agency responsible for field quality control.
f. Patterned concrete subcontractor.
g. Primary admixture manufacturers.
h. Architect or Owner’s representative.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

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

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

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

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

E. Form-Release Agent: Commercially formulated form-release agent with a maximum VOC of 350 g/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

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

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

1. Furnish units that will leave no corrodible metal closer than 1 ½ inches (25 mm) to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

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

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

C. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips.

1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60, deformed bars.

D. Plain-Steel Wire: ASTM A 82, as drawn.

E. Deformed-Steel Wire: ASTM A 496.

F. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

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

B. Slab-on-grade, use supports with sand plates or horizontal runners where base materials will nor support chair legs. Alternately, use concrete brick of same strength as the concrete specified for the work. Minimum size of brick: 4” x 4”.

C. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I/II. Use Type II cement for concrete slabs on grade, use one brand of cement throughout project unless otherwise acceptable to Architect.

1. Fly Ash: ASTM C618, Class C or F.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Severe weathering region, but not less than 3S.
2. Nominal Maximum Aggregate Size: 1 inch (38 mm) for 4 inch slabs and 1 ½ inch for 5” & 6” slabs.
3. For slab-on-grade, follow ACI302.1 recommended aggregate grading per section 8.9.2.1. Note a uniformly graded #467 distribution will typically closely

align with these recommendations. Provide aggregate gradation analysis and chart showing mix conformance.

4. For slab-on-grade, follow ACI 302.1 recommended workability recommendations per section 8.9.2.2 to put mix in the optimal range on the coarsness factor chart. Provide coarseness factor chart showing mix conformance.
5. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances. Aggregate shall be free of lignite.

C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

   a. “Air-Mix” or “Perma-Air”, Euclid Chemical Co.
   b. “Daravair”, W.R. Grace & Co.
   c. “MB-VR” or “Micro-Air”, Master Builders, Inc.
   d. “Sika AER”, Sika Corp.
   e. Air-entraining admixture shall not be utilized in integrally colored concrete.

C. Water-Reducing Admixture: ASTM C 494, Type A.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

   a. “Eucon WR-75”, Euclid Chemical Co.
   b. “WRDA w/ Hycol”, W.R. Grace & Co.
   c. “Pozzolith Normal” or “Polyheed”, Master Builders, Inc.
   d. “Plastocrete 161”, Sika Corp.

D. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

1. Available Products: Subject to change to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

   a. “Accelguard 80”, Euclid Chemical Co.

2.6 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers:

a. Greenstreak.
b. Progress Unlimited, Inc.
c. Williams Products, Inc.

2. Profile: Ribbed with center bulb.
3. Dimensions: 6 inches by 3/8 inch thick; nontapered.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

1. Products:

a. JP Specialties, Inc.; Earth Shield TPE-Rubber.
b. Vinylex Corp.; PetroStop.
c. WESTEC Barrier Technologies, Inc.; 600 Series TPE-R.

2. Profile: Ribbed with center bulb.
3. Dimensions: 4 inches by 3/16 inch thick; nontapered.

2.7 VAPOR RETARDERS

A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 10 mils thick:

1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 10 mils thick.
2. Three-ply, nylon- or polyester-cord-reinforced, laminated, high-density polyethylene sheet; 7.8 mils thick.

2.8 CURING MATERIALS

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

B. Water: Potable.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200sq. ft./gal. For applications in all other areas.

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

a. Euclid Chemical Co.
b. W.R. Grace & Co.
c. Master Builders, Inc.
d. Sika Corp.

2.9 CURING/SEALING MATERIALS

A. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.10 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

B. Expansion Joint Cap: Preformed, plastic, void cap designed to be removed after placement of concrete, equal to Plastic Void Cap Strip Expansion Joint (EXPJ-006) by Right Pointe Company.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to, the following:

a. “SBR Latex”, Euclid Chemical Co.
b. “Daraweld C”, W.R. Grace & Co.
c. “Acryl-Set”, Master Builders, Inc.

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

1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

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

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

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings, walls and all concrete except floor slab: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4500 psi.
2. Maximum Slump: 4 inches plus or minus 1 inch.
3. W/C ratio: 0.45 maximum
4. Type V Cement
5. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for concrete containing ¾ inch nominal maximum aggregate size, or 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1 inch or 1-1/2 inch nominal maximum aggregate size.

D. Slabs at Showroom, Presentation Lanes, Service and Detailing Areas, and Carwash: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.
2. Minimum Cementitious Materials Content: 520 lb/cu. yd..
3. Maximum Slump: 4 inches plus or minus 1 inch.
4. W/C ratio 0.50 maximum
5. Type II Cement
6. See Section 2.4.B for aggregate gradation.
7. Provide a concrete mix design with a maximum unrestrained shrinkage strain less than or equal to 0.04% at 28 days per ASTM 157 (Modified).
8. Air Content: Do not use air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

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

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent except concrete receiving integral colored shall not exceed 10 percent – 12 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent except concrete receiving integral colored which slag is not permitted.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent unless noted for integral colored concrete.

F. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

G. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

H. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

I. Use water-reducing admixture or high-range water-reducing admixture (superplasticizers) in concrete, as required, for placement and workability.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

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

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

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

1. Class A, 1/8 inch; Tolerances for concrete surfaces exposed to view.
2. Class C, 1/2 inch; Tolerances for all other concrete surfaces.

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

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

to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

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

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

H. Chamfer all exterior corners and edges of permanently exposed concrete unless noted otherwise.

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

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

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

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

M. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.

N. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer’s instructions.

O. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.2 EMBEDDED ITEMS

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

1. Install anchor bolts, accurately located, to elevations required.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at

not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. 28-day design compressive strength.

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

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

3.4 VAPOR RETARDERS

A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

B. Place vapor barrier sheeting over prepared drainage course with longest dimension parallel with directions of pour. Lap joints 6”.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

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

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

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

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

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

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

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

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

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
3. Provide plastic void cap strip expansion joint where detailed on the drawings.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Polished concrete shall not be placed until overhead roof joists and metal deck are in-place.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
3. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures.

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

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

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

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

H. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Architect.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete.

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

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

3.9 FINISHING FLOORS AND SLABS

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

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

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
2. After floating, begin first trowel finish operation using a power-driven trowel. Begin with final trowelling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-trowelling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to following tolerances:

a. Specified individual values of flatness, F(F) 30; and levelness, F(L) 25.
b. Specified composite values of flatness, F(F) 45; and levelness, F(L) 35.

C. Grind smooth surface defects that would telegraph through applied floor covering system.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

E. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

F. Polished Finish – See 09625

3.10 MISCELLANEOUS CONCRETE ITEMS

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

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

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Slabs receiving finished flooring specified in Section 09800 – Epoxy Flooring System shall be wet cured only. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

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

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

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

    a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing and Sealing Compound (For use in all areas scheduled as Sealed Concrete in the Finish Schedule): Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound (For use in all integrally colored concrete areas): Apply uniformly to slabs with an airless sprayer with a 515 tip. Coordinate application rate with concrete polishing subcontractor.

3.12 CONCRETE SURFACE REPAIRS

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

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

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

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

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

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment copmounds may be used when acceptable to Architect.
4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

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

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

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172, except modified for slump to comply with ASTM C94, shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight or normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

    a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days and two at 28 days and one specimen retained in reserve for later testing if required.

    a. Test one field-cured specimen at 7 days and two at 28 days and one at a later date.
    b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders. Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

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

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

C. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 03300

SECTION 042000
UNIT MASONRY
PART 1 GENERAL

1.01 SECTION INCLUDES

A This Section includes unit masonry assemblies consisting of the following:
1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Single-wythe masonry flashing.
7. Miscellaneous masonry accessories.

B Products installed, but not furnished, under this Section include the following:
1. Section 055000 - Metal Fabrications: Loose steel lintels.
2. Section 071113 - Bituminous Dampproofing: Dampproofing parged masonry surfaces.
3. Section 072100 - Thermal Insulation: Masonry-cell foam insulation and insulation for cavity spaces.
4. Section 076200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
5. Section 079200 - Joint Sealants: Sealing control and expansion joints.
6. Section 081113 - Hollow Metal Doors and Frames: for frames in unit masonry openings.
7. Section 083100 - Access Doors and Frames: for access doors in unit masonry for mechanical items.

1.02 RELATED REQUIREMENTS

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

1.03 DEFINITIONS

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

1.04 PERFORMANCE REQUIREMENTS

A Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
1. For Concrete Unit Masonry: f'm= 2000 psi

1.05 SUBMITTALS

A Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B Shop Drawings: Show fabrication and installation details for the following:
1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

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

D Mix Designs: For each type of mortar [and grout]. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.

2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.06 QUALITY ASSURANCE

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

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

C Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

D Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects, and set quality standards for materials and execution.

1. Build a mockup for each typical exterior wall area shown on the drawings. Each mockup shall be approximately 60 inches (1500 mm) long by 60 inches (1422 mm) high by full thickness, including face, backup withes, masonry anchors, sheathing, insulation, vapor barrier, thru wall flashing, metal studs and accessories as indicated.
   a. Include a sealant-filled joint.
   b. Include a return corner on mockup for 4” veneer.
2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups is for texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship, including establishing the acceptable tolerance between all of the adjacent face shells of split-face masonry units.
4. Do not remove the mock-up until directed by the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

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

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

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

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

1.08 PROJECT CONDITIONS

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

1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.

B Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A General: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, return corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless indicated as bullnose.

B Concrete Masonry Units: ASTM C 90 and as follows:
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to the following dimensions:
   a. As indicated on Drawings.
4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
5. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dry-Block; W. R. Grace & Co., Construction Products Division.

2) Rheopel; Master Builders.

C Decorative Concrete Masonry Units: ASTM C 90 and as follows:
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
2. Density Classification: Normal weight.
3. Size: Manufactured to dimensions indicated for nondecorative units.
4. Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples.
   a. Normal-weight aggregate, split-face finish.
5. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dry-Block; W. R. Grace & Co., Construction Products Division.
      2) Rheopel; Master Builders.

2.02 MORTAR AND GROUT MATERIALS

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

B Hydrated Lime: ASTM C 207, Type S.

C Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

D Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

E Aggregate for Grout: ASTM C 404.

F Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

G Water: Potable.

H Products: Subject to compliance with requirements, provide one of the following:
1. Colored Portland Cement-Lime Mix:
   a. Eaglebond; Blue Circle Cement.
   b. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
   c. Centurion Colorbond PL; Lafarge Corporation.
   d. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
2. Cold-Weather Admixture:
   a. Accelguard 80; Euclid Chemical Co.
   b. Morseled; W. R. Grace & Co., Construction Products Division.
   c. Trimix-NCA; Sonneborn, Div. of ChemRex, Inc.

2.03 REINFORCING STEEL

A Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

2.04 MASONRY JOINT REINFORCEMENT

A General: ASTM A 951 and as follows:
1. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.

2. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
3. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
4. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.

B For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

2.05 SINGLE-WYTHE MASONRY FLASHING SYSTEM

A Flashing Sytem: System of 5/8-inch thick CMU cell flashing pans with no visible drip edge, with 5/16-inch perimeter flanges with built-in adjoining bridge made from high-density polypropylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.

B Products: Subject to compliance with requirements, provide the following:
1. Mortar Net Solutions; BlockFlash

C Accessories:
1. Drainage mat for individual CMU cells
2. Factory installed Insect Guard for integral molded weeps

2.06 MISCELLANEOUS MASONRY ACCESSORIES

A Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.

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

D Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, 3-1/2 inches high and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color: clear.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) Advanced Building Products Inc.; Mortar Maze weep vent.
        2) Blok-Lok, A Hohmann & Barnard Company; Cell-Vent.
        3) Heckmann Building Products Inc.; No. 85 Cell Vent.
        4) Hohmann & Barnard, Inc.; QV Quadro-Vent.
        5) Mortar Net Solutions; CellVent
        6) Wire-Bond; Cell Vent.

E Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Advanced Building Products, Inc.; Mortar Break Weep Mesh
    b. Heckmann Building Products, Inc.; No. 84 WallDefender
    c. Hohmann & Barnard, Inc.; Mortar Trap
    d. Mortar Net Solutions; Wall Defender
    e. Wire-Bond; Cavity Net DT (3611D)
2. Configuration:

a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.07 MASONRY CLEANERS

A Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.08 MORTAR AND GROUT MIXES

A General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

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

C Mortar for Unit Masonry: Comply with ASTM C 270 Proportion Specification.
1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. For masonry below grade, in contact with earth, and where indicated, use Type S.
3. For reinforced masonry and where indicated, use Type S.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N or RN.
5. For interior non-load-bearing partitions, use Type N.

D Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

E Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 or dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

PART 3 EXECUTION

3.01 EXAMINATION

A Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

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

3.02 INSTALLATION, GENERAL

A Thickness: Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

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

D Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.03 CONSTRUCTION TOLERANCES

A Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

B For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

C For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

D For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

E For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

F For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.04 LAYING MASONRY WALLS

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

B Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

C Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items, including roof framing members.

F Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

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

H Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.
2. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.05 MORTAR BEDDING AND JOINTING

A Lay hollow masonry units as follows:
1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

B Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

C Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.06 MASONRY JOINT REINFORCEMENT

A General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 16 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
   a. Reinforcement above is in addition to continuous reinforcement.

B Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 CONTROL AND EXPANSION JOINTS

A General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B Form control joints in concrete masonry as follows:
1. Install preformed control-joint gaskets designed to fit standard sash block.

3.08 LINTELS

A Install steel lintels where indicated.

B Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
1. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

C Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

3.09 FLASHING, WEEP HOLES, AND VENTS

A General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C Install flashing as follows:
1. At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier or building paper.
2. At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn flashing up not less than 2 inches (50 mm) to form a pan.
3. Cut flashing off flush with face of wall after masonry wall construction is completed.

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

E Install weep vents in head joints in exterior wythes of first course of masonry, immediately above embedded flashing, and as follows:
1. Use specified vent products to form weep holes.
2. Space weep vents formed from plastic 16 inches (400 mm) o.c.
3. Cover cavity side of weep vents with plastic insect screening at cavities insulated with loose-fill insulation.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

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

C Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.11 FIELD QUALITY CONTROL

A Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
1. Payment for these services will be made by Owner.

2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

D Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

E Mortar Test (Property Specification): For each mix provided, per ASTM C 780.

F Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.12 REPAIRING, POINTING, AND CLEANING

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

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

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

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

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

A Excess Masonry Waste: Remove excess masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 047200
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast window sills.

B. Precast sign base caps.

1.02 RELATED REQUIREMENTS:

A. Section 071900 - "Water Repellents" for Cast Stone sealer.

1.03 SUBMITTALS

A. Product Data: For cast stone units, include dimensions and profiles of all individual components.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions; details of reinforcement and anchorages, if any; and indication of finished faces. Include outside comers and joint spacing.

C. Samples: For each color and texture of cast stone required.

D. Qualification Data: For cast stone manufacturer. Include lists of completed projects with names and addresses of architects and owners.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:
   1. Architectural Cast Stone Corp.
   2. Architectural Concrete Co., Inc.
   3. ConArt, Inc.
   4. DuraStone.
   5. Miller Precast, Inc.

2.02 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364.
   1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.
   2. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.
   3. Provide drips on projecting elements, unless otherwise indicated.
   4. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
   5. Yard cure units until the sum of the mean daily temperatures for each day equals or exceeds 350 deg F.
   6. Acid etch units to remove cement film from surfaces indicated to be finished.
   7. Size (Width): Manufactured to the following dimensions:
      a. As indicated on Drawings.

B. Colors and Textures: To match natural limestone.

2.03 ACCESSORIES

A. Anchors and Dowels: Type 304 stainless steel.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner; approved for intended use by cast stone manufacturer and approved by cleaner manufacturer

for use on cast stone and adjacent masonry materials.

1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
   a. Diedrich Technologies, Inc.; 202 New Masonry Detergent.
   b. ProSoCo, Inc.; Sure Klean No. 600 Detergent.

2.04 MORTAR MIXES

A. Comply with requirements in Division 4 Section "Unit Masonry Assemblies" for mortar mixes.

B. Setting Mortar: Comply with ASTM C 270, Proportion Specification, Type S.
   1. Limit cementitious materials to portland cement and lime.
   2. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set units in full bed of mortar with full head joints, unless otherwise indicated. Build anchors and ties into mortar joints as units are set.
   1. Fill dowel holes and anchor slots with mortar.
   2. Fill collar joint solid as units are set.
   3. Build concealed flashing into mortar joints as units are set.
   4. Leave head joints open in coping and other units with exposed horizontal surfaces. Keep joints clear of mortar, and rake out to receive sealant.

B. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

C. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

E. Provide expansion, control, and pressure-relieving joints at wall control joint locations.
   1. Sealing joints is specified in Division 7 Section "Joint Sealants."
   2. Keep joints free of mortar and other rigid materials.

3.02 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.

B. Variation from Level: Do not exceed 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.03 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses. Remove mortar fins and smears before tooling joints.

D. Protect during construction by covering with visqueen.

E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Protect adjacent surfaces from contact with cleaner.
   3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   4. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION

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SECTION 051200

STRUCTURAL STEEL

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. Structural steel.

B. Structural steel is to be furnished by the Owner and erected by the General Contractor. The General Contractor shall be responsible for unloading and storing structural steel materials and members. The General Contractor shall verify correctness of materials delivery within 24 hours of materials delivery on-site. The General Contractor shall notify the Owner in writing, of any discrepancies.

1. Contractor is responsible to obtain MSDS information from Owner's material supplier. Owner's supplier shall be Hill Country Steel. Hill Country contact information may be obtained from Owner's representative.

C. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Metal Fabrications" for steel lintels or shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
3. Division 9 painting Sections and Division 9 Section "High-Performance Coatings" for surface preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand

ASD-service loads or LRFD-ultimate loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and applicable AISC's "Steel Construction Manual."
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Construction: Type 3, semirigid framing.

1.5 SUBMITTALS

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

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

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include design calculations sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For Installer, fabricator, professional engineer, testing agency.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout

F. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

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

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: “This approval constitutes the owner’s acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings”.

3. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
4. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design or Load and Resistance Factor Design."
5. AISC's "Specification for the Design of Steel Hollow Structural Sections."
6. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
7. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
8. AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings”, including “Commentary” and Supplements thereto as issued.
9. American Welding Society (AWS) D1.1 “Structural Welding Code – Steel”.
10. ASTM A 6 “General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use”.

D. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS “Standard Qualification Procedure”.
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
2. If recertification of welders is required, retesting will be Contractor’s responsibility.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage device, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.

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

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 572/A 572M, Grade 50.

B. Channels, Angles, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Standard.
2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.
2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.

a. Finish: Plain.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM A 36/A 36M.

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

E. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M min., see drawings.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

G. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.

H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: SSPC-Paint 25, Type I, iron oxide, zinc oxide, raw linseed oil, and alkyd.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I or Type II; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

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

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design or Load and Resistance Factor Design."

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

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

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

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

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

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

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

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

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
2. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning." or
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

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

1. Fill vent holes and grind smooth after galvanizing.

2. Galvanize any materials that are indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

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

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

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

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

1. Level and plumb individual members of structure.

E. Splice members only where indicated and accepted on shop drawings.

F. Do not use thermal cutting during erection unless approved by Architect.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design or Load and Resistance Factor Design" for bearing, adequacy of

temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

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

B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

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

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories**,** bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

D. Coating Below Grade Steel: After erection, apply two (2) heavy coats of asphaltic paint to all structural steel below grade or to be encased in concrete to within 1” of finished surface.

END OF SECTION 05120

SECTION 052100

STEEL JOISTS

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. Extent of steel joist and joist girders are shown on drawings, including basic layout and type of joists and joist girders required.

B. Steel joist and joist girders are to be furnished by the Owner and erected by the General Contractor. The General Contractor shall be responsible for unloading and storing steel joists and joist girders. The General Contractor shall verify correctness of materials delivery within five (5) working days of materials delivery on-site. The General Contractor shall notify the Owner in writing, or any deficiencies.

C. This Section includes the following:

1. Open-web K-series steel joists.
2. KCS-type, open-web K-series steel joists.
3. LH-series long-span steel joists.
4. Joist girders.
5. Joist accessories.

D. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for installing bearing plates in unit masonry.
2. Division 5 Section "Metal Fabrications" for furnishing steel bearing plates.
3. Division 9 Section "Painting" for prime painting.

1.3 DEFINITIONS

A. Special Joists: Joists requiring modification by the manufacturer to support nonuniform, unequal, or special loading conditions that invalidate SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Dead Loads: As shown on Structural Drawings
2. Live Loads: As shown on Structural Drawings
3. Wind Loads: As shown on Structural Drawings
4. Earthquake Loads: As shown on Structural Drawings

B. Design joists to withstand design loads with live/total load deflections no greater than the following:

1. Roof Joists: Vertical deflection of 1/240 of the span for live load.
   Vertical deflection of 1/180 of the span for total load.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated: Submit manufacturers specifications and installation instructions. Include manufacturer's certification that joists comply with SJI "Specifications".

B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.

1. Comprehensive engineering analysis certified by the qualified professional engineer responsible for its preparation.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.

1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.
2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
3. Professional Engineer Qualifications: A professional engineer who is legally authorized 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 joists

that are similar to those indicated for this Project in material, design, and extent.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

B. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

C. High-Strength Bolts and Nuts: ASTM A, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

D. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primers shall comply with SJI “Specifications”, except asphalt type paint shall not be permitted. Color: Gray

2.3 OPEN-WEB K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.

1. Joist Type: K-series steel joists and KCS-type K-series type joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications."

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds ¼ inch per 12 inches (1:48).

2.4 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:

1. Joist Type: LH-series steel joists.
2. End Arrangement: Underslung.
3. Top-Chord Arrangement: Parallel.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Camber long-span steel joists according to SJI's "Specifications".

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.5 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specifications for Joist Girders," in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as follows:

1. End Arrangement: Underslung with bottom-chord extensions.
2. Top-Chord Arrangement: Parallel.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joist girders.

D. Camber joist girders according to SJI's "Specifications."

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.6 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.

1. Furnish additional erection bridging if required.

B. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

C. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface, unless otherwise indicated.

D. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.7 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting members and steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Joists bolted to supporting steel framework shall utilize high-strength structural bolts, unless otherwise indicated. Comply with RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

F. Contractor is responsible to obtain MSDS information from Owner’s material supplier. Owner’s supplier shall be Vulcraft Joist. Vulcraft contact information may be obtained from Owner’s representative. Contractor will comply with all manufacturer handling and installation recommendations.

3.3 FIELD QUALITY CONTROL

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

B. Field welds will be visually inspected according to AWS D1.1.

C. Bolted connections will be visually inspected.

1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

D. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates and abutting structural steel.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 053100

STEEL DECK

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. Roof deck.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
2. Division 9 Section "Painting" for repair painting of painted deck.

C. Roof Deck to be furnished by the Owner and installed by the General Contractor. The General Contractor shall be responsible for unloading and storing the roof deck. The General Contractor shall verify correctness of material delivery within five (5) working days of material delivery on-site. The General Contractor shall notify the Owner in writing, of any deficiencies

1.3 SUBMITTALS

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

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Mechanical fasteners.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

F. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

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

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Steel Deck:

a. BHP Steel Building Products USA Inc.
b. Consolidated Systems, Inc.
c. Epic Metals Corp.

d. Marlyn Steel Products, Inc.
e. Nucor Corp.; Vulcraft Div.
f. Roof Deck, Inc.
g. United Steel Deck, Inc.
h. Verco Manufacturing Co.
i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and the following:

1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Deck Profile: Type PLB, wide rib.
3. Profile Depth: 1-1/2 inches (38 mm).
4. Design Uncoated-Steel Thickness: see contract drawings
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

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

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8 mm) minimum diameter.

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

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

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

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib**,** 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

I. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

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

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

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

1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.

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

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

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

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

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

J. Contractor is responsible to obtain MSDS information from Owner’s material supplier. Owner’s supplier shall be Vulcraft Joists. Vulcraft contact information may be obtained from Owner’s representative. Contractor will comply with all manufacturer handling and installation recommendations.

K. Do not attach hanging loads to the roof deck that are over 25 lbs/lineal foot distributed or 50 lbs. concentrated. Hanging loads should be attached to the structural steel framing system or joists.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds a maximum of 12 inches (305 mm) apart in the field of the roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions of FM Loss Prevention Data Sheet 1-28.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding pattern specified in drawings, and as follows:

1. Mechanically fasten with Verco VSC2 sidelap fastening system.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least 1 weld at each corner.

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

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

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field welds will be subject to inspection.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

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

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

3.5 REPAIRS AND PROTECTION

A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

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

END OF SECTION 05310

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Exterior non-load-bearing curtain-wall framing.
2. Roof trusses.
3. Roof rafter framing.
4. Fiberglas-mat faced, moisture and mold resistant gypsum wall and roof sheathing.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for plywood roof sheathing.
2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies.

1.3 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

1.4 PERFORMANCE REQUIREMENTS

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

1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Non-Load-Bearing Curtain-Wall Framing with CMU/Brick Veneer: Horizontal deflection of 1/240 of the wall height (per IBC, Brick Institute recommendation of 1/600 not required). If GC desires more stringent deflection criteria, this may be done at no additional cost to the owner.
b. Roof Trusses: Vertical deflection of 1/240 of the span.

c. Roof Rafter Framing: Horizontal deflection of 1/240 of the horizontally projected span.

2. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

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

C. Design roof trusses according to AISI's "Design Guide for Cold-Formed Steel Trusses."

1.5 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

C. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Clark Steel Framing Industries.
2. Consolidated Fabricators Corp; Buildings Products Division
3. Consolidated Systems, Inc.
4. MarinoWare; Div. of Ware Industries, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003, structural grade, type H, metallic coated, of grade and coating as follows:

1. Grade: ST33H
2. Coating: G60

2.3 NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths and thickness indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Flange Width: As determined by calculations and structural data prepared by qualified engineer but no less than 1-5/8” inches unless noted otherwise on drawings

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: Matching steel studs.
2. Flange Width: As determined by calculations and structural data prepared by qualified engineer but no less than 1-1/4 inches

2.4 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths and thickness indicated, unpunched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Flange Width: As determined by calculations and structural data prepared by qualified engineer but no less than 1-5/8” inches unless noted otherwise on drawings.

2.5 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths and thickness indicated, unpunched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Flange Width: As determined by calculations and structural data prepared by qualified engineer but no less than 1-5/8 inches unless noted otherwise on drawings.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS Standards

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

2.9 GYPSUM SHEATHING

A. Wall Sheathing: Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.

1. Type and Thickness: Regular,-5/8 inch thick min.
2. Size: 48 by 96 inches.
3. Weight: 2.5 lb/sq ft.
4. Edges: Square.
5. Surfacing: Fiberglass mat on face, back, and long edges.
6. Permeance (ASTM E96): Not less tham 17 perms.
7. Mold Resistance (ASTM D3273): 10, in a test as manufactured.
8. Microbial Resistance (ASTM D6329, UL Environmental Greenguard 3-Week protocol): Will not support microbial growth.
9. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by Georgia-Pacific Corp.

B. Roof/Parapet Sheathing: Glass-Mat Gypsum Roof Board: ASTM C 1177/C 1177M.

1. Type and Thickness: Regular,-5/8 inch thick min.
2. Size: 48 by 96 inches.
3. Weight: 2.5 lb/sq ft.
4. Flute Span (ASTM E661): 5 inches.
5. Permeance (ASTM E96): Greater than 35 perms.
6. Water Absorption (ASTM C1177): Less than 10 percent of weight.
7. Product: Subject to compliance with requirements, provide "Dens-Deck Prime" by Georgia-Pacific Corp.

2.10 SHEATHING ACCESSORIES

A. Fasteners: Steel drill screws, ASTM C 954, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.11 UNDERLAYMENT MATERIALS

A. Self-Adhering, Polyethylene-Faced Sheet: ASTM D 1970, 40 mils thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold-applied.

1. Products:

a. Grace, W.R. & Co.; Grace Ice and Water Shield.
b. Polyguard Products, Inc.; Polyguard Deck Guard.

2.12 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as indicated on drawings:

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.4 TRUSS INSTALLATION

A. Install, bridge, and brace trusses according to Shop Drawings and requirements in this Section.

B. Truss Spacing: As indicated on the drawings.

C. Do not alter, cut, or remove framing members or connections of trusses.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

E. Erect trusses without damaging framing members or connections.

F. Align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.

G. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings.

3.5 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each

board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Protect gypsum sheathing that will be exposed to weather for more than 60 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.

D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

SECTION 055000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Steel ladders.
2 Loose bearing and leveling plates.
3 Loose steel lintels.
4 Shelf angles.
5 Steel framing and supports for overhead doors.
6 Steel framing and supports for operable partitions.
7 Steel framing and supports for mechanical and electrical equipment.
8 Steel framing and supports for applications where framing and supports are not specified in other Sections.
9. Pipe bollards.

B. Miscellaneous steel is to be furnished by the Owner and erected by the General Contractor. The General Contractor shall be responsible for unloading and storing miscellaneous steel materials and members. The General Contractor shall verify correctness of materials delivery within 24 hours of materials delivery on-site. The General Contractor shall notify the Owner in writing, of any discrepancies.

1. Contractor is responsible to obtain MSDS information from Owner's material supplier. Owner's supplier shall be Hill Country Steel. Hill Country contact information may be obtained from Owner's representative.

C. Related Sections include the following:

1. Division 5 Section "Structural Steel" for structural-steel framing system components.

1.3 SUBMITTALS

A. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Provide templates for anchors and bolts specified for installation under other Sections.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.

B. Welding: Qualify procedures and personnel according to the following:

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

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Tubing:

1. Cold-formed steel tubing complying with ASTM A 500.
2. Hot-formed steel tubing complying with ASTM A 501.

D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Malleable-Iron Castings: ASTM A 47, Grade 32510.

F. Gray-Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

G. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3.

E. Lag Bolts: ASME B18.2.1.

F. Plain Washers: Round, carbon steel, ASME B18.22.1.

G. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: The anchors must meet the description in Federal Specification FF-S-325, Group II, Type 4, Class 1 for concrete expansion angles. Anchors shall be Hilt, Kwik Bolt II as supplied by Hilt, Fastening Systems, or engineered approved equivalent.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.5 GROUT

A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

C. Epoxy Grout: “Sup-R-Set” capsule anchor by Ramset for securing pipe guards (ballards) to concrete floor stubs.

2.6 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

L. Rough Hardware: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division-6 sections.

2.8 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.

B. Siderails: Continuous structural channels as indicated on the Drawings.

C. Bar Rungs: 3/4-inch- diameter steel bars, spaced 12 inches o.c.

D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
2. Furnish inserts if units must be installed after concrete is placed.

C. Fabricate supports for operable partitions as follows:

1. Beams: Continuous steel shapes of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

2.12 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior.

2.13 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

B. Provide steel strap anchors, 1/8 by 2 inches, with a minimum 6-inch embedment and 2-inch hook, unless otherwise indicated, for securing door frames into adjoining concrete or masonry. Weld anchors to frame jambs no more than 12 inches from both bottom and head of frame, and space anchors not more than 30 inches apart.

C. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

D. Galvanize frames.

2.14 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 40 steel pipe.
B. Where indicated, fabricate bollards with 3/8-inch thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for ¾ inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

2.15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

1. Paint all exterior exposed steel and lintels in exterior walls with two (2) coats of steel primer paint.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the AWS Code for procedures and the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 SETTING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

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

C. Support steel girders on solid grouted masonry, concrete, or steel columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of columns.

1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

1. Do not grout baseplates of columns supporting steel girders until girders are installed and leveled.

3.4 INSTALLING PIPE BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch greater than OD of bollard. After bollards have been inserted into holes, fill annular space surrounding bollard solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Fill bollards solidly with concrete, mounding top surface.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood blocking and nailers.

B. Sheathing.

C. Plywood substrate panels.

D. Plywood backing panels.

E. Fiberglass reinforced plastic (FRP) panels.

1.02 RELATED REQUIREMENTS

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

B. Section 033000 - Cast-in-Place Concrete: Setting anchors in concrete.

C. Section 055000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

D. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.

E. Section 072600 - Vapor Retarders: Vapor retarder over sheathing.

F. Section 072700 - Air Barriers: Air barrier over sheathing.

G. Section 076200 - Sheet Metal Flashing and Trim: Sill flashings.

H. Section 077200 - Roof Accessories: Prefabricated roof curbs.

I. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NELMA - Northeastern Lumber Manufacturers Association.
   2. NLGA - National Lumber Grades Authority.
   3. SPIB - Southern Pine Inspection Bureau.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

B. Wood Structural Panels:
   1. Plywood: DOC PS 1.
   2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.

3. Factory mark panels according to indicated standard.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber. Do not use material that is warped or does not comply with requirements for untreated material.

C. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Framing for non-load-bearing partitions.
   3. Framing for non-load-bearing exterior walls.
   4. Roof construction.
   5. Plywood backing panels.
   6. Plywood substrate panels (behind wood veneer finishes)

2.04 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and the following species:
   1. Mixed southern pine; SPIB.

2.05 SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
   1. Span Rating: Not less than 32/16.
   2. Thickness: Not less than 1/2 inch (13 mm).

2.06 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

B. Plywood Substrate Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch (12.7 mm) thick.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: CABO NER-272.

C. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

D. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.08 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. General: Furnish and install fiberglass reinforced plastic panels at locations indicated on the drawings and in accordance with the manufacturer’s printed installation instructions.

B. Panels shall be minimum 0.090” thick, Class C, white textured sheets. Sheets shall be provided in sizes to minimize vertical wall joints. Provide vinyl moldings, in color to match the panel, for all terminations and vertical joints. Panels shall be equal to “Fiber-Lite” liner panels by Nudo Products, Inc.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

D. 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.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

3.03 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Sheathing:
      a. Screw to cold-formed metal framing.
      b. Space panels 1/8 inch (3 mm) apart at edges and ends.
   2. Plywood Backing Panels: Screw to supports.

END OF SECTION

SECTION 064200
INTERIOR ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior standing and running trim (including wall caps).

B. Plastic-laminate cabinets.

C. Plastic-laminate countertops and edge treatment.

1.02 RELATED REQUIREMENTS

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

B. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 SUBMITTALS

A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
   4. For laminates with directional wood grain patterns, indicate grain direction on submittal drawings.

1.04 QUALITY ASSURANCE

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.07 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be

supported and installed as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
   1. Particleboard: ANSI A208.1, Grade M-2 and M-2-Exterior Glue.
   2. Softwood Plywood: DOC PS 1.
   3. Medium-Density Fiberboard: ANSI A208.1, Grade 130

C. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
   1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
      a. International Paper; Decorative Products Div.

E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.02 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

D. Pulls: Unless noted otherwise, Wire Pulls. Back mounted, 4 inches (127 mm) long, 1-1/2 inches (62 mm) deep, and 5/16 inches (8 mm) in diameter.
   1. [At Showroom Print Station: Provide continuous recessed drawer pull.
      a. Material: Aluminum
      b. Manufacturer: NYMETAL
      c. Style: NYM165]

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.

F. Drawer and Sliding Shelf Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
   1. Box Drawer Slides: 75 lbf (330 N).
   2. Sliding Shelf Slides: 75 lbf (330 N).

G. Door Locks: BHMA A156.11, E07121;
   1. Lock: quantity as indicated on drawings; to be keyed alike.

H. Grommets for Cable Passage through Countertops: 2 ½-inch OD, black molded-plastic grommets and matching plastic caps with slot for wire passage.

I. Exposed Hardware Finishes: Except where noted otherwise, for hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

2.03 INSTALLATION MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.04 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of openings in countertops with a coat of varnish.

2.05 INTERIOR STANDING AND RUNNING TRIM FOR LAMINATE FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: Custom

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Medium-Density Fiberboard.

E. Laminate Cladding for Exposed Surfaces (Including low wall caps): High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces: HGS
   2. Edges/Vertical Surfaces: VGP (VF-3)

2.06 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.

B. Grade: Custom.

C. AWI Type of Cabinet Construction: Flush overlay.

D. Core material: Medium-Density Fiberboard.

E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: HGS.
   2. Vertical Surfaces: HGS.
   3. Edges: HGS.

F. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative overlay.
   2. Drawer Sides and Backs: Thermoset decorative overlay.
   3. Drawer Bottoms: Thermoset decorative overlay.

G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated on drawings.

H. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.07 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HGS.

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated on drawings.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces, unless noted otherwise.
   1. At print factory in Business Office, edge treatment shall be EdgeCo Incorporated, “Amber Maple” in 3MM PVC.

F. Core Material: Medium-Density Fiberboard.

G. Core Material at Sinks: Medium-Density Fiberboard made with exterior glue.

H. Grain direction: at wood grain finish where indicated on drawings, parallel to front edge of counter. Miter corners.

PART 3 EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
   1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

F. Cabinets: Install without distortion so 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 installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with toggle bolts through metal backing or metal framing behind wall finish.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Secure backsplashes to walls with adhesive.
   3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform

appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

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SECTION 068316
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

C. FM 4880 - Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials 2017.

D. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Crane Composites, Inc: www.cranecomposites.com/#sle.
   2. Marlite, Inc: www.marlite.com/#sle.
   3. Nudo Products, Inc: www.nudo.com/#sle.
   4. Panolam Industries International, Inc: www.panolam.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

A. Wall Panels:
   1. Panel Size: 4 by 8 feet (1.2 by 2.4 m).
   2. Panel Thickness: 0.10 inch (2.5 mm).
   3. Surface Design: Embossed.
   4. Color: As indicated on drawings.
   5. Attachment Method: Adhesive only, sealant joints, no trim.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
   2. Class 1 fire rated when tested in accordance with FM 4880.
   3. Impact Strength: Greater than 6 ft lb force per inch (320 J per m), when tested in accordance with ASTM D256.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 071300
SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubberized-asphalt sheet waterproofing and protection course.

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

1.02 RELATED REQUIREMENTS

A. This Section includes the following:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section..
   2. Section 334100 - Subdrainage: for geotextile filter fabrics.
   3. Section 079200 - Joint Sealants: for joint-sealant materials and installation.

1.03 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water.

1.04 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.08 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
   1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.
   2. Warranty Period: Five years after date of Substantial Completion.

B. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following products:
   1. Rubberized-Asphalt Sheet Waterproofing:
      a. W. R. Grace & Co.; Bituthene.
      b. W. R. Meadows, Inc.; Mel-Rol.

2.02 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.

E. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

F. Protection Course: Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
   1. Thickness: 1/8 inch (3 mm), nominal.
   2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for type of protection course.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

F. Bridge and cover expansion joints with overlapping sheet strips.
   1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
   1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
      a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.03 RUBBERIZED-ASPHALT SHEET APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
   1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Horizontal Application: Extend membrane over footing and turn down the face of the wall footing.

E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

F. Seal exposed edges of sheets at terminations with mastic or sealant.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches (150 mm) beyond repaired areas in all directions.

H. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.04 PROTECTION COURSE INSTALLATION

A. Install protection course with butted joints over waterproofing membrane before starting subsequent construction operations.

3.05 PROTECTION AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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SECTION 071900
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clear water-repellent coatings for the vertical and nontraffic horizontal concrete (unpainted) surfaces.

1.02 RELATED REQUIREMENTS

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

1.03 PERFORMANCE REQUIREMENTS

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
   1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
      a. Stone: ASTM C 97.
   2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
   3. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
   4. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.
   5. Chloride-Ion Intrusion in Concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.
      a. Reduction of Water Absorption: 80 percent.
      b. Reduction in Chloride Content: 80 percent.

1.04 SUBMITTALS

A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

B. Samples: Of each substrate indicated to receive water repellent, 12 inches (300 mm) square, with specified repellent treatment applied to half of each sample.

1.05 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:
   1. Ambient temperature is less than 40 deg F (4.4 deg C).
   2. Concrete surfaces and mortar have cured for less than 28 days.
   3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 24 hours.
   4. Application is earlier than 24 hours after surfaces have been wet.
   5. Substrate is frozen or surface temperature is less than 40 deg F (4.4 deg C).
   6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Siloxanes: With more than 3.3 lb/gal. (400 g/L) VOCs.
      a. Prime-A-Pell 200; Chemprobe Technologies, Inc.
      b. Euco Weather-Guard; Euclid Chemical Company (The).
      c. Thorosiloxane-8S; Harris Specialty Chemicals, Inc.

d. Shed OX; L&M Construction Chemicals, Inc.
e. Weather Seal Siloxane; ProSoCo, Inc.

2.02 WATER REPELLENTS

A. Siloxanes: Penetrating water repellent. Alkylalkoxysiloxanes that are oligomerous with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier.

B. VOC-Complying Water Repellents: Products complying with local regulations controlling use of VOCs, as certified by manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.

B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

3.02 APPLICATION

A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
   1. Precast Work: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.

B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.03 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION

SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rigid underslab and foundation insulation.

B. Rigid exposed wall insulation.

C. Masonry cell foam insulation.

1.02 RELATED REQUIREMENTS

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

B. Section 042000 - Unit Masonry.

C. Section 074200 - Exterior Insulation and Finish Systems - Class PB: for insulation specified as part of these systems.

D. Section 075400 - Thermoplastic Membrane Roofing: for insulation specified as part of roofing construction.

1.03 SUBMITTALS

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

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, for each insulation type indicated provide products by one of the following or an approved alternate product meeting or exceeding the performance criteria of the listed product:
   1. Rigid underslab and foundation insulation;
      a. Extruded-Polystyrene Board Insulation with minimum R-value of 10:
         1) DiversiFoam Products.
         2) Dow Chemical Company.
         3) Owens Corning.
         4) Tenneco Building Products.
   2. Rigid exposed wall insulation:
      a. Foil-faced polyisocyanurate board insulation with minimum R-value of R-11.4 at Wholesale and R-9.5 at Service.
         1) ATLAS Roofing Corporation: Energy Shield Pro, Continuous Wall Insulation.
         2) RMAX, Inc.: TSX-8510.
   3. Masonry cell foam insulation;

a. Two component thermal insulation with minimum R-value of 4.91 per inch.
   1) Tailored Chemical Products; Core-Filll 500.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively.
   1. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.

C. Foil-Faced, Polyisocyanurate (Rigid exposed wall insulation): ASTM C 1289, Type I, Class 1, with maximum flame-spread and smoke developed indices of 75 and 450, respectively. Provide manufacturer’s standard foil facer on one surface and 12 mil, embossed aluminum sheet on exposed face. Provide 48” wide sheets in maximum lengths feasible for application. Minimum R-value of 14.0. Install utilizing manufacturers standard extruded PVC battens (PVC Quick Clip Insulation Retaining System) and ‘J’ mould at bottom of panel.
   1. Paint aluminum facer and pvc trim materials to match wall.

D. Masonry cell foam insulation: ASTM C 177. Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls with minimum R-value of 4.91/inch @ 32 degrees F mean; ASTM C 177

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

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

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

D. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

E. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

F. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

G. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
   1. If not indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

3.05 INSTALLATION OF EXPOSED BUILDING INSULATION

A. Install rigid, heavyweight aluminum-foil faced, units to exterior wall with adhesive in accordance with manufacturer’s written instructions. Install “J” trim at bottom of panel and “T” batten/receiver trim at all vertical joints.

B. Install insulation board vertically with one-piece full height. Channel backside of insulation to receive surface mounted conduit, piping, etc.

C. Carefully cut and place insulation board tightly around wall mounted equipment and reels; rough cut, oversized, or carelessly cut openings and reveals in panels will not be accepted.

D. Provide stand offs for all horizontal and vertial piping, conduits, etc. Refer to mechanical and electrical drawings and specifications for additional information and requirements.

E. Prepare exposed surface of rigid insulation to receive paint finish in accordance with manufacturer's instructions.

3.06 INSTALLATION OF MASONRY FOAM CELL INSULATION

A. Foam cells of all exterior concrete masonry units and where otherwise indicated.

B. Insulation shall be pumped into masonry unit cells at height intervals not exceeding eight feet.

3.07 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. If foil facer of rigid insulation is damaged during installation, provide manufacturer's recommended repair required to maintain thermal and vapor permeance performance as originally specified.

END OF SECTION

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SECTION 074113
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concealed-fastener, flush metal wall panels

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Roof framing and purlins.

B. Section 061000 - Rough Carpentry: Roof sheathing.

C. Section 079200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

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

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.

D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.06 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.07 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including rupturing, cracking, or puncturing.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 CONCEALED-FASTENER, FLUSH METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using concealed fasteners in side laps. Include accessories required for weathertight installation. Panels are then back-stitched with manufacturer's standard fasteners vertically along seam/joint between adjacent panels.

B. Manufacturer: Petersen Aluminum Corporation; Flush/Reveal panel.

C. Material: Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, 22ga. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

D. Finish:
   1. Exterior Finish: Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum

total dry film thickness of 0.5 mil (0.013 mm).

3. Color: As indicated on drawings.

E. Panel Coverage: 12 inches.

F. Panel Height: 1 inch.

G. No stiffener beads.

2.02 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Surface: Ribbed finish.
3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
   a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.
4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.03 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.

1. Fasteners for Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.04 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0269-inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae,

parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.05 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
   1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
   2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
   1. Examine primary and secondary wall framing to verify that angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

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

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.03 METAL WALL PANEL INSTALLATION, GENERAL

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in predrilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:
1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.04 FIELD-ASSEMBLED METAL WALL PANEL INSTALLATION

A. CONCEALED-FASTENER, FLUSH METAL WALL PANELS
1. Compliance: Comply with manufacturer's product data, recommendations and installation instructions for substrate verification, preparation requirements and installation.
2. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
3. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
4. Provide uniform, neat seams.
5. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.

6. Locate and space concealed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
7. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
8. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
9. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.
10. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.

3.05 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.06 ERECTION TOLERANCES

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

3.07 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 074114
METAL ROOF AND SOFFIT PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-formed and field-assembled, standing-seam metal roof panels.

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Roof framing and purlins.

B. Section 054000 - Cold Formed Metal Framing: Secondary support framing for metal panels and roof sheathing.

C. Section 061000 - Rough Carpentry: Roof sheathing.

D. Section 072100 - Thermal Insulation: Rigid roof insulation.

E. Section 074213 - Metal Wall Panels: Preformed wall panels.

F. Section 77100 - Manufactured Roof Specialties: Copings not part of metal roof panel assemblies.

G. Section 079200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

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

1.03 DEFINITIONS

A. Metal Roof and Soffit Panel Assembly: Metal roof panels, metal soffit flush panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof and soffit panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class [1A-90].

C. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel, roof sheathing, and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof and soffit panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
   a. Flashing and trim.
   b. Integral Gutters.

c. Downspouts.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Roof and Soffit Flush Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other metal roof panel accessories.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Maintenance Data: For metal roof and soffit flush panels to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
1. Installer's responsibilities include fabricating and installing metal roof and soffit flush panel assemblies and providing professional engineering services needed to assume engineering responsibility.

B. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Preliminary Roofing Conference: Before starting roof sheathing construction, conduct conference at Project site. Review methods and procedures related to roof construction and metal roof panels including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof and soffit panel installation, including manufacturer's written instructions.
4. Examine conditions for compliance with requirements, including flatness and attachment to structural members.
5. Review flashings, special roof details, roof drainage, and condition of other construction that will affect metal roof and soffit panels.
6. Review roof observation and repair procedures after metal roof and soffit panel installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof and soffit panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof and soffit panels to ensure dryness. Do not store metal roof and soffit panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.09 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

B. Coordinate metal panel roof and soffit panel assemblies with rain drainage work, flashing, trim, and construction of parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof and soffit panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including rupturing, cracking, or puncturing.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof and soffit panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof and soffit panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Weathertight Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
   2. Basis-of-Design Product: The design for the metal roof and soffit panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   2. Surface: Smooth, flat finish.
   3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605.
   4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.03 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Exposed fasteners are not acceptable.
   1. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

2.04 STANDING-SEAM METAL ROOF AND SOFFIT FLUSH PANELS

A. General: Provide factory-formed metal roof and soffit panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1592.

B. Low Slope, Integral Standing Seam Metal Roof Panels (Tire Enclosure): Formed with integral ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and mechanically seaming side edges of adjacent panels
   1. Basis-of-Design Product: Petersen Aluminum Corporation, TITE-LOC PLUS Panels or a comparable product of one of the following:
   2. Available Manufacturers:
      a. AEP-Span.
      b. MBCI; Div. of NCI Building Systems.
   3. Material: Zinc-coated (galvanized – G90) steel sheet, 24 gauge thick.
      a. Exterior Finish: Fluoropolymer.
      b. Color: As noted on drawings.
   4. Clips: Two-piece floating to accommodate thermal movement.
      a. Material: 0.064 thick, zinc-coated (galvanized) steel sheet.
   5. Panel Coverage: 16 inches (406 mm).
   6. Panel Height: 2 inches.
   7. Uplift Rating: UL 90.
   8. Sealant Bead: Factory applied sealant bead.
   9. Factory-produced eave notching.

2.05 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof and soffit panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings,

sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

B. Flashing and Trim: Formed from 0.024 thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Downspouts: Formed from 0.024 thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10-foot- (3-m-) long sections, complete with formed elbows and offsets. Finish downspouts to match metal roof panels.

2.06 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements. Field-forming or portable roll-formed panels will not be permitted.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in finish color of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.
   1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
   2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
   3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

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

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

3.03 METAL ROOF AND SOFFIT PANEL INSTALLATION, GENERAL

A. General: Provide metal roof and soffit panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal roof and soffit panels by torch is not permitted.
   2. Rigidly fasten ridge and the panels shall be hemmed downward to engage the eave and valley cleats. Predrill panels.
   3. Provide metal closures at peaks, rake edges, rake walls and each side of ridge.
   4. Flash and seal metal roof and soffit panels with metal weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   5. Locate and space fastenings in uniform vertical and horizontal alignment.
   6. Install ridge caps as metal roof panel work proceeds.
   7. Panel splices are not allowed. Extend panels from ridge to eave without splices.
   8. Lap metal flashing over metal roof and soffit panels to allow moisture to run over and off the material.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof and soffit panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
   1. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.04 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
   1. Install UL-90 clips in accordance with UL listing, to supports with self-tapping fasteners.
   2. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

3.05 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof and soffit panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

3.06 ERECTION TOLERANCES

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

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform inspections and prepare reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof and soffit panel installation, including accessories. Report results in writing.

C. Remove and replace applications of metal roof and soffit panels where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.08 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof and soffit panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof and soffit panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof and soffit panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures. Individual metal roof and soffit panels with scratches that exceed 2 inches in length through the paint finish exposing bare metal shall be replaced. Single panels with scratches less than 2 inches or that do not exceed 10 inches but does not expose bare metal shall be touched up in the field. All finish touchup shall be made with Valspar Azores paint product as recommended by the manufacturer.

END OF SECTION

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SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Flashings.

D. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 053100 - Steel Decking: Placement of acoustical insulation for deck flutes.

B. Section 061000 - Rough Carpentry: Wood cant strips.

C. Section 077100 - Roof Specialties: Prefabricated roofing expansion joint flashing.

D. Section 077600 - Roof Pavers: Roof mounted pavers and pedestals.

E. Section 154300 - Plumbing Specialties: Roof Drains

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

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

D. Fire/Windstorm Classification: Class 1A

E. Wind Uplift Pressure Rating
   1. Roof Field Area Rating: I-75.
   2. Roof Perimeter Area Rating: I-105.
   3. Roof Corner Area Rating: I-135.

1.05 SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Insulation fastening patterns.

C. Maintenance Data: For roofing system to include in maintenance manuals.

D. Warranties: Special warranties specified in this Section.

E. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Source Limitations: Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

C. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
   2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

D. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to roofing system including, but not limited to, the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   5. Review temporary protection requirements for roofing system during and after installation.
   6. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

C. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, other components of membrane roofing system.
   2. Warranty Period: 10 years from date of Substantial Completion.
   3. Manufacturer’s Warranty shall be written to benefit CarMax Auto Superstores, Inc. at 12800 Tuckahoe Creek Parkway, Richmond, Virginia 23238-1115, Attention CarMax Construction Department.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form provided at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
   1. Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products Company.
      c. GenFlex Roofing Systems.
      d. GAF Materials Corporation
      e. Johns Manville International, Inc.
      f. Sarnafil Inc.
      g. Versico Roofing Systems
   2. Thickness: 60 mils (1.5 mm), nominal.
   3. Exposed Face Color: White.
   4. Physical Properties:
      a. Breaking Strength: 225 lbf (1 kN); ASTM D 751, grab method.
      b. Elongation at Break: 15 percent; ASTM D 751.
      c. Tearing Strength: 55 lbf (245 N) minimum; ASTM D 751, Procedure B.
      d. Brittleness Point: Minus 22 deg F (30 deg C).
      e. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- (75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 pphm (100 mPa); ASTM D 1149.
      f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F (116 deg C); ASTM D 573.
      g. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F (70 deg C); ASTM D 471.

2.02 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard water-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings. Manufacturer’s standard solvent-based bonding adhesive for the membrane will be considered allowable for cold-weather applications.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

E. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.03 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
   1. Manufacturers:
      a. As approved by the Membrane Manufacturer.
   2. Provide a minimum aged value LTTR of: R-40.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to meet field conditions and to provide positive drainage.

2.04 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D 312, Type III or IV.

B. Asphalt Primer: ASTM D 41.

2.05 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 INSTALLATION - INSULATION UNDER MEMBRANE

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install two layers of insulation, with joints staggered, under area of roofing to achieve required thickness.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Fasten insulation independently of the roofing membrane.

3.04 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
   1. Install sheet according to ASTM D 5036.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply water-based bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
   1. Unless noted otherwise on Drawings, extend roofing membrane up and over all roof parapet wall conditions. Extend roofing membrane over top of parapet under coping assembly and terminate minimum one inch down exterior face of parapet blocking.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

I. All cut edges of the membrane shall be seam caulked at the end of each day.

3.05 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings.

F. All base flashings, wall flashings and penetration flashings in the area of that day’s installation shall be completely installed by the end of the work day.

3.06 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.07 FIELD QUALITY CONTROL

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

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

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

3.08 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. During the installation of the metal roof and wall panels, protection of the single ply membrane is required. Protection shall consist of a 6-mil, clear, polyethylene sheeting beneath a minimum thicknes of 1 inch polyisocyanurate insulation board covered with a minimum thichness of ½" plywood sheathing. The material shall be properly weighted down to ensure that the components are not blown about the roof surface. This protection system shall extend out 8 feet from the eave and the rake edge shall be protected as well. Upon completion of the metal panel work, remove the protection course from the roof area.

C. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

CONTRACTOR WARRANTY FORM

PROJECT: _____

LOCATION: _____

WE,_____,

SUBCONTRACTOR FOR _____

THE ABOVE-REFERENCED PROJECT, DO HEREBY WARRANT THAT ALL LABOR AND MATERIALS FURNISHED AND WORK PERFORMED ARE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND AUTHORIZED MODIFICATIONS THERETO, AND WILL BE FREE FROM DEFECTS DUE TO DEFECTIVE WORKMANSHIP FOR A PERIOD OF TWO (2) YEARS FROM DATE OF SUBSTANTIAL COMPLETION. THIS WARRANTY COMMENCES ON

_____

(DATES OF SUBSTANTIAL COMPLETION AFFIXED BY OWNER)

14.01 SHOULD DEFECTS DEVELOP DURING THE WARRANTY PERIOD DUE TO DEFECTIVE WORKMANSHIP, THE AFFECTED MATERIALS, INCLUDING ADJACENT WORK DAMAGED AS A RESULT OF THE SITED DEFECTIVE WORKMANSHIP, SHALL BE MADE GOOD BY THE UNDERSIGNED AT NO EXPENSE TO THE OWNER. THE OWNER WILL GIVE CONTRACTOR WRITTEN NOTICE OF DEFECTIVE WORK AND CONTRACTOR AGREES TO RESPOND WITHIN 24 HOURS. SHOULD CONTRACTOR FAIL TO CORRECT DEFECTIVE WORK WITHIN 60 DAYS AFTER RECEIVING WRITTEN NOTICE, THE OWNER MAY, AT HIS OPTION, CORRECT DEFECTS AND CHARGE CONTRACTOR COSTS FOR SUCH CORRECTION. CONTRACTOR AGREES TO PAY SUCH CHARGES UPON THE OWNER'S DEMAND.

NOTHING IN THE ABOVE SHALL BE DEEMED TO APPLY TO WORK WHICH HAS BEEN ABUSED OR NEGLECTED BY THE OWNER, ACTS OF GOD, CIVIL DISOBEDIENCE OR DEFECTS IN THE STRUCTURE.

FOR THE PURPOSES OF THIS WARRANTY, THE OWNER SHALL BE [CARMAX AUTO SUPERSTORES, INC., A VIRGINIA CORPORATION.][CARMAX AUTO SUPERSTORES WEST COAST, INC., A VIRGINIA CORPORATION.][CARMAX AUTO SUPERSTORES CALIFORNIA, LLC, A VIRGINIA LIMITED LIABILITY COMPANY.]

FOR: _____

(COMPANY NAME)

BY: _____

TITLE: _____

DATE: _____

END OF SECTION

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SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exposed trim, gravel stops, and fasciae.

B. Reglets.

C. Downspouts

D. Gutters

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

1.02 RELATED REQUIREMENTS

A. Section 077123 - Manufactured Gutters and Downspouts.

B. Division 4 Sections for through-wall flashing and other integral masonry flashings specified as part of masonry work.

C. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

D. Division 7 Section "Joint Sealants" for elastomeric sealants.

E. Division 7 Roofing Sections for flashing and roofing accessories installed integral with roofing membrane as part of roofing-system work.

F. Division 7 Section “Manufactured Roof Specialties” for pre-formed metal coping system.

1.03 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone: Wind Zone 1: Wind pressures of 10 to 20 psf (0.48 to 0.96 kPa).

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.06 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 METALS

A. Zinc-coated (Galvanized) Steel Sheet: ASTM A 526, G 90 (ASTM A 526M, Z 275), commercial quality, or ASTM A 527, G 90 (ASTM A 527M, Z 275), lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 20 gauge, unless otherwise indicated.

2.02 FABRICATION, GENERAL

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

C. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

D. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

F. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

G. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

2.03 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

B. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

C. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

D. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

E. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
   1. Material: Galvanized steel, 18 gauge.

F. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Fry Reglet Corporation.
   2. Hickman: W.P. Hickman Co.

3. Keystone Flashing Company.

2.04 DOWNSPOUTS

A. General: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Zinc-Coated Steel: Nominal 24 ga. Thickness.
   2. Metallic-Coated Steel Sheet Downspouts: Zinc-coated (galvanized) steel, nominal 24 ga thickness.
      a. Surface: Smooth flat finish.
      b. Finish: Two-coat fluoropolymer.
      c. Color:
         1) Tire Enclosure: Match Petersen Aluminum Corporation “Sierra Tan”.

2.05 GUTTERS

A. General: Manufactured in the following exposed metal and in uniform section lengths not exceeding 12 feet (3.6 m) with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
   1. Zinc-Coated Steel: Nominal 24 ga. Thickness.
   2. Metallic-Coated Steel Sheet Gutters: Zinc-coated (galvanized) steel, nominal 24 ga thickness.
      a. Surface: Smooth flat finish.
      b. Finish: Two-coat fluoropolymer.
      c. Color:
         1) Tire Enclosure: Match Petersen Aluminum Corporation “Sierra Tan”.

2.06 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

B. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

C. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

D. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

E. 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 thickness required for performance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "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. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
   1. Use joint adhesive for nonmoving joints specified not to be soldered.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

F. Install reglets to receive counterflashing according to the following requirements:
   1. Where reglets are shown in masonry, furnish reglets for installation under Division 4 Section "Unit Masonry."

3.03 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

SECTION 077100
MANUFACTURED ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, and gravel stops.

1.02 RELATED REQUIREMENTS

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

B. Section 061000 - Rough Carpentry: Wood nailers, curbs, and blocking.

C. Section 076200 - Sheet Metal Flashing and Trim: Custom- and site-fabricated sheet metal flashing and trim.

D. Section 077200 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.

1.03 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. FMG Listing: Manufacture and install copings that are listed in FMG's "Approval Guide" and approved for Windstorm Classification: CLASS 1-60.
   1. Identify materials with FMG markings.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Include the following:
   1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.

C. Samples for Verification: Of the following products, in manufacturer's standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work. Furnish straight Samples in lengths specified below or where corner pieces are required for Project; furnish corner Samples with each leg in lengths specified below:
   1. Copings: 8 inches (200 mm) long.

D. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.06 COORDINATION

A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.07 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   3. Basis-of-Design Product: The designs for copings are based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers specified.

2.02 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
   1. Surface: Smooth, flat finish.
   2. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

2.03 CONCEALED METALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.05 COPINGS

A. Copings: Manufactured coping system consisting of shop formed or pre-formed metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.
   1. Basis-of-Design Product: PAC - Continuous Cleat Coping or a comparable product by one of the following:
      a. Hickman, W. P. Company.
      b. Metal-Era

2. Coping Caps: Snap-on, fabricated from the following exposed metal:
   a. Aluminum: 0.050 inch (1.2 mm) thick.
3. Coping Cap Color: As indicated on drawings.
4. Corners:
   a. Provide preformed or shop formed corners equal to one of the following;
      1) Continuously welded mitered.
      2) PAC-Tite Quicklock miter assembly.
5. Snap-on Coping Anchor Plates: Continuous, concealed, galvanized steel sheet, with integral cleats, both front and rear.
6. Concealed Splice Plates: Manufacturer's standard concealed splice plates, minimum 8 inches wide, with factory applied non-curing sealant strips.
7. Fasteners: No exposed fasnteners are permitted. Fasteners installed through back leg, front leg or top of coping assembly will result in rejection of coping assembly installation.

2.06 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use concealed fasteners, separators, splice plates, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
   1. Install manufactured roof specialties with provisions for thermal and structural movement.
   2. Torch cutting of manufactured roof specialties is not permitted.
   3. Field forming of roof specialties is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (450 mm) of corners or intersections.

F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

G. Seal joints between dissimilar materials with elastomeric sealant as required by manufacturer of roofing specialties and where indicated on drawings.

3.03 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to resist uplift and outward forces according to performance requirements.

C. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

D. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

E. Coordinate installation of flashing flanges into reglets.

F. Do not install fasteners through back leg, front leg or top of coping assembly. Exposed fasteners of any kind will not be accepted and will result in rejection of coping assembly installation.

3.04 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077200
ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SECTON INCLUDES

A. This Section includes the following:
   1. Roof hatch.
   2. Roof hatch rail system.
   3. Roof curbs.
   4. Roof top equipment supports.

B. Related Sections include the following:

1.02 RELATED REQUIREMENTS

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

B. Section 061000 - Rough Carpentry: Roof sheathing, wood cants, and wood nailers.

C. Section 076200 - Sheet Metal Flashing and Trim: Shop and field-fabricated metal flashing and counterflashing, scuppers, gutters and downspouts, fasciae, roof expansion-joint covers, valleys, and miscellaneous sheet metal trim and accessories.

D. Section 077200 - Roof Accessories: Roofing accessories included as part of roofing Work.

E. Section 077100 - Roof Specialties: Other manufactured roof specialty items.

F. Division 15 Sections for factory-provided curbs with mechanical equipment and other equipment supports.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

1.04 QUALITY ASSURANCE

A. Standards: Comply with the following:
   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Roof Hatch:
      a. Babcock-Davis Hatchways, Inc.
      b. Bilco Company.
      c. Dur-Red Products, Inc.
      d. J. L. Industries, Inc.
      e. Milcor, Inc.
   2. Roof Curbs:
      a. Custom Curbs, Inc.
      b. Pate Co. (The).
   3. Equipment Supports:
      a. Pate Co. (The).
      b. RPS (Roof Products & Systems)

2.02 MATERIALS, GENERAL

A. Galvanized Steel Sheet: ASTM A 653/A 653M with G90 (Z275) coating designation; commercial quality, unless otherwise indicated.
   1. Structural Quality: Grade 40 (Grade 275), where indicated or as required for strength.

B. Insulation: Manufacturer's standard rigid glass-fiber board of thickness indicated.

C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
   1. Where removing exterior exposed fasteners affords access to building, provide nonremovable fastener heads.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

2.03 ROOF HATCH

A. General: Fabricate units to withstand 40-lbf/sq. ft. (1.9- kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loading pressure. Frame with minimum 12-inch- (225-mm-) high, integral-curb, double-wall construction with 1-1/2-inch (38- mm) insulation, formed cants and cap flashing (roofing counterflashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1- inch- (25-mm-) thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.
   1. Basis-of-Design Product: Bilco type S-20

B. Type: Single-leaf personnel access.
   1. For Ladder Access: 30 by 36 inches (750 by 900 mm).

C. Material: Galvanized Steel.
   1. Finish: Prime painted.

D. Sloping Roofs: Where slope or roof deck exceeds 1/4 inch per foot (1:48), fabricate hatch curbs with height tapered to match slope to level tops of units.

2.04 HATCH RAIL SYSTEM

A. Basis-of-Design Manufacturer: Type Bil-Guard® Roof Hatch Railing System by The Bilco Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530

B. Furnish and install where indicated on plans hatch rail system Model RL-S. The hatch rail system shall be field assembled and installed (by others) per the manufacturer’s instructions.

C. 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.

D. Posts and Rails: Shall be round pultruded reinforced fire retardant yellow fiberglass treated with a UV inhibitor.

E. Hardware: Mounting brackets shall be ¼” (6mm) thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.

2.05 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be

supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Load Requirements: Obtain equipment information from supplier.
2. Material: Galvanized steel sheet, 0.052 inch (1.32 mm) thick.
   a. Finish: Prime painted.
3. Liner: Same material as curb, of manufacturer's standard thickness and finish.
4. Factory install wood nailers at tops of curbs.
5. Factory insulate curbs with 1-1/2-inch- (38-mm-) thick, glass-fiber board insulation.
6. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches (300 mm) above the elevation of the roof membrane.

2.06 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide fully flashed internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings with continuously welded corner joints, stepped integral cant raised the thickness of the roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
   1. Construction:
      a. Insulation: Factory insulatited with 1-1/2 inch thick glass-fiber board insulation.
      b. 18 gauge galvanized steel
      c. Fabricate equipment supports to a minimum height of 11 inches above roof surface unless otherwise indicated.
      d. Internally reinforced unitized construction
      e. Factory-installed continuous wood nailers 5-1/2” wide at tops of equipment supports.
      f. Metal counterflashing; Manufacturer’s standard, removable, fabricated of same metal finish as equipment support.
      g. Form deck-mounting flange at perimeter bottom to conform to roof profile.

B. Equipment Support Schedule: Provide under all roof top equipment supports, including, but not limited to:
   1. Paint booth exhaust ductwork and fans
   2. Other roof top mounted equipment not specified by other sections.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated,

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of all-purpose sealant to form a seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.

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

3.02 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION

SECTION 078400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

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

B. Section 017000 - Execution and Closeout Requirements: Cutting and patching.

C. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 PERFORMANCE REQUIREMENTS

A. General: For joints in the following constructions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed:
   1. Fire-resistance-rated load-bearing walls, including partitions with fire-protection-rated openings.
   2. Fire-resistance-rated non-load-bearing walls, including partitions with fire-protection-rated openings.

B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.
   1. Load-bearing capabilities as determined by evaluation during the time test.

C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UBC Standard 26-9 and UL 2079.

1.04 SUBMITTALS

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

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From fire-resistive joint system manufacturer indicating the following:
   1. Materials forming joint substrates have been tested for compatibility and adhesion with fill materials.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

G. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to fire-resistive joint system manufacturers, for testing indicated below, samples of materials that will contact or affect fill materials.
   1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
      a. Perform tests under environmental conditions replicating those that will exist during installation.
   2. Submit no fewer than nine pieces of each type of material, including joint substrates, forming materials, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain fire-resistive joint system manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "Performance Requirements" Article:
   1. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
      a. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
      b. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
      c. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
   2. Fire-resistive joint systems are identical to those tested per ICBO ES AC30 and are qualified for types of joints and joint movement capabilities indicated in a current Evaluation Report by the ICBO Evaluation Service.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.08 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities

having jurisdiction, have examined each installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Basis-of-Design Products: The design for each fire-resistive joint system is based on products named in Part 2 articles. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
      a. 3M Fire Protection Products: www.3m.com/firestop/#sle.
      b. A/D Fire Protection Systems Inc.: www.adfire.com/#sle.
      c. Hilti, Inc.: www.hilti.com/#sle.
      d. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
      e. Specified Technologies Inc.: www.stifirestop.com/#sle.
      f. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
      g. United States Gypsum Company (USG).
      h. W.R. Grace.
      i. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.03 FIRE-RESISTIVE JOINT SYSTEMS

A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

B. Head-of-Wall, Fire-Resistive Joint System:
   1. 1 Hour Construction: UL System HW-D-0064.

C. Wall-to-Wall, Fire-Resistive Joint System:
   1. 1 Hour Construction: UL System WW-D-0032.

D. Through-Wall Penetration Fire-Resistive Joint System:
   1. 1 Hour Construction: UL System W-J.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.

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

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems and to prepare inspection reports.
   1. Inspecting agency will state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

B. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.

C. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

3.05 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sealants for the following applications, including those specified by reference to this Section.

B. Sealants for the following applications:
   1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
      a. Control and expansion joints in unit masonry.
      b. Joints between different materials listed above.
      c. Perimeter joints between materials listed above and frames of doors and windows.
      d. Other joints as indicated.
   2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
      e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      g. Other joints as indicated.
   3. Interior joints in the following horizontal traffic surfaces:
      a. Other joints as indicated.

1.02 RELATED REQUIREMENTS

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

B. Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.

C. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.

D. Division 8 Section "Glazing" for glazing sealants.

E. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

F. Division 9 Section “Ceramic Tile” for control and expansion joints in interior horizontal traffic tile surfaces.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
   3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.08 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 Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: Match Architect's samples. Provide custom colors where required to match adjacent finish surfaces.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.

C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

2.04 LATEX JOINT SEALANTS

A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.05 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Type C: Closed-cell material with a surface skin.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
      a. Metal.
      b. Glass.
      c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform

beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
    a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.06 ELASTOMERIC JOINT-SEALANT SCHEDULE

A. Low-Modulus Nonacid-Curing Silicone Sealant: Provide products complying with the following:
    1. Products: Provide one of the following
        a. Silicone (custom color):
            1) 790; Dow Corning.
            2) Silpruf; GE Silicones.
            3) 864; Pecora Corporation.
            4) Spectrem 1; Tremco.
    2. Type and Grade: S (single component) and NS (nonsag).
    3. Class: 25.
    4. Use Related to Exposure: NT (nontraffic).
    5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
    6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
    7. Applications: Joints within exterior insulation and finish system.

B. Medium-Modulus Neutral-Curing Silicone Sealant: Provide products complying with the following:
    1. Products: Provide one of the following
        a. Silicone (paintable):
            1) MasterSeal NP 150; BASF
            2) Momentive SCS7000; GE
        b. Silicone (custom color) FOR STOREFRONT PERIMETER [AND INTEGRAL COLORED MASONRY]:
            1) 795; Dow Corning.
            2) Spectrem 2; Tremco.
            3) Tremsil 600; Tremco.
    2. Type and Grade: S (single component) and NS (nonsag).
    3. Class: 25.
    4. Use Related to Exposure: NT (nontraffic).
    5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
    6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

7. Applications: Exterior building joints, including joints in precast units. Provide non-paintable custom color sealant at storefront perimeter and precast units.

C. Mildew-Resistant Silicone Sealant: Provide products formulated with fungicide that are intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes, and that comply with the following:
   1. Products: Provide one of the following
      a. 786 Mildew Resistant; Dow Corning.
      b. Sanitary 1700; GE Silicones.
      c. 898 Silicone Sanitary Sealant; Pecora Corporation.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
   6. Applications: Interior “wet joints”.
   7. Provide white sealant at porecelain fixtures/materials.
   8. Provide clear sealant at stainless steel fixtures/materials.

3.07 LATEX JOINT-SEALANT SCHEDULE

A. Latex Sealant: Provide products complying with the following:
   1. Products: Provide one of the following
      a. Chem-Calk 600; Bostik Inc.
      b. AC-20; Pecora Corporation.
      c. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
      d. Tremflex 834; Tremco.
   2. Applications: Interior joints.

END OF SECTION

SECTION 081113
STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following:
   1. Steel doors.
   2. Steel door frames.
   3. Sidelight frames
   4. Borrowed-light frames.
   5. Fire-rated door and frame assemblies.
   6. Louvers in doors.

B. Related Sections include the following:
   1. Division 4 Section "Unit Masonry Assemblies" for installing anchors and grouting frames in masonry construction.
   2. Division 8 Section "Flush Wood Doors" for wood doors installed in steel frames.
   3. Division 8 Section "Door Hardware for door hardware and weather stripping.
   4. Division 8 Section "Glazing" for glass in glazed openings in doors and frames.
   5. Division 9 Section "Gypsum Board Assemblies" for spot-grouting frames installed in steel-framed gypsum board partitions.
   6. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.02 RELATED REQUIREMENTS

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

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing: Glass for doors and borrowed lites.

D. Section 099113 - Exterior Painting: Field painting.

E. Section 099123 - Interior Painting: Field painting.

1.03 SUPPLIER REQUIREMENTS

A. All products in this section shall be Owner Furnished and Installed by General Contractor.
   1. Required supplier:
      a. D.H. Pace Company, Inc.
      b. Email: CarMaxDoors@DHPace.com (Preferred Method of Contact)
      c. Phone: 877.579.2333
      d. 1901 E. 119th Street / Olathe, KS 66061
      e. Attention: Luke Hannan

1.04 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.05 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:
   1. Elevations of each door design.
   2. Details of doors including vertical and horizontal edge details.
   3. Frame details for each frame type including dimensioned profiles.
   4. Details and locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.

6. Details of anchorages, accessories, joints, and connections.
7. Coordination of glazing frames and stops with glass and glazing requirements.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.06 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, products by one of the following will be provided:
1. Steel Doors and Frames:
a. Amweld Building Products, Inc.
b. Ceco Door Products; a United Dominion Company.
c. Curries Company.
d. Republic Builders Products.
e. Steelcraft; a division of Ingersoll-Rand.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

2.03 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 2 (18 ga) and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 3 (16 ga) and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

D. Door Louvers: Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 24 ga thick, cold-rolled steel sheet set into 20 ga thick steel frame.

1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

E. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.04 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 16 ga thick steel sheet for:
1. Level 2 steel and all wood doors.
2. Level 3 steel doors.

C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

E. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.05 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction.

C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
1. Cold-rolled steel sheet, unless otherwise indicated.

D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.

F. Clearances for Fire-Rated Doors: As required by NFPA 80.

G. Single-Acting, Door-Edge Profile: Beveled edge.

H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

K. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.

L. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

M. Frame Construction: Fabricate frames to shape shown.
1. Fabricate frames with mitered or coped and continuously welded corners.
2. Provide welded frames with temporary spreader bars.

N. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

O. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

P. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

2.06 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. 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.
1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In masonry construction, provide at least four wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
4. Install fire-rated frames according to NFPA 80.
5. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
1. Fire-Rated Doors: Install within clearances specified in NFPA 80.

3.02 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.03 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

C. Adjust for smooth and balanced door movement.

3.04 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 081416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 081213 - Hollow Metal Frames.

C. Section 087100 - Door Hardware.

D. Section 088000 - Glazing.

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

1.03 SUPPLIER REQUIREMENTS

A. All products in this section shall be Owner Furnished and Installed by General Contractor.
   1. Required supplier:
      a. D.H. Pace Company, Inc.
         1) Email: CarMaxDoors@DHPace.com (Preferred Method of Contact)
         2) Phone: 877.579.2333
         3) 1901 E. 119th Street / Olathe, KS 66061
         4) Attention: Luke Hannan

1.04 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate doors to be factory finished and finish requirements.
   4. Indicate fire ratings for fire doors.

C. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors” and AWI's "Architectural Woodwork Quality Standards Illustrated”.
   1. Provide flush wood doors that meet AWI specifications and requirements.
   2. Provide letter on manufacturer’s company letterhead that doors provided have been constructed in accordance with AWI specifications and requirements for finishes and grades specified.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to [NFPA 252] [UBC Standard 7-2].

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
   1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
      a. Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, products by one of the following shall be provided:
   1. Flush Wood Doors:
      a. Algoma Hardwoods Inc.
      b. Eggers Industries; Architectural Door Division.
      c. Marshfield DoorSystems, Inc.
      d. Mohawk Flush Doors, Inc.
      e. Oshkosh Architectural Door Co.
      f. VT Industries, Inc.

2.02 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:
   1. Grade: Premium, with Grade AA faces.
   2. Species and Cut: Algoma White Maple Sliced RA-100

2.03 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:
   1. Particleboard: ANSI A208.1, Grade LD-2.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.:
      a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
      b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.

B. Interior Veneer-Faced Doors:
   1. Core: Particleboard.
   2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware:
   a. 5-inch (125-mm) top-rail blocking.
   b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
   c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

2.04 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
   1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
   1. Light Openings: Trim openings with moldings of same wood species as door faces and manufacturer’s standard profile.

2.05 FACTORY FINISHING

A. General: Comply with AWI's “Architectural Woodwork Quality Standards Illustrated” for factory finishing.

B. Finish doors at factory.

C. Finish doors at factory that are indicated to receive transparent finish.

D. Transparent Finish:
   1. To match RA-100 by Algoma Hardwoods Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.02 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

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

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 081613
FIBERGLASS DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced polyester (FRP) flush doors with aluminum frames.

1.02 RELATED REQUIREMENTS

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

B. Section 087100 - Door Hardware.

1.03 SUPPLIER REQUIREMENTS

A. All products in this section shall be Owner Furnished and Installed by General Contractor.
   1. Required supplier:
      a. D.H. Pace Company, Inc.
         1) Email: CarMaxDoors@DHPace.com (Preferred Method of Contact)
         2) Phone: 877.579.2333
         3) 1901 E. 119th Street / Olathe, KS 66061
         4) Attention: Luke Hannan

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
   1. Flame Spread: Maximum of 25.
   2. Smoke Developed: Maximum of 450.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.

C. Samples:
   1. Color: Submit manufacturer's samples of standard colors of doors and frames.

D. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

E. Warranty: Submit manufacturer's standard warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.07 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on the Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Toll Free (800) 821-6531. Phone (269) 423-7068. Fax (800) 423-7610.

B. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

C. Door Opening Size: As indicated on the Drawings.

D. Construction:
   1. Door Thickness: 1-3/4 inches.
   2. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.
   3. Corners: Mitered.
   4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
   5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
   6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
   7. Rail caps or other face sheet capture methods are not acceptable.
   8. Extrude top and bottom rail legs for interlocking continuous weather bar.
   9. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.

E. Face Sheet:
   1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
   2. Texture: Pebble.

F. Core:
   1. Material: Poured-in-place polyurethane foam.
   2. Density: Minimum of 5 pounds per cubic foot.
   3. R-Value: Minimum of 11.

G. Hardware:
   1. Pre-machine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
   2. Factory install hardware.

2.02 MATERIALS

A. Aluminum Members:
   1. Extrusions: ASTM B 221.
   2. Sheet and Plate: ASTM B 209.
   3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:
   1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
   2. Compatibility: Compatible with items to be fastened.
   3. Exposed Fasteners: Screws with finish matching items to be fastened.

D. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

E. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

F. Assembly:

2.03 FABRICATION

A. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.

B. Remove burrs from cut edges.

C. Welding: Welding of doors or frames is not acceptable.
   1. Fit:

D. Maintain continuity of line and accurate relation of planes and angles.

E. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.04 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:

B. Size and Type: As indicated on the Drawings.

C. Materials: Aluminum Alloy 6063-T5, 1/8-inch minimum wall thickness.

D. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.

E. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.

F. Caulking: Caulk joints before assembling frame members.

G. Joints:
   1. Secure joints with fasteners.
   2. Provide hairline butt joint appearance.

H. Field Fabrication: Field fabrication of framing using stick material is not acceptable.

I. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.

2.05 HARDWARE:

A. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.

B. Factory install hardware.

2.06 ANCHORS:

A. Provide anchors appropriate for wall conditions to anchor framing to wall materials.

B. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.

2.07 ALUMINUM FINISH

A. Anodized Finish: Class I finish, 0.7 mils thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.03 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

E. Set thresholds in bed of mastic and backseal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.04 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.05 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

C. PROTECTION

D. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 083323
OVERHEAD COILING DOORS - RYTEC & GDB

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated service doors.

B. Hi Speed glazed service doors.

C. Glazed service doors.

D. Counter doors.

E. High Performance Vinyl Carwash Doors.

F. High Performance Motorized fabric roll-up doors at Photobooth.

1.02 RELATED REQUIREMENTS:

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

B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 083326 - Overhead Coiling Grilles.

D. Section 087100 - Door Hardware: Cylinder cores and keys.

E. Section 099113 - Exterior Painting: Field paint finish.

F. Section 099123 - Interior Painting: Field paint finish.

G. Section 260533.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.

H. Section 260583 - Wiring Connections: Power to disconnect.

1.03 SUPPLIER REQUIREMENTS

A. All products in this section shall be Owner Furnished and Vendor Installed. Refer to Door Schedule included in Drawings and information in Part 2 for specific door vendor for each door type/location.

1.04 DEFINITIONS

A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.05 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Resistance to Wind Load: Uniform pressure (velocity pressure) acting inward (pressure) and outward (suction) of wind acting normal to plane of wall as determined in accordance with ASTM E330/E330M, FBC TAS 202, or ANSI/DASMA 108-2012:
   a. Uniform pressure (velocity pressure): 22.7 lbs/sq ft.

B. Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 100,000 cycles.

1.06 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
2. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; coatings; damp

location modifications.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
   1. Obtain operators and controls from the overhead coiling door manufacturer.

C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, the following manufacturers and products shall be provided:
   1. Insulated Service Doors:
      a. GDB Group (Contact: Randy Gale, President GDB Group, 404-808-0709, RGale.GDBGroup@outlook.com)
         1) Manufacturer: Wayne Dalton
         2) Model: Thermotite 800-C.
         3) Reference Door Types Q and S.
   2. High Speed Glazed Service Doors
      a. Rytec Corporation (Contact: Telephone: 262-677-9046; Monday – Friday 8am – 5pm (Central Time), Fax: 262-677-2058, Email: info@rytecdoors.com
         1) Model: Spiral FV Model STT-L System 4, coiling service door with vision slats, high speed.
         2) Reference Door Type U.
         3) Glazing
            (a) U-Value: 1.13 max
            (b) SHGC: .28 max
   3. Glazed Service Doors
      a. Rytec Corporation (Contact: Telephone: 262-677-9046; Monday – Friday 8am – 5pm (Central Time), Fax: 262-677-2058, Email: info@rytecdoors.com
         1) Model: Spiral FV Model VPD – Direct Drive Standard Lift, service door with vision slats.
         2) Reference Door Type V .
         3) Glazing
            (a) U-Value: 1.13 max
            (b) SHGC: .28 max
   4. Counter Doors:
      a. GDB Group (Contact: Randy Gale, President GDB Group, 404-808-0709, RGale.GDBGroup@outlook.com)
         1) Model: 500 Rolling Counter Door.
         2) Reference Door Type OH1/OH2
   5. High Performance Vinyl Carwash Doors:

a. DH Pace Company, Inc. (Contact: Luke Hannan, 877-579-2333, CarMaxDoors@DHPace.com)
   1) Manufacturer: Airlift Doors Inc.
   2) Model: XRS Extreme Roll Up Series, Vinyl Door
      (a) Color: Black
      (b) Reference Door Type V.

6. High Performance Motorized fabric roll-up doors at Photobooth:
   a. GDB Group (Contact: Randy Gale, President GDB Group, 404-808-0709, RGale.GDBGroup@outlook.com)
      1) Manufacturer: Dynaco
      2) Mode: D-313 Cleanroom; All surfaces/finishes to be White.
      3) Reference Door Type W.

2.02 DOOR MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Structural-quality, cold-rolled galvanized steel sheets, min. 22 gauge, complying with ASTM A 653, with G90 (ASTM A 653M, with Z275) zinc coating.
      a. Provide manufacturer's standard flat-profile slats.
   2. Insulation: Fill slat with manufacturer's standard polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
   3. Inside Curtain Slat Face: To match material of outside metal curtain slat and as follows:
      a. Galvanized Steel Sheet Thickness: Not less than 0.028 inch (0.7 mm).
   4. Aluminum Door Curtain Slats (Counter Doors): ASTM B 209 (ASTM B 209M) or ASTM B 221 (ASTM B 221M), 1 ½ inches high by ½ inch deep of 0.040 inch aluminum.
      a. Provide manufacturer's standard flat-profile slats.

B. Endlocks: Malleable-iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets, or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets or high-strength nylon, as required to comply with wind load.

D. Bottom Bar for Insulated Service Doors: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.

E. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, aluminum extrusions to suit type of curtain slats.

F. Curtain Jamb Guides (Service Doors): Fabricate curtain jamb guides of steel angles, or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch- (5-mm-) thick, galvanized steel sections complying with ASTM A 36 (ASTM A 36M), and ASTM A 123. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain and a continuous bar for holding windlocks.

G. Curtain Jamb Guides (Counter Doors): Fabricate curtain jamb guides of angles, or channels and angles of heavy duty, extruded aluminum sections with snap-on cover to conceal fasteners, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide polypropylene pile runners of both sides of curtain guides to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain. The use of pre-fabricated, anodized aluminum, channel jamb guides is acceptable at non-fire rated assemblies.

2.03 HOODS AND ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
   1. Fabricate steel hoods, for steel doors, of not less than 0.028-inch (0.7-mm) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653 (ASTM A 653M).
   2. For fire-rated counter doors, include automatic drop baffle to guard against passage of smoke or flame.
   3. Fabricate aluminum hoods, complying with ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and not less than 0.032 inch (0.8 mm) thick, for aluminum doors.
   4. Shape: Square.

B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and at top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous sheet secured to inside of curtain coil hood.
   1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
   2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

C. Windows: Provide windows of 1/4-inch (6-mm) clear, transparent acrylic sheet, of size and in arrangement shown. Set glazing in vinyl, rubber or neoprene glazing channel secured to curtain slats.

D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

E. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
   1. Locking Bars: Single-jamb side, operable from inside only.
   2. Lock cylinder: Counter Doors only; specified in another Division 8 Section.

F. Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.04 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.05 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

2.07 STEEL AND GALVANIZED STEEL FINISHES

A. Powder-Coat-Applied Finish: Apply manufacturer's standard powder-coat-applied finish consisting of primer and topcoat(s) according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
   1. Color:
      a. Service Doors: Tan
      b. Counter Doors: Grey
   2. Sheen: Gloss

2.08 ELECTRIC DOOR OPERATORS FOR NON-FIRE RATED ASSEMBLIES

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head hoist-type door operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain-hoist and floor level disconnect.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps (0.2 m/s) or more than 1 fps (0.3 m/s), without exceeding nameplate ratings or considering service factor.
   1. Type: Polyphase, medium-induction type.
   2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
   3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
   4. Provide open drip proof (ODP) type motor, and controller with NEMA ICS 6, Type 1 enclosure.

5. Provide totally enclosed fan cooled (TEFC) type motor, and controller with NEMA ICS 6, Type 4/12 enclosure at Carwash building.

H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
   1. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      a. Provide electrically actuated automatic bottom bar.
         1) Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.
   2. Photo Eyes: Provide each motorized door with NEMA4X through beam photo eyes mounted on each jamb. Locations as indicated on architectural and electrical drawings.

I. Door Control Devices: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop", and timer defeat switch and loop defeat switch where indicated on drawings."
   1. Provide interior units, full-guarded, recessed-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
   2. Provide exterior units for car wash building, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
   3. Overhead Traffic Detection Microwave Motion Sensor: In addition to the 3-button operator referred to above, provide microwave motion sensor above overhead doors on inside and outside of doors and as indicated on drawings. including sealant in color that matches adjacent finish, at the penetration of any conduit or wiring.
      a. Include Defeat Switch
   4. Time to Close: Provide time to close function on motorized doors with ability to adjust timing. Include timer defeat switch as indicated on the architectural and electrical drawings.
   5. Carwash Exit Door Pneumatic Hose Sensor: Provide flexible pneumatic hose sensor for door opener operation.
   6. Time to Close: Provide time to close function on motorized doors with ability to adjust timing. Include timer defeat switch as indicated on the architectural and electrical drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
   1. Install fire-rated doors to comply with NFPA 80.

3.02 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.03 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
   3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."

4. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION

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SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following:
   1. Exterior aluminum storefronts and entrance systems.

1.02 RELATED REQUIRMEENTS

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

B. Section 051200 - Structural Steel Framing: Steel attachment members.

C. Section 055000 - Metal Fabrications: Steel attachment devices.

D. Section 072500 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.

E. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

F. Section 084229 - Automatic Entrances.

G. Section 087100 - Door Hardware: Hardware items other than specified in this section.

H. Section 088000 - Glazing: Glass and glazing accessories.

I. Section 122400 - Window Shades: Attachments to framing members.

1.03 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
   1. Air infiltration and water penetration exceeding specified limits.
   2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

D. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
   1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, unless otherwise indicated.

E. Seismic Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.

F. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
   1. Provide a minimum 1/8-inch (3.18-mm) clearance between members and top of glazing or other fixed part immediately below.
   2. Provide a minimum 1/16-inch (1.59-mm) clearance between members and operable windows and doors.

G. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads

indicated without failure of materials or permanent deformation.

H. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. (0.3 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75.2 Pa).

I. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (299 Pa). Water leakage is defined as follows:
   1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

J. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

K. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

L. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.

M. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F (3.57 W/sq. m x K) when tested according to AAMA 1503.1.

N. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.04 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Engineer shall be licensed to practice in the State in which the project is to be constructed.

C. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
   1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

D. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer. Source of aluminum entrance and storefront system shall be the same as the source of the glazed aluminum curtain wall system.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions." For storefront components with insulated glazing, basis of design shall be Kawneer 451T (2” x 4 1/2”) for 1” thick glazing. All other storefront systems shall be Kawneer 400.
   1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.07 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including, but not limited to, excessive deflection.
   2. Failure of system to meet performance requirements.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Failure of operating components to function normally.
   5. Water leakage through fixed glazing and frame areas.

C. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide products by one of the following or a product from another manufacturer and meets or exceeds the performance criteria listed:
   1. EFCO Corporation; Series 526
   2. Kawneer Company, Inc.: Trifab 451/451T
   3. Trulite Glass & Aluminum Solutions, LLC: CT-451

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
   1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
   5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Glazing as specified in Division 8 Section "Glazing."

D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

F. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

G. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

H. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.03 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch- (44.5-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
   1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
   2. Stile Design: Wide stile; over 4 inches (101.6 mm) wide, at all doors.

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Reinforce members as required to retain fastener threads.
   2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.

F. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:
   1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.
   2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.04 HARDWARE

A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.

B. Offset Pivots: ANSI/BHMA A156.4, Grade 1 with exposed parts of cast-aluminum alloy. Provide top, bottom, and intermediate pivots at each door leaf.

C. Closers, General: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.

1. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
   a. Exterior Doors: 15 lbf (67 N).
   b. Interior Doors: 5 lbf (22.2 N).

D. Concealed Overhead Closers:
1. For all interior door locations, except as noted below: LCN 2030. Provide 110 degree opening with hold-open function at 90 degrees.
   a. (a) For all interior doors entering into Presentation: LCN 2030. Provide 110 degree opening without hold-open function .
2. For all exterior door locations: LCN 5030. Provide 110 degree opening.

E. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.

F. Mortise Cylinders: See Door Schedule on the Drawings and Section 08711 – “Door Hardware” for specific cylinder and cylinder core requirements.

G. Thumb Turns: Manufacturer's standard cast-aluminum-alloy, inside thumb-turn cylinders.

H. Cylinder Guard: Manufacturer's standard hardened-steel security ring with retainer plate for inside stile wall that protects lock cylinder from removal by wrenches, prying, or sawing.

I. Deadlock: Manufacturer's standard mortise deadlock with minimum 1-inch- (25.4-mm-) long throw bolt and complying with ANSI/BHMA A156.5, Grade 1 requirements.
1. Two-Point Locking: Provide bottom bolt and mechanism that automatically throws active-leaf bottom bolt into threshold when deadlock engages inactive leaf and provides one-stage unlocking.

J. Lockset Faceplates: Manufacturer's standard extruded-aluminum faceplate for lock type indicated that lays flush with door stile.

K. Flat Face Strikes: Manufacturer's standard stainless-steel, flat face strike with steel mounting plate and black-plastic dustbox.

L. Manual Flush Bolts: ANSI/BHMA A156.16, edge-mortised, lever-extension-type flush bolts.
1. Locate flush bolts at top and bottom of inactive leaf of pairs of doors.

M. Push / Pull Handles:
   a. Pull Handles: 12” center-to-center, 90-degree offset, 1-inch diameter, satin stainless steel (US32D).
   b. Push Bar: 1-inch diameter, satin stainless steel (US32D), bar equal to SmartPush Model H-1111 by YKK America.
   c. Provide one pull handle and push bar on all swinging, aluminum entrance doors.
   d. Provide end caps, in finish to match the push/pull material, at all exposed ends caps.

N. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

2.05 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
1. Fabricate components for screw-spline frame construction.
2. Fabricate components for head- and sill-receptor frame construction with shear-block construction at intermediate horizontal components.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

G. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Storefront: Fabricate framing in profiles indicated for glazing. Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

I. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
   1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
   2. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single-door frames and 2 silencers on head of double-door frames.

2.06 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker. (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte).

2.07 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do

not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
   1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.
   1. Remove excess sealant from component surfaces before sealant has cured.

H. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
   1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
   3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.03 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 086200
UNIT SKYLIGHTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes factory-assembled, self-flashing, unit skylights and curbs for installation in flat roof areas.

1.02 RELATED REQUIREMENTS

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

B. Section 055000 - Metal Fabrications: Miscellaneous steel framing for rough opening.

C. Section 061000 - Rough Carpentry: Wood support curbs, framing and blocking.

1.03 SUBMITTALS

A. Product Data: For unit skylights. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For unit skylights. Include plans, elevations, sections, details, and attachments to other Work.

C. Samples for Verification: For each type of exposed finish required, in a representative section of each unit in manufacturer's standard size.

1.04 QUALITY ASSURANCE

A. Fire-Test Response Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Self-Ignition Temperature: 650 deg F (343 deg C) or greater for plastic sheets in thickness indicated when tested per ASTM D 1929.
   2. Smoke Production Characteristics: Comply with either requirement below:
      a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
      b. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
   3. Relative-Burning Characteristics: Tested per ASTM D 635.
      a. Polycarbonate Glazing: Class CC1, burning extent of 1 inch (25 mm) or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Uncontrolled water leakage.
   2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   3. Yellowing of acrylic glazing.
   4. Breakage of polycarbonate glazing.
   5. Deterioration of insulating-glass hermetic seal.

B. Warranty Period: Five years from Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Sunoptics Signature Series Dome

2.02 UNIT SKYLIGHTS

A. General: Factory-assembled units that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding design loads indicated.

B. Curb: Self-flashing type.
   1. Height: 12 inches (355.6 mm) 24 inches (711.2 mm).
   2. Insulation: Standard rigid type.
   3. Color: Interior surfaces primed white

C. Unit Shape and Size: Frame 800MD and 4080.

D. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated per UL 972, and with average impact strength of 12 to 16 ft-lb/in. (640 to 854 J/m) of width when tested per ASTM D 256, Test Method A (Izod).
   1. Double-Glazing Profile: Dome, 25 percent rise.
      a. Inner Glazing Color: SR25 White prismatic lens.
      b. Outer Glazing Color: SR40 100% Impact modified clear prismatic acrylic.
      c. U-Value: .50 max
      d. SHGC: .40 max

E. Glazing Gaskets: EPDM, neoprene, partially vulcanized butyl tape, or liquid-applied elastomeric sealant.

F. Aluminum Components:
   1. Sheets: ASTM B 209 (ASTM B 209M), alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad alloy 3005-H25.
   2. Extruded Shapes: ASTM B 221 (ASTM B 221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of alloy 6063-T52.
   3. Anodic Coating: Class I, clear anodic coating complying with AAMA 611.

G. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

H. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

I. Thermal Break: Fabricate unit skylights with thermal barrier separating interior metal framing from materials exposed to outside temperature.

J. Security Grill: Safety Security Screen.

2.03 INSTALLATION MATERIALS

A. Elastomeric Sealant: ASTM C 920; Type S; Grade NS; Class 25; and Uses NT, G, A, and (as applicable to joint substrates indicated) O; recommended by unit skylight manufacturer and compatible with joint surfaces.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate unit skylight installation with installation of substrates, 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.
   1. Unless otherwise indicated, install unit skylights according to construction details of NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Anchor unit skylights and curbs securely to supporting substrates.

3.02 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION

SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial door hardware for the following:
   1. Swinging doors.
   2. Cylinders for doors specified in other Sections.
   3. Electrified door hardware.

B. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Cylinders for locks on aluminum and glass entrance doors.

1.02 RELATED REQUIREMENTS

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

1.03 SUPPLIER REQUIREMENTS

A. All products in this section shall be Owner Furnished and Installed by General Contractor.
   1. Required supplier:
      a. D.H. Pace Company, Inc.
         1) Email: CarMaxDoors@DHPace.com (Preferred Method of Contact)
         2) Phone: 877.579.2333
         3) 1901 E. 119th Street / Olathe, KS 66061
         4) Attention: Luke Hannan

1.04 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, 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. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
      a. Organize door hardware sets in same order as in the Door Hardware Schedule indicated on the Drawings..
   3. 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 each 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.
   4. 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. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

D. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door 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.

B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

C. Regulatory Requirements: Comply with provisions of the following:

D. 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

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.

1.07 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.08 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 door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators and door hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: three years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, door hardware sets indicated in door and frame schedule.

2.02 HINGES AND PIVOTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hinges:
      a. Hager Companies (HAG).
      b. McKinney Products Company; Div. of ESSEX Industries, Inc. (MCK).

c. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

B. Fasteners: Comply with the following:
1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

2.03 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Mechanical Locks and Latches:
a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
b. Schlage Lock Company; an Ingersoll-Rand Company (SCH).
c. Yale Security Inc.; Div. of Williams Holdings (YAL).
d. Lock shall accept Schlage Keyway, compatible with Everest C123 keying system.

B. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

2.04 DOOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flush Bolts:
a. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
b. Hager Companies (HAG).
c. Ives: H. B. Ives (IVS).
d. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
e. Rockwood Manufacturing Company (RM).

B. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

C. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
1. Dutch-Door Bolts: Minimum 3/4-inch (19-mm) throw.
2. Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

2.05 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Adams Rite Manufacturing Co. (ARM).
2. NT Dor-O-Matic Hardware Div.; an Ingersoll-Rand Company (NTD).
3. Falcon Hardware; an Ingersoll-Rand Company (FIR).
4. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
5. Von Duprin; an Ingersoll-Rand Company (VD).

B. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

C. 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.

2.06 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cylinders: Same manufacturer as for locks and latches.
a. Schlage Lock Company; an Ingersoll-Rand Company (SCH). Everest C123 keying system.
2. Key Control Systems:
a. Key Control Systems, Inc. (KCS).
b. Major Metalfab Co. (MM).

c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
d. Sunroc Corporation (SUN).

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
1. Number of Pins: six.
2. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Interchangeable Cores: Core insert, removable by use of a special key, and usable with other manufacturers' cylinders.

D. Construction Keying: Comply with the following:
1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:
1. Master Key System: Cylinders are operated by a change key and a master key.

F. Keys: Provide nickel-silver keys complying with the following:
1. Quantity: Provide two extra blank keys for each lock.

2.07 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Surface-Mounted Closers:
a. LCN Closers; an Ingersoll-Rand Company (LCN).
b. Norton Door Controls; Div. of Yale Security Inc. (NDC).
c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
d. Yale Security Inc.; Div. of Williams Holdings (YAL).

B. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.08 LOCK AND LATCH GUARDS

A. Basis of Design: Subject to compliance with requirements, provide products by Ives, LG1, US2G.

2.09 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Metal Protective Trim Units:
a. Hager Companies (HAG).
b. Ives: H. B. Ives (IVS).
c. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
d. Rockwood Manufacturing Company (RM).

B. Materials: Fabricate protection plates from the following:
1. Stainless Steel: 0.050 inch (1.3 mm) thick; beveled top and 2 sides.

C. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

D. Furnish protection plates sized 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in Door Hardware Schedule.

2.10 STOPS AND HOLDERS

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

1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
2. Ives: H. B. Ives (IVS).
3. NT Quality Hardware; an Ingersoll-Rand Company (NTQ).
4. Rockwood Manufacturing Company (RM).

B. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

2.11 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Door Gasketing:
      a. National Guard Products, Inc. (NGP).
      b. Pemko Manufacturing Co., Inc. (PEM).
      c. Reese Enterprises, Inc. (RE).
      d. Zero International, Inc. (ZRO).
   2. Door Bottoms:
      a. National Guard Products, Inc. (NGP).
      b. Pemko Manufacturing Co., Inc. (PEM).
      c. Reese Enterprises, Inc. (RE).
      d. Zero International, Inc. (ZRO).

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

2.12 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. National Guard Products, Inc. (NGP).
   2. Pemko Manufacturing Co., Inc. (PEM).
   3. Reese Enterprises, Inc. (RE).
   4. Zero International, Inc. (ZRO).

2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Steel Machine or Wood Screws: For the following fire-rated applications:
      a. Mortise hinges to doors.

b. Strike plates to frames.
c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.
4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.14 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.03 INSTALLATION

A. 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."

B. Install each door hardware item to comply with manufacturer's 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.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.04 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.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

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

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.07 DOOR HARDWARE SCHEDULE

A. See Drawings

END OF SECTION

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SECTION 088000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Exterior and Interior Swinging Doors.
   2. Glazed entrances.
   3. Interior borrowed lites.
   4. Storefront framing and entrances.

B. Insulating glass units.

C. Interior uninsulated glazing units.

1.02 RELATED REQUIREMENTS

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

B. Section 072500 - Weather Barriers.

C. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.

D. Section 081113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

E. Section 081416 - Flush Wood Doors: Glazed lites in doors.

F. Section 083200 - Sliding Glass Doors: Glazing provided by door manufacturer.

G. Section 084313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

H. Section 102800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 RELATED DOCUMENTS

1.04 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic and/or ceramic coatings.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.05 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Specified Design Wind Loads: As indicated on the Drawings.
      b. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
      c. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.06 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
   1. Each color of tinted float glass.
   2. Insulating glass for each designation indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Warranties: Special warranties specified in this Section.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass and insulating glass.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

E. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA's "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
   4. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Polycarbonate Glass: 11 mm 7/16 inch nominal glass-clad polycarbonate: 3 mm 1/8 inch clear chemically-strengthened glass, .3 mm 0.050 inch polyurethane interlayer, 3 mm 1/8 inch polycarbonate sheet, 1.3 mm 0.050 inch polyurethane interlayer, 3 mm 1/8 inch clear chemically-strengthened glass.

D. Fire Rated Glazing: Thickness: 5/16 inch (8 mm) overall, Weight: 4 lbs./sq. ft., approximate Visible Transmission: 85 percent, approximate Visible Reflection: 9 percent, Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II), STC Rating: Approximately 38 dB., Surface Finish: Premium Grade-Ground and polished on both sides, Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes. Basis of design: FireLite Plus.

E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
   2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
   3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
   4. Sealing System: Dual seal, with primary and secondary sealants as follows:
      a. Manufacturer's standard sealants.
   5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
      a. Spacer Material: Aluminum with mill or clear anodic finish.
      b. Corner Construction: Manufacturer's standard corner construction.

2.03 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Neoprene, ASTM C 864.
   2. EPDM, ASTM C 864.
   3. Silicone, ASTM C 1115.
   4. Any material indicated above.

2.04 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.05 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.06 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear), Kind FT (fully tempered) float glass.
   1. Thickness: 6.0 mm.

B. Uncoated Tinted Float-Glass Units: Class 2 (tinted) Kind FT (fully tempered) float glass.
   1. Products:

a. “Solar Blue” by Viracon, or equal by
b. Pilkington Building Products.
c. Vitro Architectural Glass (formerly PPG)
2. Thickness: 6.0 mm.
3. Visible Light Transmittance: 55 percent minimum.
4. Outdoor Visible Reflectance: 6 percent maximum.

2.07 INSULATING-GLASS UNITS

A. Tinted, (Passive Solar Low-E) Insulating-Glass Units:
1. Basis-of-Design Product: Viracon, Solar Blue VE-26-85 or a comparable product by one of the following:
a. Pilkington Building Products.
b. Vitro Architectural Glass (formerly PPG)
2. Overall Unit Thickness and Thickness of Each Lite: 1-inch (25 and 6.0 mm).
3. Interspace Content: Air.
4. Outdoor Lite: Class 2 (tinted) float glass.
a. Kind HS (heat strengthened), or fully tempered where required.
5. Indoor Lite: Class 1 (clear) float glass.
a. Kind HS (heat strengthened), or fully tempered where required.
6. Low-E Coating: Sputtered on second surface.
7. Visible Light Transmittance: 48 percent minimum.
8. Winter Nighttime U-Factor: 0.38 maximum.
9. Summer Daytime U-Factor: 0.38 maximum.
10. Solar Heat Gain Coefficient: 0.36 maximum.
11. Outdoor Visible Reflectance: 8 percent maximum.

B. Aluminum Swinging Entrance Doors:
1. Overall Unit Thickness and Thickness of Each Lite: 1-inch (25 and 6.0 mm).
2. Interspace Content: Air.
3. Outdoor Lite: Class 1 (clear) float glass.
a. Kind HS (heat strengthened), or fully tempered where required.
4. Indoor Lite: Class 1 (clear) float glass.
a. Kind HS (heat strengthened), or fully tempered where required.
5. Low–E coating: Sputtered on second surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.05 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.06 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.07 GLAZING SCHEDULE

A. Exterior Storefront and all Curtain Wall Glazing: Tinted, Passive Solar Low-E Insulating-Glass Units where indicated on drawings.

B. All Exterior Glazed Doors (including Sliding Doors): Uncoated Tinted Float-Glass Units, unless otherwise indicated.

C. All Glazing in Fire-Rated Assemblies: Fire rated glazing.

D. All Interior Glazing, including doors, unless otherwise indicated: Uncoated Clear Float-Glass Units

END OF SECTION 08800

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SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Non-load-bearing steel framing.
   3. Sound attenuation blankets.

1.02 RELATED REQUIREMENTS

A. Related Sections include the following:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   2. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.
   3. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
   4. Section 072100 - Thermal Insulation: Acoustic insulation.
   5. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.
   6. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
   7. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
   8. Section 092216 - Non-Structural Metal Framing.
   9. Section 093000 - Tiling: Tile backing board.
   10. Division 15 Section “Basics Materials and Methods” for access doors installed in gypsum board assemblies.

1.03 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   1. Steel Framing and Furring:
      a. Clark Steel Framing Systems.

b. MarinoWare; Division of Ware Ind.
c. SCAFCO Corporation.
2. Gypsum Board and Related Products:
a. G-P Gypsum Corp.
b. National Gypsum Company.
c. United States Gypsum Co.
d. Certainteed Gypsum, Inc.

2.02 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

C. Hangers: As follows:
1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with manufacturer's standard corrosion-resistant zinc coating.
1. Depth: 1-1/2 inches (38.1 mm).

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).

2.03 STEEL PARTITION AND SOFFIT FRAMING

A. Components, General: As follows:
1. Comply with ASTM C 754 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.

B. Steel Studs and Runners: ASTM C 645.
1. Minimum Base Metal Thickness: As indicated.
2. Depth: As indicated.

C. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
2. Depth: 7/8 inch (22.2 mm).

E. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.04 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 1396 / C1396M.
1. Regular Type:
a. Thickness: 1/2 inch (12.7 mm), unless otherwise indicated.
b. Long Edges: Tapered.
c. Location: As indicated.
2. Type X:
a. Thickness: 5/8 inch (15.9 mm).

b. Long Edges: Tapered.
c. Location: Where required for fire-resistance-rated assembly.

C. Gypsum Ceiling Board: ASTM C 1396 / C1396M.
1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

D. Abuse (Impact) Resistant Gypsum Wallboard: ASTM C 1629 / C 1629M.
1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.
3. Location: Presentation Lane
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.
5. Microbial Resistance ASTM D6329, EPA 12-week protocol: Will not support microbial growth.
6. Abuse Resistance:
a. Surface Abrasion: Level 3.
b. Surface Indentation: Level 1.
c. Soft-Body Impact: Level 2.

2.05 TILE BACKING PANELS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Gypsum Backing Board: ASTM C 1396 / C1396M.
1. Core: 1/2 inch (12.7 mm), regular type.
2. For substrate for all ceramic wall tile as well as all installations located within four (4) feet of any water source.

2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc, Plastic.
2. Shapes:
a. Cornerbead: Use at outside corners, unless otherwise indicated.
b. LC-Bead (J-Bead): Use at exposed panel edges.
c. Expansion (Control) Joint: Use where indicated.
d. Outside Corner Vinyl Wall Covering (VWC) Trim: Extrude-a-Trim model #FRO230, use where scheduled or indicated on drawings.

2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

2.08 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. Isolation Strip at Exterior Walls:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Locations: As noted on Drawings.

F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

3.03 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
   1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
   2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.04 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by

bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.

E. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 24 inches (610 mm) o.c.

F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.05 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install foam-gasket isolation strip between studs and wall.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.
2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
    a. Terminate partition framing at suspended ceilings where indicated.

D. Install steel studs and furring at the spacing indicated on drawings

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb

anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint at Architect's direction. Do not install control joints without approval from Architect on locations.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

3.06 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings where indicated on Drawings or where approved by Architect.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

3.07 PANEL APPLICATION METHODS

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

D. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

E. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

F. Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Install where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

3.08 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.09 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
1. Level 1: Joints and interior angles shall have tape embedded in joint compound. Surfaces shall be free of excess joint compound. Tool marks and ridges are acceptable. This finish level may be used in plenum area above ceilings, in attics and in areas where the assembly is concealed unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 3: Joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. This final level may be used in areas that are to receive heavy textured, thick (1/8 inch or greater) wall coverings.
4. Level 4: Joints and interior angles shall have tape embedded in joint compound and three separate coats of joint compound applied over joints, angles, fastener heads, and

accessories. Joint compound shall be smooth and free of tool marks and ridges. Prepare surface to be coated with a primer/sealer prior to the application of final finishes. This finish level may be used where lights, textured finishes, and wall coverings are to be applied and all panel surfaces that will be exposed to view, unless otherwise indicated

5. Level 5: In addition to Level 4 requirements provide final skim coat on top of final level 4 finish coat.
    a. Locations: See floor plans and elevations for specific locations.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Supplementary insulation above ceiling.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.02 RELATED REQUIREMENTS

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

B. Section 072100 - Thermal Insulation: Acoustical insulation.

1.03 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

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

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

C. Maintenance Data: For finishes to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 450 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical panels 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.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Furnish 1 carton each of size, type, and color for each installed product.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.03 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – 24 BY 48 INCHES

A. Available Products:
   1. Fine Fissured Second Look II, Armstrong World Industries.
   2. Radar ClimaPlus Illusion Two/24, USG Corporation.
   3. Performa - Fine Fissured, CertainTeed.

B. Color: White.

C. Edge Detail: Reveal sized to fit flange of exposed suspension system members.

D. Thickness: As indicated on drawings.

2.04 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – 24 BY 24 INCHES

A. Available Products:
   1. Fine Fissured Open Plan, Armstrong World Industries.
   2. Olympia Micro Clima Plus Panels, USG Corporation.
   3. Performa - Fine Fissured HNRC (High NRC), CertainTeed.

B. Color: White.

C. Edge Detail: Reveal sized to fit flange of exposed suspension system members.

D. Thickness: As indicated on drawings.

2.05 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

2.06 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Manufacturers:
   1. Armstrong World Industries.
   2. Certainteed.
   3. USG Interiors, Inc.

B. Wide-Face, Capped, Double-Web Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
   1. Structural Classification: Heavy-duty system.
   2. End Condition of Cross Runners: Override (stepped) type.
   3. Face Design: Flat, flush.
   4. Cap Material: Steel cold-rolled sheet.
   5. Cap Finish: Painted white.

2.07 METAL EDGE MOLDINGS AND TRIM

A. Available Manufacturers:
   1. Armstrong World Industries, Inc.
   2. Certainteed, Wall Angle and Grid Accessories.
   3. USG Interiors, Inc.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
   1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.08 ACOUSTICAL SEALANT

A. Available Products:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with [ASTM C 636] and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   6. Do not attach hangers to steel deck tabs.
   7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.04 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 096250
DECORATIVE CONCRETE POLISHED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Application of liquid harders with mechanical grinding and polishign to deocrate and protect horizontal concrete surfaces.

1.02 RELATED REQUIREMENTS

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

B. Section 033000 - Cast In Place Concrete: Concrete sub-floor to have a steel troweled finish and comply with the minimum Ff/Fl requirements.

C. Section 098000 - Epoxy Flooring Systems: Epoxy Stripe Coating located in Service and FQC buildings as indicated on drawings. Provide surface preparation as indicated.

1.03 SUBMITTALS

A. Samples: Submit two 12 inch by 12 inch cured samples of each floor color indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

C. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 01770 Closeout Procedures.

1.04 QUALITY ASSURANCE

A. Samples: Submit two 12 inch by 12 inch cured samples of each floor color indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

C. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 017700 Closeout Procedures.

1.05 QUALITY ASSURANCE

A. Materials used in the floor surfacing shall be the products of a single manufacturer.

B. Installation shall be performed by an applicator with minimum 3 years experience in work of similar nature and scope. Installer must be approved by the manufacturer of the floor surfacing materials. The contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

C. Prior to installation of structural floor slab, advise General Contractor, in writing, of all requirements of concrete substrate regarding finish, level tolerance, and curing.

D. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related material manufacturers.
   1. Joint locations may or may not be shown in drawings.

E. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the owners' representative and the Architect upon request.

F. Contractor to have proven experience with specified system.

G. Mock-up: Prior to starting application of flooring, provide full-scale mock-up to establish acceptable quality, and performance criteria identified in paragprah 1.6 below. Mock-up area must not be less than 100 square feet.
   1. Locate mock-up in Presentation Lane area; mock-up area shall encompass both flat and sloped portions of flooring. Coordinate location of mock-up with Owner. Acceptable mock-up to be standard of quality for remaining work.
   2. Accepted work may remain in place. Unacceptable work to be removed and replaced until acceptable.

1.06 PERFORMANCE

A. High tolerance hardened concrete floor finish shall comply with the following performance requirements.
   1. Performance Characteristics:
      a. Meets or exceeds ADA COF of 0.60 for accessible routes and 0.80 for ramps tested in accordance with ASTM C 1028.
      b. Degree of Reflectiveness as per horizontal test area tested in accordance with ASTM E 430.
      c. Degree of Hardness as per horizontal test area tested in accordance with ASTM D 3363-05.
      d. Measure of Water Absorption as per horizontal test area tested in accordance with Rilem Test Method – Test No. 11.4

1.07 PROJECT CONDITIONS

A. Maintain the ambient room and the floor temperatures at 50 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

B. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

1.08 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to project site in original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.

B. Store materials in dry protected area at a temperature between 50° F to 80° F.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: PROSOCO, Inc.

2.02 CERTIFIED INSTALLER/APPLICATOR

A. The applicators for this product are proprietary. No other installers will be allowed.
   1. FlorLine Group. Shane Reynolds (330) 830-3380 or shane@florline.com
   2. BNR Concrete Polishing, LLC. David A. Beck, 972.307.8951 ext. 221, dbeck@bnrconcrete.com, 972.661.5533 fax
   3. Desco Flooring. Mark Verry, 317.339.1173 mobile, mark@descofloors.com

2.03 SURFACE PREPARATION PRODUCTS

A. The General Contractor shall coordinate required surface preparation product requirements of the concrete slab with the applicator.

B. Consolideck® Wax & Cure Remover
   1. Description: A wax and sealant remover that does not contain methanol, methylene chloride or other halogenated solvents.

C. Consolideck® Cleaner/Degreaser
   1. Description: A mildly alkaline solution scours oil and grease films, adhesive tape residues and rubber tire marks and scuffs from concrete floors.

D. Consolideck® Concrete Floor Restorer
   1. Description: General purpose, non etching acidic cleaner removes rust, mud, oil, atmospheric dirt, mortar smears and other stains.

E. Consolideck® Oil and Grease Stain Remover
   1. A poultice cleaner for pulling stubborn oil and grease stains out of concrete.

2.04 LIQUID HARDENERS

A. Consolideck® LS
   1. Description: Premium hardener and sealer for concrete surfaces. A penetrating lithium silicate treatment reacting with the calcium hydroxide from concrete hydration to produce insoluble calcium silicate hydrate (C-S-H).

2.05 PROTECTIVE TREATMENTS

A. Consolideck® LSGuard
   1. Description: LSGuard is a high-gloss penetrating premium sealer, lithium silicate hardener for horizontal concrete surfaces including cement terrazzo. Treated surfaces resist damage from water, chemical attack and abrasion.

2.06 MAINTENANCE CLEANING PRODUCTS

A. Consolideck® LSKlean™
   1. Description: A concentrated maintenance cleaner for concrete floors. The lithium silicate component helps maintain concrete hardness by curing any “soft” calcium hydroxide left over from the original hardening-densifying treatment.

2.07 CLEANING EQUIPMENT

A. Scrubber Machines: Equipment used for cleaning operations
   1. Clark Encore Max38 or L38 with a head pressure of 150 lbs
   2. American Lincoln # 7760
   3. Approved equal similar equipment as required to produce the specified result and specifications and submitted at pre-job meeting for approval.

2.08 SCRUBBER BRUSH:

A. Soft Nylon fiber brush or similar equipment as required to produce the specified results. No brushes or pads with any kind of grit. i.e., strata, super grit, etc.

2.09 CONCRETE POLISHING EQUIPMENT

A. Grinding and Polishing Equipment
   1. HTC 800/950 Planetary Grinder Heads with 3 or 4 heads or similar.
   2. Walk behind grinder with planetary, counter-rotating 3 or 4 head with variable speed heads and at least 600 pounds down pressure.

B. Grinding/Polishing Pads
   1. Metal 25, 40 and 80 grits
   2. Resin 50, 100, 200, 400 and 800 grits.

2.10 BURNISHING EQUIPMENT

A. High Speed Burnisher Manufacturer
   1. Manufacturer:
      a. Clark

B. High speed propane burnisher
   1. Talon Series

a. Minimum 27 inch head
2. Propane motor generating a minimum 3,000 RPM.

C. Burnishing Pad Manufacturers: Provide products for burnishing as manufactured by the following or equivalent to the extent as required to produce specified results
1. HTC Twister

D. Burnishing Pads: Pads may include the following or similar as required to produce specified results.
1. Norton Abrasive Pad.

2.11 ADDITIONAL EQUIPMENT

A. Pump Sprayer and tip
1. Pump compatible for solvent for SLX100
2. Pump compatible for water based material
3. Tip size not to exceed .5 GPM

B. Airless
1. Produces .47 GPM, equivalent to GRACO 390 with 4 or 611 tip and Extended Reach Tools.
2. Approved equal similar equipment as required to produce the specified result and specifications and submitted at pre-job meeting for approval

C. Microfiber Mop with wet pads

D. Soft bristle broom

2.12 ENVIRONMENTAL EQUIPMENT

A. Applicator is to submit Environmental Plan in accordance with local regulatory requirements. Permits or notice from local regulatory accepting and acknowledging method of disposal of waste.

B. Dust Extraction System: pre-separator, and squeegee attachments with minimum flow rating of 322 cubic feet per minute. Submit proposed system and waste minimization plan for approval.

C. Waste Slurry Removal System: Required for wet grinding. Submit proposed system and waste minimization plan for approval

PART 3 - EXECUTION

3.01 PREPARATION FOR DECORATIVE CONCRETE POLISHED FLOORING

A. Obtain Architect's approval of mock-up before installing flooring.

B. Locate all flexible joints required. Seal joints in accordance with the manufacturer’s recommended product.

C. Preparation of Surface for decorative concrete polished flooring:
1. After concrete curing period (28 days minimum) has elapsed, inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.
2. Notify Architect in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.
3. Verify that moisture content is within range acceptable to flooring material manufacturer using calcium chloride test kit and/or plastic sheet method per ASTM D-4263.
4. Prepare surface as required by manufacturer's printed instructions.
5. Treat cracks in concrete using manufacturer's recommended practice. Rout out crack and joints, and fill with semi-flexible epoxy.
6. Remove plastic void cap at the top of the expansion joint material placed at the perimeter of the concrete slabs. Clean joint of all foreign material, and install flexible epoxy joint filler.

3.02 PREPARATION FOR EPOXY STRIPE COATING

A. Inspect surfaces to receive Epoxy Stripe Coating and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work.
   1. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.
   2. Mechanically abrade the surface to remove any sealers, loose or deteriorated concrete and impart a uniform surface profile consistent ICRI CSP-3

3.03 APPLICATION – GRINDING STEP

A. Surface is to be opened to receive liquid hardener. Test floor for hardness to determine beginning point. Select appropriate grinding level to begin and grind surface to achieve uniform even finish with minimal exposure of aggregate.
   1. Grind in perpendicular directions for each step.
   2. Clean surface with vacuum system or auto-scrubber between each step.
   3. Do not overlap grind paths.
   4. Do not exceed double the level of the previous step.
   5. If using metal bonds, drop back one level down to resin.
   6. Bring surface to 200 resin level
   7. Use an auto-scrubber to remove all dust and debris from surface prior to application of liquid hardener.

3.04 APPLICATION – LIQUID HARDENER STEP

A. Allow surface to completely dry before application of liquid hardener.

B. Apply liquid hardener to substrates in accordance with manufacturer’s instructions, and application procedures.
   1. Do not dilute or alter products. Apply as packaged.
   2. Do not apply to painted surfaces.
   3. Avoid overspray, wind drift and splash of all products.
   4. Apply in uniform even pattern by low pressure spray or airless.
   5. For low pressure spray utilize .5 GPM tip.
   6. For airless spray equipment should be a .47 GPM sprayer, similar to a GRACO 390 with a 611 or similar sized tip.
   7. Application is to be even across the surface leaving film. If material beads on surface use a soft bristle broom and lightly drag across material breaking surface tension to allow material to flow out on surface.
   8. If “bird baths” or low areas reveal excess liquid hardener standing, while wet move material to other areas of floor with a soft bristle broom, microfiber pad. Try not to let material pond on surface.
   9. Excess material will dry on the surface and needs to be removed by brush, broom, vacuum, auto-scrubber, etc.
   10. Allow material to dry and react which should occur in the first 10-15 minutes.
   11. Normal coverage rate is estimated to be 400 – 500 square feet on surfaces brought to 200 grit level. Reaction is dependent on calcium hydroxide exposure on surface of concrete.
   12. Treated horizontal concrete surface shall meet criteria performance Test established in 1.6 of this Section.

3.05 APPLICATION – POLISHING STEP

A. Allow area to be surface dry, approximately 30 – 60 minutes.

B. Polish concrete surface with resin diamonds in progressive levels to final level.

C. Polish each diamond level with two perpendicular passes.

D. After each pass auto-scrub surface to remove dust and dirt.

E. Polish: Level 3: High sheen, 800 grit.

3.06 APPLICATION – PROTECTIVE TREATMENT STEP

A. Apply products to substrates in accordance with manufacturer's instructions, and application procedures.

B. Apply to clean, dry, cured and properly prepared surfaces approved by the Architect.

C. Do not dilute or alter products. Apply as packaged.

D. Apply Consolideck® LsGuard @ 1,000 - 1,500 sq. ft. per gallon. Application by low pressure spray pump with a .5 GPM tip is recommended utilizing a premoistened microfiber pad as a spreader to pull material out in a thin film. Do not be concerned about complete coverage by spray as you pull material out you will gain uniform coverage.

E. If material absorbs into surface too fast and leaves applicator lines dilute material 1:1 with clear potable water. Apply in the same manner as above at a rate of 500 – 750 square feet per gallon.

F. After, material has dried, burnish with a high-speed propane burnisher (3,000 rpm) with Norton Abrasive pad either 2-4 to set LsGuard. Temperature immediately behind burnisher must be a minimum of 90.5°F. Run burnisher in two perpendicular passes to insure complete coverage.

G. Avoid overspray, wind drift and splash of all products.

H. Apply two additional coats, applying as stated above. Burnishing between coats.

I. Treated horizontal concrete surface shall meet performance test criteria established in 1.6 of this Section.

3.07 FIELD QUALITY CONTROL

A. Inspection: Inspect the application of the products with the Contractor, Architect, applicator and manufacturer's representative, and compare with test area results approved by the Architect.

B. Upon completion of the project the test area is to be divided into four quadrants with five test determination per quadrant shall be taken and recorded.

3.08 TOLERANCES

A. Allowable differences from the approved mock-up:
   1. Gloss = less than 10 percent
   2. Hardness = less than 10 percent
   3. Slip Resistance = more than .60 (as defined by ADA Title III, 1992)
   4. Rilem Tube = less than 1 ml loss

3.09 FINAL CLEANING

A. Clean site of all unused product, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas following completion of the work of this section.

C. Repair, restore or replace to the satisfaction of the Architect, all surfaces damaged by exposure to the work of this section.

D. Run auto-scrubber over surface with Consolideck® LsKlean diluted 4 oz. to one gallon of water.

E. Over entire surface run high-speed burnisher with appropriate Norton Abrasive pad. If areas have blemishes or scuff marks use a 1:1 diluted solution of Consolideck® LsGuard sprayed in front of burnisher. Confirm temperature as above.

3.10 PROTECTION

A. General Contractor is to protect surfaces with applied products until completion of project.

B. Do not permit traffic over unprotected floor surfaces.

C. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 096500
RESILIENT FLOOR TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient Tile Flooring Vinyl composition tile (VCT).

B. Resilient wall base and accessories

1.02 RELATED REQUIREMENTS

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

B. Section 096501 - Sheet Vinyl Floor Coverings: for sheet vinyl floor covering.

1.03 SUBMITTALS

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

B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
   1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples.

C. Maintenance Data: For resilient products to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.06 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C)] or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 24 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.
   1. Armstrong World Industries, Inc.;
   2. Azrock Commercial Flooring, DOMCO;
   3. Tarkett Inc.;

B. Class: 1 (solid-color tile).

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm), for field tile. 1-inch wide feature strip, where indicated.

F. Fire-Test-Response Characteristics:
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

G. Color:
   1. Field Tile: As indicated on drawings.

2.03 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
   1. Armstrong World Industries, Inc.;
   2. Azrock Commercial Flooring, DOMCO;
   3. Johnsonite;
   4. Marley Flexco (USA), Inc.;
   5. Musson, R. C. Rubber Co.;
   6. Roppe Corporation;
   7. VPI, LLC, Floor Products Division;

B. Type (Material Requirement): TV (vinyl).

C. Group (Manufacturing Method): I (solid, homogeneous) or II (layered).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.125 inch (3.2 mm).

F. Height: 4 inches (102 mm)

G. Lengths: Coils in manufacturer's standard length.

H. Outside Corners: Job Formed.

I. Inside Corners: Job Formed.

J. Surface: Smooth.

K. As indicated on drawings.

2.04 RESILIENT MOLDING ACCESSORY

A. Description: As indicated below, based on models numbers by Johnsonite.
   1. Burke Mercer Flooring Products;
   2. Johnsonite;
   3. Marley Flexco (USA), Inc.;
   4. Roppe Corporation;

B. Material: Vinyl

C. Profile and Dimensions:
   1. Paver tile to Concrete: CRS-XX-B, color to match vinyl base.
   2. Sheet vinyl to Concrete: SSR-XX-B, color to match vinyl base.
   3. Sheet vinyl to Paver tile: CE-XX-A, with MCT-XX-A track, color to match sheet vinyl.
   4. Contractor shall verify thickness of adjacent floor coverings.

2.05 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.
   2. Do not install resilient products until relative humidity of space is between 40% and 60%.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain running in one direction.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. 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 tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. 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.

3.04 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

3.05 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.06 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
      a. Use commercially available product acceptable to manufacturer.
      b. Coordinate selection of floor polish with Owner's maintenance service.
   2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
   3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096501
SHEET VINYL FLOOR COVERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet vinyl floor coverings, with backings.

1.02 RELATED REQUIREMENTS

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

B. Section 069500 - Resilient Floor Tile: for resilient wall base, reducer strips, and other accessories installed with sheet vinyl floor coverings.

1.03 SUBMITTALS

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

B. Samples for Verification: In manufacturer's standard size, but not less than sections of each different color and pattern of floor covering required.

C. Maintenance Data: For floor coverings to include in maintenance manuals.

D. Qualification Data: For Installer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by the manufacturer for reslilient sheet flooring installation and seaming methods indicated.

B. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

B. Furnish the Owner with material quantity take-off, itemized by Room Name, including all necessary consideration for pattern layout, waste and required attic stock. Quantities shall be furnished on Owner provided forms, via e-mail, to CarMax Procurement; Attn: Ms. Kellie Carter, kellie_carter@carmax.com or contacted at (804) 747-0422, extension 4856.

1.06 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 24 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 SHEET VINYL FLOOR COVERING

A. Products as indicated on the Drawings

B. Seaming Method: Tape or heat weld per Owner’s Supplier.

2.02 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.

C. Seamless-Installation Accessories: Heat-Welding Bead: Manufacturer’s solid-strand product for heat welding seams.

D. Cementitious Self Leveling Underlayment: Where noted on drawings. Manufacturer and product: Mapie, Novoplan Easy with Prmer T, no substitutions.
   1. General: Mix and apply underlayment components according to manufacturer's written instructions.
      a. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
      b. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
      c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
   2. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
   3. Apply underlayment to produce uniform, level surface to allow Sheet Vinyl Floor covering finish to match adjacent floor elevations.
      a. Apply a final layer without aggregate to product surface.
      b. Feather edges as necessary.
   4. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   5. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
   6. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install floor coverings until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Unroll sheet vinyl floor coverings and allow them to stabilize before cutting and fitting.

B. Lay out sheet vinyl floor coverings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading / sheen and patterns at seams.
   4. Avoid cross seams.
   5. Trim factory edges and butt them so as to align and match the embossed pattern at seams where seam visibility is the greatest.

C. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

G. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:
   1. Heat-Welded Seams: Comply with ASTM F 1516.
   2. Comply with the Lonseal Technical Data Sheet for Welding Thread Application.
   3. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing floor covering installation:
   1. Remove adhesive and other blemishes from floor covering surfaces.
   2. Sweep and vacuum floor coverings thoroughly.
   3. Damp-mop floor coverings to remove marks and soil.
      a. Do not wash floor coverings until after time period recommended by manufacturer.

B. Perform the following operations immediately after installing sheet vinyl floor coverings.
   1. Apply Taski Profi cleaning agent in accordance with manufacturer’s written instructions.

2. Apply 2-3 thin coats of Taski Vision Star floor finish using a clean small-string cotton mop. Mop should be wet, not dripping.
   a. Apply first coat to edge; others to 6 inches from edge.
   b. Allow 20-30 minutes between coats.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
1. Apply protective floor polish to surfaces that are free from soil, visible adhesive, and blemishes if recommended in writing by manufacturer.
2. Cover floor coverings with undyed, untreated building paper until Substantial Completion.
3. Do not move heavy and sharp objects directly over floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096701
FLUID-APPLIED EPOXY FLOORING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Medium Texture Fluid Applied Seamless Epoxy Resin Flooring, Key Mortar SLT 1/8” thickness.

B. Light Texture Fluid Applied High Build Epoxy Coating 40 – 50 mil DFT Resin Flooring.

C. Smooth, Pigmented Epoxy Floor Coating System 16-18 mils DFT Resin Flooring.

D. Clear Epoxy Floor Coating System.

E. Accessories necessary for complete installation for all systems.

1.02 RELATED REQUIREMENTS

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

B. Sectoin 033000 - Cast-In-Place Concrete: Concrete sub-floor to be level and to have a steel troweled finish. All concrete slabs shall be either wet cured or cured through the use of moisture-retaining covers. No curing agents or other additives which could prevent bonding shall be used.

C. Section 079200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

D. Section 096250 - Decorative Concrete Polished Flooring: Surface preparation for epoxy strip coating system.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) Publications:

B. Military Specifications (Mil. Spec.)

C. ACI 301 Specifications for Structural Concrete for Buildings (most recent edition). Committee in Concrete 403 bulletin 59-43, Bond Strength to Concrete.

1.04 SUBMITTALS

A. Samples: Submit two 12 inch by 12 inch cured samples of each floor color indicating color combination and non-skid properties. Approved samples will be used during installation for product match.

B. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

C. Shop Drawings: Shop Drawings shall be furnished showing installation of cove base and termination details, and details at floor material transitions and where adjoining equipment. Locate and provide detailing for flexible joints required for flooring in area of installation.

D. Maintenance Instructions: Submit current copies of the flooring manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 01770 Closeout Procedures.

1.05 QUALITY ASSURANCE

A. Materials used in the floor surfacing shall be the products of a single manufacturer.

B. Installation shall be performed by an applicator with minimum 3 years experience in work of similar nature and scope. Installer must be approved by the manufacturer of the floor surfacing materials. The contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

C. Installer to verify locations of all flexible joints required by the provisions of this Section and by the recommendations of the related material manufacturers.
   1. Joint locations may or may not be shown in drawings.

D. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the owners' representative and the Architect upon request.

E. Contractor to have proven experience with specified system.

F. Mock-up: Prior to starting application of flooring, provide full-scale mock-up to establish acceptable quality, durability, and appearance. Mock-up area must not be less than 50 square feet.
   1. Acceptable mock-up to be standard of quality for remaining work.
   2. Accepted work may remain in place. Unacceptable work to be removed and replaced until acceptable.

1.06 PROJECT CONDITIONS

A. Maintain the ambient room and the floor temperatures at 50 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

B. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

1.07 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring by masking, or by other means, to maintain these surfaces free of the flooring material.

B. Provide adequate ventilation and fire protection at all mixing and placing operations. Prohibit smoking or use of spark or flame producing devices within 50 feet of any mixing or placing operation.

C. Provide polyethylene or rubber gloves or protective creams for all workmen engaged in applying products containing epoxy.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to project site in original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.

B. Store materials in dry protected area at a temperature between 50° F to 80° F.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Key Resin Company. Contact: Fred Ramsey (757) 253-7577, (804) 512-4429.

2.02 CERTIFIED INSTALLER/APPLICATOR

A. The applicators for this product is proprietary. No other installers will be allowed.
   1. FlorLine Inc. Shane Reynolds (330) 830-3380

2.03 MATERIALS

A. Medium Texture Fluid Applied Seamless Epoxy Resin Flooring shall be Key Mortar SLT 1/8" Textured Self Leveling Flooring System, sealed with Chemical and Stain Resistant Polyurethane Sealer, Key #470 Polyaspartic Topcoat.
   1. Prime Coat: Two component penetrating damp-proof epoxy: Key #502 Primer/Low Modulus Binder.
   2. Aggregates:
      a. Blended self-leveling slurry filler: Key Self-Leveling Filler.
      b. Key CEC 1000 Broadcast Aggregate.
   3. Matrix: Matrix-epoxy/aggregate composition using 100% solids epoxy binder: Key #511 Epoxy Binder (pigmented).

4. High solids seal coat:
5. Colored two component, 100% solids epoxy: Key #520 100% Solids Epoxy Coating
6. Colored two component, chemically cured polyaspartic: Key #470 Polyaspartic Topcoat.

B. Flexible epoxy joint filler: Key #780 Joint Filler to match color of floor topping.
   1. Elastomeric, crack-bridging membrane: Key #580 Flexible Epoxy

C. Light Texture Fluid Applied High Build Epoxy Coating Resin Flooring 40 – 50 mils DFT.
   1. Severe and Moderate Environments (Gloss Finish): One finish coat over a primer coat of epoxy with a broadcast aggregate for non-slip surface and grout coat of pigmented epoxy.
      a. Two-part 100 % Solids Epoxy Primer. Primer coat to be applied over properly prepared concrete substrate at 10.0 mils WFT. While material is wet broadcast 30 mesh washed silica sand at approximately 20 lb. per 100 sq. ft. (to excess).
         1) Key Resin Company: Key Resin # 502 Primer/Low Modulus Binder Clear.
         2) Key Resin Company: Key Resin 30 Mesh Broadcast Aggregate.
      b. Intermediate Coat: Two-part 100% Solids Epoxy Binder. Key Resin Company: Key # 520 Epoxy Coating. After primer has cured sweep excess aggregate from floor and apply intermediate coat at 10 mils WFT to lock in aggregate.
      c. Finish Coats: Two-part 100% Solids Epoxy Binder. Key Resin Company: Key Resin # 520 Epoxy Coating. Apply finish coat at 10 mils WFT.

D. Epoxy Stripe Coating
   1. Stripes located at Decorative Concrete Polished Flooring in Service and FQC as indicated on drawings.
      a. Primer: Key Resin # 502 Epoxy Primer (pigmented white will help top coat cover better but not required) @ 200 sq. ft. per gallon (8 mils DFT).
      b. Finish Coat: Key Resin # 470 Polyaspartic Carmax Yellow @ 160 sq. ft. per gallon (10 mils DFT).

E. Smooth, Pigmented Epoxy Floor Coating System 16-18 mils DFT
   1. Severe and Moderate Environment (Gloss Finish): One coat over a primer coat.
   2. Primer: Two-part 100% Solids Epoxy Primer. Primer coat to be applied over properly prepared concrete substrate at 8.0 to 10.0 mils WFT. While material is wet broadcast 30 mesh washed silica sand at approximately 20 lb. per 100 sq. ft. (to excess).
      a. Key Resin Company: Key Resin # 502 Primer/Low Modulus Binder Clear.
   3. Finish Coat: Two-part 100% Solids Epoxy Coating applied at 8.0 to 10.0 mils WFT.
      a. Key Resin Company: Key Resin # 520 Epoxy Coating at 8.0 to 10.0 mils WFT.

F. Clear Epoxy Floor Coating System
   1. One coat over a primer coat.
      a. Primer: Two-part 100% Solids Epoxy Primer. Primer coat to be applied over properly prepared concrete substrate at 5.0 to 8.0 mils. WFT.
         1) Key Resin Company: Key Resin # 502 Primer/Low Modulus Binder Clear.
      b. Finish Coat: Two-part 100% Solids Epoxy Coating Clear applied at 5.0 to 8.0 mils WFT.
         1) Key Resin Company: Key Resin # 502 Primer/low modulus Binder Clear.

2.04 FINISHES

A. Color and texture as indicated on drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Obtain Architect's approval of mock-up before installing flooring.

B. Prior to installation of structural floor slab, advise General Contractor, in writing, of all requirements of concrete substrate regarding finish, level tolerance, and curing.

C. Locate all flexible joints required.

D. Preparation of Surface:

1. After concrete curing period (28 days minimum) has elapsed, inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.
2. Notify Architect in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.
3. Verify that moisture content is within range acceptable to flooring material manufacturer using calcium chloride test per ASTM F1869 and/or relative humidity probe test per ASTM F2170.
4. Prepare surface as required by manufacturer's printed instructions. Preferred surface preparation is steel shot blasting or similar mechanical method.
5. Air Drying: After completion of cleaning, allow concrete surface to air dry thoroughly prior to application of the floor surfacing. Blowers or oil free compressed air may be used. Do not use flame-drying methods. Prior to application of surfacing, the concrete surface shall be tested for excessive moisture vapor transmission in at least two locations. Place rubber mats at each location with smooth side against concrete. Polyethylene with all edges taped may be used in lieu of mats. After 16 - 24 hours, remove mat or sheeting and examine the floor surface for moisture accumulation. If tests indicate an accumulation of moisture at either location, additional air-drying shall be undertaken until such time as additional tests show no moisture accumulation.
6. Treat cracks in concrete using manufacturer's recommended practice. Rout out crack and joints, and fill with semi-flexible epoxy; coat with flexible membrane in accordance with manufacturer's recommendation to prevent cracking through flooring system.
7. Remove plastic void cap at the top of the expansion joint material placed at the perimeter of the concrete slabs. Clean joint of all foreign material.
8. Verify that surface preparation for Epoxy Stripe Coating meets manufacturers requirements.

3.02 INSTALLATION

A. Install all floor materials in strict conformance with manufacturer's instructions.

B. Install a screed line or termination strip at all color transitions except at stripes where a masked edge topcoat of a different color shall be installed.

C. Elastomeric membrane, if required, at concrete slab applications and where indicated. Install in single or multiple coats to a minimum dry film thickness of 25 mils.

D. Once self-leveling broadcast epoxy materials have cured remove excess broadcast sand from floor surface.

E. Match finished work to approved samples, uniform in thickness, sheen, color, patterns and texture, and free from defects detrimental to appearance.

F. Install flexible joint filler at all perimeter expansion joints where concrete slab abuts vertical wall assembly. Color of filler to match floor system.

G. Install flexible epoxy joint sealant in all saw cut and cold joints.

H. Apply temporary protection until floor is fully cured.

3.03 INSPECTION

A. Touch up and repair all work that is not acceptable to Architect and request final acceptance.

3.04 CLEANING AND PROTECTION

A. Remove coating spatters from glass, plumbing fixtures, and adjoining surfaces.

B. Repair any damage to coating or surfaces caused by cleaning operation start.

C. Remove debris from job site and leave storage area clean.

D. At Presentation Lanes protect finished surfaces from damage for remainder of construction period until project is turned over to Owner.

1. Remove protection measures from Presentation Lanes at time of Punchlist Walkthrough.
2. Reinstall protection measures after Punchlist Walkthrough has occurred and maintain until directed to remove by Owner.

END OF SECTION

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SECTION 097200
WALL COVERINGS

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 wall covering.
      a. GC-Furnished and GC installed.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed 5 projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.04 ACTION SUBMITTALS

A. Samples for Verification: For each type of wall covering provided by GC and for each color, pattern, texture, and finish specified, full width by [12-inch- (304-mm-)] long in size.
   1. Wall-Covering Sample: From same production run to be used for the Work.

1.05 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install wall covering until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

B. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles (160 lux) is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

1.06 EXTRA MATERIALS

1. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contnts.
   a. VWC7, “Grasscloth”: 2 rolls, unused

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Wall Coverings shall be provided and installed by GC as indicated on drawings.

2.02 ADHESIVES

A. General: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application, as recommended by wall covering manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for moisture content and other conditions affecting performance of Work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

C. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
   1. Painted Surfaces: Treat areas susceptible to pigment bleeding.
   2. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   3. Prime new gypsum board with primer / release coat as recommended by wall covering manufacturer.

D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

E. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.03 INSTALLATION, GENERAL

A. General: Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.

C. Install wall covering with no gaps or overlaps.

D. Match pattern 72 inches (1830 mm) above finish floor.

E. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) from inside corners. No horizontal seams.

F. Remove air bubbles, wrinkles, blisters, and other defects.

G. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

3.04 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by wall covering manufacturer.

C. Replace strips that cannot be cleaned.

END OF SECTION

SECTION 099100
PAINTING

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

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

B. Division 5 Section "Structural Steel" for shop priming structural steel.

C. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.

D. Section 081113 - Steel Doors and Frames: for factory priming steel doors and frames.

E. Section 092116 - Gypsum Board Assemblies: for surface preparation of gypsum board.

F. Division 9 Section "High-Performance Coatings" for special coatings applied to specified exterior surfaces.

1.02 SECTION INCLUDES

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

B. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

F. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

B. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

C. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

D. Paint schedule: Provide schedule indicating each product and specific application.

E. Samples for Initial Selection: For each type of finish-coat material indicated.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.07 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Benjamin Moore & Co. (Benjamin Moore).
   2. ICI Paint Stores, Inc. (Dulux Paint).
   3. PPG Industries, Inc. (Pittsburgh Paints).
   4. Sherwin-Williams Co. (Sherwin-Williams).

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide interior 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. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion

of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

D. Colors: Match Architect's samples.

2.03 INTERIOR CONCRETE UNIT MASONRY BLOCK FILLERS

A. Interior Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
   1. Benjamin Moore; Moorcraft Super Craft Latex Block Filler No. 285: Applied at a dry film thickness of not less than 8.1 mils (0.206 mm).
   2. Dulux Paint; Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler: Applied at a dry film thickness of not less than 7.0 to 14.5 mils (0.178 to 0.368 mm).
   3. Pittsburgh Paints; 6-7 SpeedHide Interior/Exterior Masonry Latex Block Filler: Applied at a dry film thickness of not less than 6.0 to 12.5 mils (0.152 to 0.318 mm).
   4. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils (0.203 mm).

2.04 EXTERIOR PRIMERS

A. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
   1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   2. Dulux Paint; 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
   3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
   4. Sherwin-Williams; primer not required over this substrate.

2.05 INTERIOR PRIMERS

A. Interior Concrete: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
   1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
   2. Dulux Paint; 1030-1200 Ultra-Hide PVA Interior Primer-Sealer General Purpose Wall Primer: Applied at a dry film thickness of not less than 1.9 mils (0.048 mm).
   3. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
   4. Sherwin-Williams; Loxon Concrete and Masonry Primer A24W8300: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

C. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
   1. Dulux Paint; 1000-1200 Dulux Ultra Basecoat Interior Latex Wall Primer: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
   2. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
   3. Sherwin-Williams; ProMar 200 Zero VOC Latex Primer B28W2600 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

D. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
   1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
   2. Dulux Paint; 4130-6130 Devshield Rust Penetrating Metal Primer: Applied at a dry film thickness of not less than 2.2 mils (0.056 mm).
   3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).

4. Sherwin-Williams; Kem Kromik Universal Metal Primer B50NZ6/B50WZ1: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

E. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
2. Dulux Paint; 4160-6130 Devguard Multi-Purpose Tank & Structural Primer: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).
3. Pittsburgh Paints; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).
4. Sherwin-Williams; primer not required over this substrate.

2.06 EXTERIOR FINISH COATS

A. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Flat Latex House Paint No. 171: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).
2. Dulux Paint; 2200-XXXX Dulux Professional Exterior 100 Percent Acrylic Flat Finish: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-600 Series SpeedHide Exterior House Paint Flat Latex: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
4. Sherwin-Williams; A-100 Exterior Latex Flat House & Trim Paint A6 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

B. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils (0.028 mm).
2. Dulux Paint; 2406-XXXX Dulux Professional Exterior 100 Percent Acrylic Semi-Gloss Finish applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
3. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
4. Sherwin-Williams; A-100 Latex Gloss A8 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

2.07 INTERIOR FINISH COATS

A. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
1. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).
2. Dulux Paint; 1402-XXXX Dulux Professional Acrylic Eggshell Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.4 mils (0.036 mm).
3. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils (0.032 mm).
4. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Eg-Shel B20W2600 Series: Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

B. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).
2. Dulux Paint; 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel: Applied at a dry film thickness of not less than 1.5 mils (0.038 mm).
3. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil (0.025 mm).
4. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss B31W2600 Series: Applied at a dry film thickness of not less than 1.3 mils (0.033 mm).

C. Interior Flat Latex Acrylic Dryfall: Factory-formulated flat acrylic-latex enamel for interior application.

1. Benjamin Moore; Sweep-Up Spray Latex Flat 153: Applied at a dry film thickness of not less than 2.0 mils.
2. Dulux Paint; 1280 Spraymaster Pro-WB Flat Acrylic Dryfall: Applied at a dry film thickness of not less than 1.5 mils.
3. Pittsburgh Paints; 6-725 Super Tech WB Acrylic Dry-Fog Flat Latex: Applied at a dry film thickness of not less than 2.1 mil.
4. Sherwin-Williams; Waterborne Acrylic Dryfall B42: Applied at a dry film thickness of not less than 3.0 mils.

D. Interior Semi-gloss Latex Acrylic Dryfall: Factory-formulated flat acrylic-latex enamel for interior application.
1. Benjamin Moore; Sweep-Up Spray Latex Semi-Gloss 156: Applied at a dry film thickness of not less than 2.0 mils.
2. Dulux Paint; 1486 Spraymaster Pro-WB Semi-Gloss Acrylic Dryfall: Applied at a dry film thickness of not less than 1.5 mils.
3. Pittsburgh Paints; 6-724 Super Tech WB Acrylic Dry-Fog Semi-Gloss Latex: Applied at a dry film thickness of not less than 2.1 mil.
4. Applied at a dry film thickness of not less than 3.0 mils.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. 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.
a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content

exceeds that permitted in manufacturer's written instructions.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. 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. Sand and or grind paint drips off the bottom surface of steel joists located in the Showroom, and touch up with same primer prior to field painting.
4. 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.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to

manufacturer's written instructions, sand between applications.

2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
   2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Interior Block Fillers: Apply interior block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

G. 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.

H. 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.

I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
   1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
   2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. 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 Architect.

B. 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.

3.07 EXTERIOR PAINT SCHEDULE

A. Concrete: Provide the following finish systems over exterior concrete substrates:
   1. See Section 09963 “Elastomeric Coatings”.

B. Concrete Unit Masonry: Provide the following finish systems over exterior concrete unit masonry:
   1. See Section 09963 “Elastomeric Coatings”.

C. Ferrous Metal: Provide the following finish systems over exterior ferrous metals:
   1. See Section 09960 “High Performance Coatings”.

D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces – hollow metal doors, frames and miscellaneous items:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.
      a. Primer: Exterior galvanized metal primer.
      b. Finish Coats: Exterior semigloss acrylic enamel.

E. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces – exposed structural steel components at entry canopies:
   1. See Section 09960 “High Performance Coatings”.

3.08 INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:
   1. Flat Acrylic Finish: Two finish coats over a primer.
      a. Primer: Interior concrete and masonry primer.
      b. Finish Coats: Interior flat acrylic paint.

B. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.
      a. Block Filler: Concrete unit masonry block filler.
      b. Finish Coats: Interior semigloss acrylic enamel.

C. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior low-luster acrylic enamel.
   2. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior semigloss acrylic enamel.

D. Ferrous Metal: Provide the following finish systems over ferrous metal:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior ferrous-metal primer.
      b. Finish Coats: Interior semigloss acrylic enamel.

E. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior zinc-coated metal primer.
      b. Finish Coats: Interior semigloss acrylic enamel.

F. Metal Roof Deck, Joists and Structural Steel (Shop Primed): Provide the following finish systems where scheduled as “dryfall”:
   1. Acrylic-Enamel Finish: Two finish coats over shop primed material.
      a. Primer: Coordinate with dryfall top coats.
      b. Finish Coats: Interior acrylic latex.

END OF SECTION

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SECTION 099601
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

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

B. Section 099113 - Exterior Painting.

C. Section 099123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply to this Section.

B. Gloss ranges used in this Section include the following:
   1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each coating system indicated. Include block fillers and primers.
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.
   3. Paint schedule: Provide schedule indicating each product and specific application.

B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
   1. After color selection, Architect will furnish color chips for surfaces to be coated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Mock-Up Panel: Apply scheduled block filler to the masonry mock-up panel to set quality standards for materials and execution.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
   1. Name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.

4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. Handling instructions and precautions.

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 materials and residue.
   1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.07 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C).

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
   1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
   2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

1.08 EXTRA MATERIALS

A. Furnish extra high-performance coating materials from the same production run as materials applied and in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.

B. Manufacturers' Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:
   1. International Protective Coatings; AkzoNobel.
   2. PPG Paints; PPG Industries, Inc.
   3. Sherwin-Williams Company (The).
   4. Tnemec Company, Inc.

2.02 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

2.03 COLORS

A. Colors: As indicated by on the Drawings.

2.04 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Ferrous Metal: Provide the following finish systems over exterior ferrous-metal surfaces:
   1. Aliphatic Polyurethane Enamel (Semigloss Finish): One finish coat over an intermediate coat and a two coats of primer.
      a. Primer: Two coats of an epoxy primer applied at spreading rate recommended by manufacturer.
         1) ICI: Devran 224HS High Build Epoxy.
         2) S-W: Recoatable Epoxy Primer B67 Series/B67V5.
         3) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.
      b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.0 mils (0.076 to 0.127 mm).
         1) S-W: Macropoxy 646-100 Fast Cure, B58-620 Series..
         2) Tnemec: Series 66 Hi-Build Epoxoline.
      c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
         1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
      d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
         1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
         2) S-W: Sherthane 2K Urethane B65-150 Series.
         3) Tnemec: Series 75 Endura-Shield.

B. Galvanized Metal: Provide the following finish systems over exterior galvanized-metal surfaces:
   1. Aliphatic Polyurethane Enamel (Semigloss Finish): One finish coat over an intermediate coat and a primer.
      a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.
         1) 09960.dochICI: Devran 4170 Corrosion Resistant Epoxy Primer.
         2) S-W: DTM Wash Primer B71Y1.
         3) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.
      b. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
         1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
         2) S-W: Sherthane 2K Urethane B65-150 Series.
         3) Tnemec: Intermediate coat not required.
      c. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
         1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
         2) S-W: Sherthane 2K Urethane B65-150 Series.
         3) Tnemec: Series 75 Endura-Shield.
            (a) INTERIOR HIGH-PERFORMANCE COATING SYSTEMS

C. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block, where finish is scheduled as “epoxy”:
   1. Semi-Gloss Epoxy (Semigloss Finish): One finish coat over an intermediate coat and a block filler.
      a. Block Filler: Acrylic or epoxy block filler applied at spreading rate recommended by manufacturer as sufficient to fill pores.
         1) ICI: Bloxfil 4000 Interior/Exterior Heavy Duty Acrylic Block Filler.
         2) S-W: Kem Cati-Coat HS Epoxy Filler/Sealer
         3) Tnemec: Series 130 Envirofill Waterborne Cementitious Acrylic.

b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils (0.051 to 0.127 mm), unless otherwise indicated.
   1) ICI: Devran 224 HS High Build Epoxy Enamel.
   2) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
   3) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.
c. Topcoat: Semigloss epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 to 5.0 mils (0.051 to 0.127 mm), unless otherwise indicated.
   1) ICI: Devran 224 HS High Build Epoxy Enamel.
   2) S-W: Epolon II Multi-Mil Epoxy Series B62V800.
   3) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.

D. Ferrous Metal (Carwash): Provide the following finish systems over exterior ferrous-metal surfaces:
1. Aliphatic Polyurethane Enamel (Semigloss Finish): One finish coat over an intermediate coat and a two coats of primer.
   a. Primer: Two coats of an epoxy primer applied at spreading rate recommended by manufacturer.
      1) ICI: Devran 224HS High Build Epoxy.
      2) S-W: Recoatable Epoxy Primer B67 Series/B67V5.
      3) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.
   b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.0 mils (0.076 to 0.127 mm).
      1) S-W: Maxropoxy 646-100 Fast Cure, B58-620 Series.
      2) Tnemec: Series 66 Hi-Build Epoxoline.
   c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
      1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
   d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
      1) ICI: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
      2) S-W: Sherthane 2K Urethane B65-150 Series.
      3) Tnemec: Series 75 Endura-Shield.

PART 3 EXECUTION

3.01 EXAMINATION

A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
   a. Confirmation of primer's suitability for expected service conditions.
   b. Confirmation of primer's ability to be top coated with materials specified.
2. Notify Architect about anticipated problems before using the coatings specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
   2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. 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 to prepare surfaces.
      a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   3. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
      a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10/NACE No. 2.
      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, solvent clean, and touch up with same primer as the shop coat.
         1) Galvanized-Metal Surfaces: Clean galvanized surfaces according to manufacturer’s written instructions fro the type of service, metal substrate, and application required.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
   2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
   3. Use only the type of thinners approved by manufacturer and only within recommended limits.

E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions.
   1. Use applicators and techniques best suited for the material being applied.
   2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
   3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.

4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, 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.
    a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required is the same regardless of application method.
    a. Apply two coats of primer on metal surfaces that have been shop primed and touchup painted.
    b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
    c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
    d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
    a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
    b. Brush out and work brush coats into surfaces in an even film.
    c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
    a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
    b. Apply each coat to provide the equivalent hiding of brush-applied coats.
    c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by

others.

1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

G. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
   1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform appropriate tests for the following characteristics as required by Owner:
      a. Quantitative materials analysis.
      b. Absorption.
      c. Accelerated weathering.
      d. Accelerated yellowness.
      e. Color retention.
      f. Alkali and mildew resistance.
      g. Abrasion resistance.
      h. Apparent reflectivity.
      i. Washability.
      j. Dry opacity.
      k. Recoating.
      l. Skinning.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. If necessary, Contractor may be required to remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

3.05 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
   1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
   1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
   2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION

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SECTION 099603
ELASTOMERIC COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and application of elastomeric coatings to the following exterior substrates:
   1. Concrete masonry units.
   2. Solid concrete masonry units (site wall cap).

1.02 RELATED REQUIREMENTS

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

B. Section 099100 - Painting.

1.03 SUBMITTALS

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

B. Samples for Verification: For each type of elastomeric coating indicated and in each color and gloss.

C. Warranty application: Contractor shall obtain required warranty application information forms from the manufacture prior to starting the project. All warranty application forms must be completed and submitted prior to application of materials.

D. Warranty inspection forms shall be completed and submitted to the manufacture after the project is complete

E. Product List: For each product indicated, including the following:
   1. Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Manufacturer's recommended spreading rate for each separate coat, including primers for each type of substrate as applicable.

1.04 QUALITY ASSURANCE

A. Mockup: The mock-up panel must be built of same substrates being used project to verify coating color, finish and bond. Apply coating system to mock-up panel utilizing coating system indicated and each color and finish selected to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. See attached warranty requirements for additional information. Submit application for warranty prior to priming. Inspections will be scheduled accordingly.
   1. Final approval of color and texture selections will be based on site specific mock-up. Final approval shall be based only on coatings applied to site specific block or panels at the project site and shall not be based on cards or sample panels.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

B. To allow for proper color batching and shipment, allow two weeks from product order for delivery of product

C. Where required by manufacturer for projects in cold weather climates, heated freight trucks are required for shipping.

1.06 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 90 deg F (10 and 32 deg C) unless otherwise permitted by manufacturer's written instructions. Use surface temperature thermometer to verify substrate surface temperatures meet requirement.

B. Do not apply coatings in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace elastomeric coatings that fail within specified warranty period.
   1. Warranty Period: Ten years from date of Substantial Completion.
   2. See attached literature from the product manufacturer outlining specific requirements from the General Contractor and applicator.
   3. Contact Sherwin-Williams National Accounts Representative at least 30 days in advance of project start date to begin the warranty process and to receive CarMax project pricing;
      a. Dan Giddens;
         1) Phone – 703-929-6487;
         2) email – dan.giddens@sherwin.com

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Material Compatibility:
   1. Provide elastomeric finish coatings and crack fillers, and primers as applicable for use within elastomeric finish coatings that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each material or coat, provide products and spreading rates recommended in writing by elastomeric coating manufacturer for use on substrate indicated.

B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
      a. In California (CALGREEN): 100 g/L.
   3. Primers, Sealers, and Undercoaters: 200 g/L.
      a. In California (CALGREEN): 100 g/L.

2.02 ELASTOMERIC FINISH COATINGS

A. Concrete Masonry Units; Exterior Non-Flat Waterborne, Pigmented Elastomeric Coating:
   1. Products: Subject to compliance with requirements, provide the following:
      a. Sherwin-Williams Products:
         1) Loxon Block Surfacer – Coverage rates should be confirmed in mockups on site specific substrates. Coverage rates listed as:
            (a) 50-100 ft²/gallon
         2) Loxon XP - Coverage rates should be confirmed in mockups on site specific substrates. Coverage rates listed as:
            (a) 80 – 115 ft²/gallon

B. Solid Concrete Masonry Units (Site Wall Cap): Exterior Non-Flat Waterborne, Pigmented Elastomeric Coating.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Sherwin-Williams Products:
         1) Loxon Block Surfacer – Coverage rates should be confirmed in mockups on site specific substrates. Coverage rates listed as:
            (a) 50-100 ft²/gallon
         2) Loxon XP - Coverage rates should be confirmed in mockups on site specific substrates. Coverage rates listed as:
            (a) 80 – 115 ft²/gallon

2.03 OTHER MATERIALS

A. Crack Fillers: Elastomeric coating manufacturer's recommended, factory-formulated crack fillers or sealants, including crack filler primers, compatible with substrate and other materials indicated; VOC content complying with limits of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with manufacturer's requirements for maximum moisture content, alkalinity, and other conditions affecting performance of work.

B. Begin coating only when moisture content of substrate is 7 percent or less when measured with an electronic moisture meter.

C. Begin coating no sooner than 28 days after substrate is constructed and is visually dry on both sides.

D. Verify that substrate is within the range of alkalinity recommended by manufacturer.

E. Verify suitability of substrates including surface conditions and compatibility with existing finishes and primers.

F. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

G. Cold Weather Procedures: Protect the surface prior to coating and after application to verify curing of materials. When necessary, provide tenting or protection of the substrate to raise substrate and ambient temperature to specified application temperatures. Provide ventilation gaps to prevent overheating while maintaining adequate protection. Applied product shall remain tented and heated for a minimum of 24 hours after application.

3.02 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.

B. Prior to application of the block filler and elastomeric coatings, inspect the substrate for proper cleaning and treatment of the structural cracks, voids, texture differences, damage etc. Coating application shall not proceed until unsatisfactory conditions are corrected

C. Surface to be coated shall be clean, sound and free of any loose paint, caulk, rust, grease, dirt, laitance, efflorescence, mortar droppings, mold, mildew or other such foreign materials. Surface may be cleaned by mechanical or chemical methods that will not inhibit bond of the coatings

D. Locate and identify all cracks, Static hairline cracks shall be cleaned and detailed with a stripe coat of the specified elastomeric coating. Cracks greater than hairline, shall be treated as a standard joint sealant detail. In accordance with industry standards

E. Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

F. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
   2. Perform cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.

G. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.

H. Locate and identify all weep vents prior to paint application. Provide protective coverings for all weep vents to ensure they remain free and clear of paint and debris after painting activities are complete. Remove any paint that accumulates on/within unprotected weep vents after painting activities have ceased to ensure proper function.

3.03 APPLICATION

A. Apply elastomeric coatings according to manufacturer's written instructions.
   1. Use equipment and techniques best suited for substrate and type of material being applied.
   2. Coat surfaces behind movable items, including building signage the same as similar exposed surfaces.
   3. Apply each coat separately according to manufacturer's written instructions.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats similar to color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Apply coatings to prepared surfaces as soon as practicable after preparation and before subsequent surface soiling or deterioration.

G. Application of Block Filler and Elastomeric base and topcoat can be brush, roller or spray applied. Spray applications must be back rolled for a pinhole free surface

H. Spray Application: Use spray equipment for application only when permitted by authorities having jurisdiction. Wherever spray application is used, do not double back with spray equipment to build up film thickness of two coats in one pass. Spray equipment similar to Graco 3500, President or Bulldog can be use for spray applications.

I. Roller application (required for all coats) - 1 ¼” synthetic nap roller cover

J. All coating shall be applied to a minimum 15 mils WFT per coat to achieve a continuous pinhole free membrane. Back roll all coats to eliminate all pinholes.

K. All coatings shall be applied in one continuous operation per coat maintaining a wet edge. Terminate coats at a natural break such as an outside or inside corner if one continuous coat is not possible.

L. Sufficient manpower, scaffolding and equipment shall be provided to ensure a continuous and uniform application.

M. Protect coating until fully cured from airborne contamination (dirt, dust, soot etc) weather and other damage.

N. Protect from moisture for 24 hours @ 70 F and wind driven rain for 72 hours @ 70 F

O. Apply Acrylic Modified Cementitious Wall Cap coatings according to manufacturer’s written instructions.
   1. Use equipment and techniques best suited for substrate and type of material being applied
   2. Coat surfaces behind movable items, including building signage the same as similar exposed surfaces
   3. Apply each coat separately according to manufacturer’s written instructions

3.04 FIELD QUALITY CONTROL

A. Field Testing and Inspection: Owner reserves the right to engage the services of a qualified testing agency to verify installed thickness of elastomeric coatings.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities, touch up and restore damaged or defaced coated surfaces.

3.06 COATING SCHEDULE

A. Concrete Substrates, including exterior building surfaces:
   1. Elastomeric Finish (Smooth Finish): One finish coat over an intermediate coat and a block filler.
      a. Acrylic block filler at rate listed below based on product used. Spreading rate recommended by manufacturer as sufficient to fill pores and provide a void-free substrate.
         1) Sherwin-Williams: Loxon Block Surfacer at 16 mils WFT / 8.8 mils DFT.
      b. Elastomeric coating applied at a spreading rate recommended by manufacturer to achieve a dry film thickness of not less than:
         1) Sherwin-Williams: Loxon XP at 18 mils WFT / 8 mils DFT.
      c. Elastomeric coating applied at a spreading rate recommended by manufacturer to achieve a dry film thickness of not less than:
         1) Sherwin-Williams: Loxon XP at 18 mils WFT / 9.0 mils DFT. Provide final finish coat with less than 10 pinholes per square foot.
   2. Site Wall Cap Waterproofing: One finish coat over an intermediate coat and a block filler.
      a. Acrylic block filler at rate listed below based on product used. Spreading rate recommended by manufacturer as sufficient to fill pores and provide a void-free substrate.
         1) Sherwin-Williams: Loxon Block Surfacer at 16 mils WFT / 8.8 mils DFT
      b. Elastomeric coating applied at a spreading rate recommended by manufacturer to achieve a dry film thickness of not less than:
         1) Sherwin-Williams: Loxon XP at 18 mils WFT / 8 mils DFT.
      c. Elastomeric coating applied at a spreading rate recommended by manufacturer to achieve a dry film thickness of not less than:
         1) Sherwin-Williams: Loxon XP at 18 mils WFT / 9.0 mils DFT. Provide final finish coat with less than 10 pinholes per square foot

END OF SECTION

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SECTION 102100
TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic-core toilet toilet enclosures and urinal screens.

1.02 RELATED REQUIREMENTS

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

B. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.03 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples for Verification: Of each compartment or screen color and finish required, prepared on 6-inch- (150-mm-) square Samples of same thickness and material indicated for Work.

1.04 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

2.02 PHENOLIC-CORE UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sentinel - Series 400, by Bradley Corporation: Mills Partitions.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.

E. Pilaster Shoes and Sleeves (Caps): Fabricated from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

F. Brackets (Fittings):
   1. Stirrup Type: Ear or U-brackets, stainless steel.
   2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel. Provide continuous type at urinal screens only.

G. Phenolic-Panel Finish:

1. Color and Pattern: Navy Grafix.

H. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

I. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

J. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.03 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.
   1. Urinal Screens shall be 48 inches by 24 inches, unless noted otherwise. Refer to architectural drawings for additional information.

D. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide doors for standard toilet compartments and 36-inch- (914-mm-) wide doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.
   1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
   2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
   3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
   4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
   5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
   1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.02 ADJUSTING AND CLEANING

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

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 102230
ACCORDION FOLDING PARTITIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manually operated, accordion folding partitions.

1.02 RELATED REQUIREMENTS

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

1.03 DEFINITIONS

A. NRC: Noise reduction coefficient.

B. NVLAP: National Voluntary Laboratory Accreditation Program.

C. STC: Sound transmission class.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Provide accordion folding partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
   1. Sound Transmission Requirements: Accordion folding partition assembly tested in a full-scale opening, 14 by 9 feet (4267 by 2743 mm), for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
   2. Noise-Reduction Requirements: Accordion folding partition assembly, identical to partition tested for STC, tested for sound absorption performance according to ASTM C 423 and rated for not less than the NRC indicated.

1.05 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of accordion folding partition and component specified. Include data on acoustical performance, surface-burning characteristics, and durability.

B. Shop Drawings: Show location and extent of accordion folding partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions; weights; conditions at openings and for storage; and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, and direction of travel. Show blocking to be provided by others. Include the following:

C. Setting Drawings: For embedded items and cutouts required in other work, including support beam punching template.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work.
   1. Fabric: Full width by not less than 3 inch square section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.

E. Maintenance Data: For the following to include in maintenance manuals specified in Division 1:
   1. Panel face finishes and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
   2. Seals, hardware, track, carriers, and other operating components.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the accordion folding partition manufacturer as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Fire-Test-Response Characteristics: Provide accordion folding partitions with the following fire-test-response characteristics, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and

inspecting agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:
   a. Flame Spread: 25 or less.
   b. Smoke Developed: 450 or less.
2. Fire Growth Contribution: Textile wall coverings complying with the acceptance criteria of UBC Standard 8-2.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify accordion folding partition openings and storage arrangements by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening and storage dimensions and proceed with fabricating accordion folding partitions without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Hufcor Inc.
2. Kwik-Wall Co.
3. Modernfold, Inc.
4. Panelfold, Inc.

2.02 ACCORDION FOLDING BI-PARTING PARTITIONS

A. Construction: Provide pantograph or X-type accordion folding frame supporting acoustical core and decorative facing/cover, supported by overhead suspension system, designed for horizontal extension and retraction, and reinforced for hardware attachment. Securely attach sound-insulating core and facing/cover to frame. Fabricate partitions rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of deformation and surface and finish irregularities.

B. Dimensions: Fabricate accordion folding partitions, from manufacturer's standard sizes, to form an assembled system of dimensions indicated on Drawings and verified by field measurements.

C. Accordion Folding Bi-Parting Partition Characteristics: Comply with requirements indicated in the Accordion Folding Partition Schedule at the end of Part 3.

D. Trim: Manufacturer's standard trim with decorative, protective finish.

E. Tiebacks: As required to maintain accordion folding partitions in stacked position.

2.03 SEALS AND POSTS

A. General: Provide types of acoustical seals and posts indicated that produce accordion folding partitions complying with acoustical performance requirements and the following:

1. Seals and posts made from materials and profiles that minimize sound leakage.
2. Seals and posts fitting tight at contact surfaces and sealing continuously between adjacent accordion folding partitions and between partition perimeter and adjacent surfaces, when accordion folding partition is extended, closed, and in place.

B. Seals: Sweep strips for partition top and bottom, providing continuous contact with adjacent head and sill surfaces; and continuous PVC acoustical seals for lead posts and jambs.

C. Posts and Jambs: Steel or aluminum; formed with deep-nesting and interlocking interfaces and fabricated to ensure rigidity for accordion folding partition. Provide lead posts, jamb posts, and jambs permanently fixed to walls for partition layout indicated.

2.04 HARDWARE

A. Hardware: Manufacturer's standard manually operated pulls and latches as required to operate accordion folding partitions and as follows; with decorative, protective finish:

1. Latches: Operable from both sides of closed partitions.

2.05 FINISH FACING/COVER

A. General: Provide finish facings that comply with indicated fire-test-response characteristics; factory attached or applied to accordion folding partitions over acoustical core with appropriate backing, using concealed fasteners; designed to be field replaceable.
   1. Apply facings free from air bubbles, wrinkles, blisters, and other defects, with vertical edges tightly butted, with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-B for Type indicated; Class A.

2.06 SUSPENSION SYSTEMS

A. Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of accordion folding partition indicated. Size track to support partition operation and storage without damage to suspension system, accordion folding partitions, or adjacent construction. Limit track deflection, independent of structural support, to no more than 80 percent of bottom clearance. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
   1. Track: Recessed.
      a. Head Closure Trim: Integral with track for protecting overhead surfaces; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for size and weight of partition and for easy, quiet operation; with ball-bearing four-wheel carriers at lead post and ball-bearing two-wheel carriers at intermediate spacing.

C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of accordion folding partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Comply with ASTM E 557, accordion folding partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.

B. Install accordion folding partitions and accessories after other finishing operations, including painting, have been completed.

3.03 ADJUSTING

A. Adjust accordion folding partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.04 CLEANING AND PROTECTION

A. Clean soiled surfaces, fabric facing, metal surfaces, and vacuum carpet facing on completing installation of accordion folding partitions, to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure accordion folding partitions are without damage or deterioration at time of Substantial Completion.

C. Replace partitions that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain accordion folding partitions.
   1. Test and adjust seals, hardware, carriers, tracks, and other operable components. Replace damaged or malfunctioning operable components.
   2. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
   4. Schedule training with Owner, with at least seven days' advance notice.

3.06 ACCORDION FOLDING BI-PARTING PARTITION SCHEDULE

A. Accordion Folding Bi-Parting Partition: Comply with the following:
   1. Partition Operation: Manually operated.
   2. Hardware: Latch operable from both sides.
   3. Finish Facing: Vinyl-coated fabric wall covering complying with CFFA-W-101-B, Type II.
      a. Color/Pattern: Match Modernfold Standard Koroseal, Camel Down.
   4. STC: Not less than 40.
   5. NRC: Not less than 0.55>.

END OF SECTION

SECTION 102650
IMPACT-RESISTANT WALL PROTECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

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

B. Division 8 Section "Door Hardware" for stainless-steel mop, kick, armor, and push plates.

1.03 SUBMITTALS

A. Product Data: Include physical characteristics, such as durability, resistance to fading, and flame resistance, for each impact-resistant wall protection system component indicated.

B. Samples for Verification: For the following products, showing the full range of color and texture variations expected in each impact-resistant wall protection system component. Prepare Samples from the same material to be used for the Work.

1. Wall and Corner Guards: 12-inch- (300-mm-) long, in full profile, sample of each type of impact-resistant wall protection system component required. Include examples of joinery, corners, and field splices.

C. Maintenance Data: For each impact-resistant wall protection system component to include in maintenance manuals specified in Division 1.

1. Include recommended methods and frequency for maintaining optimum condition of covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of impact-resistant wall protection system components similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each grade, finish, and type of impact-resistant wall protection system component from a single source with resources to provide components of consistent quality in appearance and physical properties.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection system and are based on the specific system indicated.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architects approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store wall surface-protection materials in original undamaged factory packaging and containers in a climate controlled location away from direct sunlight.

1. Maintain room temperature within the storage area at not less than 70 deg F (21 deg C) and humidity not greater than 50 percent during the period materials are stored

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install wall surface-protection system components until the space is enclosed and weatherproof and ambient temperature within the building is maintained at not less than 70 deg F (21 deg C) for not less than 72 hours before beginning installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

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

1. IPC Door and Wall Protection Systems; InPro Corporation, PO Box 406, Muskego, WI 53150 USA, Telephone: 800-222-5556 http://www.inprocorp.com
2. Pawling Corporation; 32 Nelson Hill Rd, PO Box 200, Wassaic, NY 12592, USA; Telephone: 800-431-3456; http://www.pawling.com
   a. Substitutions: Not Permitted
   b. Provide all corner guards and wall protection from a single source.

2.02 CORNER GUARDS

A. Unless otherwise noted on the drawings, Corner Guards are to be: Surface-Mounted, Stainless Steel Corner; 1½"(89mm) x1 ½"(89mm) x 48" (1.21m), ⅛" radius, Cement-on, 430 Stainless Steel, 16 gauge. Finish: No. 4 satin finish.
   1. InPro Corporation, Model # 181124C-304
   2. Pawling Corporation, Model # CG-50

2.03 MATERIALS

A. Stainless-Steel: Corner Guards shall be manufactured from Type 430, 16 gauge Stainless Steel;

B. Attachment: Adhesive: Field applied Locktite PL Premium, heavy duty adhesive.

2.04 FABRICATION

A. General: Fabricate impact-resistant wall protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including thicknesses of components.

B. Preassemble components in the shop to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnecting members to other construction.

E. Provide inserts and other anchoring devices for connecting components to concrete or masonry. Fabricate anchoring devices to withstand imposed loads. Coordinate anchoring devices with the supporting structure.

2.05 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions in which impact-resistant wall protection system components and impact-resistant wall covering materials will be installed.
   1. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Impact-Resistant Wall Covering Materials: Wall surfaces to receive impact-resistant wall covering materials shall be dry and free from dirt, grease, loose paint, and scale.

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

3.02 PREPARATION

A. General: Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

A. Install impact-resistant wall protection system components at all exterior corners of gypsum board partitions. Corner guards shall be plumb, and true to line without distortions.
   1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   2. Height of guard at full-height walls to be 4’-0” from top of vinyl base.
   3. Height of guard at all other walls to be as indicated on drawings.

3.04 CLEANING

A. General: Immediately on completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent. Clean metal components according to the manufacturer's written instructions.

B. Remove excess adhesive using methods and materials recommended by the manufacturer.

C. Remove surplus materials, rubbish, and debris, resulting from installation, on completion of work and leave installation areas in neat, clean condition.

END OF SECTION

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SECTION 102800
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Toilet and bath accessories.

1.02 RELATED REQUIREMENTS

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

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.04 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

1.05 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.

1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Toilet and Bath Accessories:
   a. Bradley Corporation.

2.02 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied

finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

E. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.03 FABRICATION

A. General: One, maximum 1-1/2-inch- (38-mm-) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.03 TOILET AND BATH ACCESSORY SCHEDULE

A. See schedule on Drawings.

END OF SECTION

SECTION 104400
FIRE-PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portable fire extinguishers.

B. Fire-protection cabinets for the following:
   1. Portable fire extinguishers.
   2. Mounting brackets for fire extinguishers.

1.02 RELATED REQUIREMENTS

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

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.
   2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.05 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Basis-of-Design Product: The design for each product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   1. Sheet: ASTM B 209 (ASTM B 209M).
   2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

2.03 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:

1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

C. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled-steel container for installation in Sales Areas and Presentation Lanes, and UL-rated 20-A:120-B:C, 20-lb nominal capacity, in enameled-steel container for installation in Service Areas and fuel dispensing station.

D. Regular Dry-Chemical Type in Steel Container: UL-rated 60-B:C, 10-lb (4.5-kg) nominal capacity, with sodium bicarbonate-based dry chemical in enameled-steel container.

2.04 FIRE-PROTECTION CABINET - SHOWROOM

A. Basis-of-Design Product: Larsen’s Manufacturing Company, Architectural Series Model 2409-6R or a comparable product by one of the following:

B. Manufacturers:
1. JL Industries, Inc.
2. Potter Roemer; Div. of Smith Industries, Inc.

C. Cabinet Type: Suitable for fire extinguisher.

D. Cabinet Construction: Nonrated.

E. Cabinet Material: Aluminum sheet.

F. Semi-recessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

G. Cabinet Trim Material: Aluminum sheet.

H. Door Material: Aluminum sheet.

I. Door Style: Solid opaque panel with frame.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting door pull and friction latch.
2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      1) Location: Applied to cabinet door.
      2) Application Process: Pressure-sensitive, die-cut, vinyl letters.
      3) Lettering Color: Red.
      4) Orientation: Vertical.

L. Finishes:
1. Aluminum: Clear anodic.

2.05 FIRE-PROTECTION CABINET - EXTERIOR AT FUELING STATION

A. Basis-of-Design Product: “Island Chief” by Cato or a comparable product by one of the following:

B. Manufacturers:
   1. JL Industries, Inc.
   2. Larsen’s Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries

C. Cabinet Type: Suitable for fire extinguisher.

2.06 MOUNTING BRACKETS

A. Manufacturers:
   1. JL Industries, Inc.
   2. Larsen's Manufacturing Company.
   3. Potter Roemer; Div. of Smith Industries, Inc.

B. Mounting Brackets: Manufacturer's standard, galvanized, steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   1. Color: Red.

C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

2.07 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
      a. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
   2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.08 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.09 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

2.10 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

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

3.02 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

D. Identification: Apply lettering at locations indicated.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 107300
PROTECTIVE COVERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pre-Engineered, exterior, rod-hung, canopies.

1.02 RELATED REQUIREMENTS

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

1.03 SYSTEM DESCRIPTION

A. General: Provide aluminum rod-hung canopy systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

1.04 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing canopy systems similar to those required for this Project and who is acceptable to manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of systems and are based on the specific systems indicated.
   1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 BASIS OF DESIGN

A. Basis of design is Lumishade Hanger Rod Canopy by Mapes Industries, Inc. Subject to compliance with requirements, other manufacturer's systems with equal performance characteristics may be considered.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
   1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221 (ASTM B 221M).

3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

2.03 COMPONENTS

A. Provide manufacturer's standard components as indicated below, and of the Drawings, for complete installation of roll-formed aluminum overhead hanger rod canopies.
1. Decking shall consist of an interlocking roll-formed 2 ½" "W" style.
2. Intermediate frame members shall be extruded aluminum, alloy 6063-T6.
3. Hanger rods and attachment hardware shall be galvanized/zinc plated.
4. Fascia shall be 8 inch, extruded "J" style, of a minimum 0.078" aluminum.
5. Front, concealed, drainage trough.

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Reinforce members as required to retain fastener threads.

2.04 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

2.05 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of canopy systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing canopy systems. Do not install damaged components. Fit frame joints to produce hairline

joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades without warp or rack of framing members.

END OF SECTION

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SECTION 108000
OTHER SPECIALTIES

PART 1 – GENERAL

1.01 RELATED REQUIREMENTS

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

1.02 DESCRIPTION OF WORK

A. The extent of miscellaneous specialties is indicated on the drawings and specified herein and includes:
   1. Key Drop Box.
   2. Knox Boxes - tamper switch.
   3. Knox Box - key switch.
   4. Service Order Drop Box.
   5. Maximum Occupancy Signage.
   6. Pipe Bollard Sleeves.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data showing mounting method.

PART 2 – PRODUCTS

2.01 KEY DROP

A. Key drop basis of design by Hamilton Safe. Refer to Architectural Drawings for details. GC must mention this item is for a CarMax project. Vendor contact as follows:
   1. Hamilton Safe
      a. Contact: Nick Behler
      b. (513) 874-3733
      c. nbehler@hamiltonsafe.com

B. Key drop to be furnished and installed by the General Contractor.

2.02 KNOX BOXES

A. Knox box shall be Key Vaults #3200TS with alarm tamper switch (normally closed contact switch) by Knox Company with optional rust and corrosion protection. Refer to Architectural Drawings for details. Vendor contact as follows:
   1. Knox Company
      a. 1601 Deer Valley Road
      b. Phoenix, AZ 85027
      c. Phone: 800.552.566
      d. Coordinate type of mounting requirements – recessed and surface, with the installation locations indicated on the Drawings. Provide manufacturer’s recessed mounting kit, where required.
   2. Knox box to be furnished and installed by the General Contractor.

2.03 KNOX KEY SWITCH

A. Knox Key Switch shall be #3500 Series with [single pole] [double pole] switch. Vendor contact as follows:
   1. Knox Company
      a. 1601 Deer Valley Road
      b. Phoenix, AZ 85027
      c. Phone: 800.552.5669
   2. Coordinate type of mounting requirements – recessed and surface, with the installation locations indicated on the Drawings. Provide manufacturer’s recessed mounting kit, where required.
   3. Knox Key Switch to be furnished and installed by the General Contractor.

2.04 SERVICE ORDER DROP BOX

A. Unit shall be “Early Bird/Nite Owl” by Reynolds & Reynolds.

B. Drop box to be supplied by the Owner and installed by the General Contractor.

2.05 MAXIMUM OCCUPANCY SIGNAGE

A. One Maximum Occupancy Signage furnished and installed by the General Contractor, location to be by the Owner.

B. Sign: 10" x 6"; red vinyl letters on 3mm sintra with round corners; Font: Helvetica Bold; all letters to be capitalized with copy centered and stacked. General Contractor to verify the wording of the sign with the Architect.

2.06 PIPE BOLLARD SLEEVES

A. Furnish and install protective sleeves for all pipe bollards. Sleeves shall have a nominal thickness of 0.250 inches. Material shall be Polyethylene Thermoplastic (HDPE). Color shall be Pantone 287 (to match CarMax “Reflex Blue”) and have ultra-violet resistance and anti-static properties. Size covers for pipe diameters and heights. Cover surface to be smooth with round top, no ribbed or two-piece systems will be accepted.

B. Basis of Design Manufacturer: Subject to compliance with requirements, provide products by manufacturer listed or an approved equal.
   1. Manufacturer:
      a. IDEAL SHIELD
         1) 2525 Clark Street
         2) Detroit, MI 48209-1355
         3) Phone: (877) 325-0769

PART 3 – EXECUTION

3.01 INSTALLATION

1. Install all miscellaneous specialties where indicated on the drawings, in accordance with manufacturer’s printed instructions.
2. Installation of Owner supplied parking space barcodes. Owner shall provide sales lot barcodes in accordance with the Drawings. Owner shall supply adhesive for installation of barcodes in accordance with the Drawings. General Contractor shall obtain all MSDS information and follow all recommendations by manufacturer and OSHA for handling such material.

END SECTION 10900

END OF SECTION

SECTION 111200
PARKING CONTROL EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following types of parking control equipment:
   1. Drop Beam Barricade System

1.02 RELATED DOCUMENTS

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

B. Related Sections: The following Sections contain requirements that relate to this Section:

C. Concrete for islands, curbing and support posts is included in Division 3 Section "Cast-in-Place Concrete."

D. Security access control systems are specified in Division 16.

1.03 WORK FURNISHED BY OTHERS

A. All other traffic control equipment indicated on the drawings to be furnished and installed by the Owner. (i.e.: gate control pedestals.) See Paragraph 3.3 of this Section for schedule of responsibilities.

1.04 SUBMITTALS

A. Wiring diagrams detailing wiring for parking control equipment operator, signal, and control systems differentiating clearly between manufacturer-installed wiring and field-installed wiring.

B. Show the locations of connections to electrical service provided as a unit of work under other Sections.

C. Maintenance data for parking control equipment components for inclusion in the Operating and Maintenance Manuals specified in Division 1.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is an authorized representative of the parking control equipment manufacturer for both installation and maintenance of the type of units required for this Project, and whose installations have resulted in construction with a record of successful in-service performance.

B. UL and NEMA Compliance: Provide internal electrical components required as part of parking control equipment that are listed and labeled by UL and comply with applicable NEMA standards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: The work in this section shall be provided by Delta Scientific Corporation.

B. The Drop Beam Barricade System shall be Delta Scientific Corporation, Model Number DSC7035(H) hydraulic powered for automatic operation. The system shall be furnished complete with all necessary appurtenances required for the configuration indicated on the drawings including, but not necessarily limited to, a “Magnalock” (magnetic locking device) and required length of hydraulic tubing and associated fittings.

C. Direct all questions to:
   1. Mr. Keith Brobosky
   2. Delta Scientific Corporation
   3. Phone: 661.575.1100 x340

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning equipment installation, examine areas to receive parking control equipment. Verify that critical dimensions are correct and that conditions are acceptable.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide templates for all items embedded or encased in concrete or below finished surfaces in sufficient time so as not to delay the Work.

3.03 INSTALLATION

A. General: Install parking control equipment in accordance with the manufacturer's instructions and placement drawings.

B. Coordinate placement of anchors and accessories encased in concrete with Division 3.

C. Responsibility: The following list identifies the steps and responsible parties for ordering and installation of the Delta Gate Systems. There are some additional steps necessary to complete the gate installation, but most of the items are identified and rely on Delta Scientific, the Owner and the General Contractor to work together.

TASK	DESCRIPTION	RESPONSIBLE
1	Notify Delta to proceed with shop drawings and embeds.	Owner
2	Ship shop drawings to Architect for review.	Delta Scientific
3	Ship reviewed shop drawings to Delta Scientific and GC.	Architect
4	Ship gates and shop drawings to Contractor at the site.	Delta Scientific
5	Hold pre-installation meeting at site with Contractor.	Owner
6	Install gates and associated concrete aprons, pads and conduits.	Contractor
7	Receive and unload gate control pedestals and HPU units.	Contractor
8	Distribute components to each gate location.	Contractor
9	Install gate arms.	Concentric
10	Set HPU’s into position.	Concentric
11	Bolt HPU’s to concrete slab.	Concentric
12	Set gate control pedestals into position.	Concentric
13	Bolt gate control pedestals to slab.	Concentric
14	Provide and terminate power to HPU’s and gate control pedestals.	Concentric
15	Wire HPU’s and gates (including hinges and latch heaters).	Concentric
16	Interconnect and wire gate control pedestals.	Concentric
17	Cut concrete for loop sensors.	Concentric
18	Install loop sensors.	Concentric
19	Complete hook up and test each gate location.	Concentric

3.04 DEMONSTRATION (BY CONCENTRIC)

A. Instruct the Owner's personnel in the proper operation and maintenance of parking control equipment. Train the personnel in procedures to follow in the event of operational failures or malfunctions.

3.05 CLEANING (BY CONTRACTOR)

A. After installation clean finished surfaces. Touch up damaged shop-applied finishes as required to restore damaged areas.

END OF SECTION

SECTION 122113
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Miniblinds with aluminum louver slats.

1.02 RELATED REQUIREMENTS

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

1.03 DEFINITIONS

A. Miniblind: Venetian blind with nominal 1-inch-wide louver slat.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Samples for Verification: For the following products, prepared on Samples from the same material to be used for the Work.
   1. Louver Slat: Not less than 4 inches (300 mm) long.

C. Window Treatment Schedule: Include horizontal louver blinds in schedule using same room designations indicated on Drawings.

D. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:
   1. Methods for maintaining horizontal louver blinds and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Resistance Ratings: Passes NFPA 701.

C. Corded Window Covering Product Standard: Provide horizontal louver blinds complying with WCMA A 100.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver blinds in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Horizontal Louver Blinds, Aluminum Louver Slats:
      a. Hunter Douglas Window Fashions.
      b. Levolor Contract; a Newell Company; Levolor.
      c. Springs Window Fashions Division, Inc.; Bali.
      d. Springs Window Fashions Division, Inc.; Graber.

2.02 HORIZONTAL LOUVER BLINDS, ALUMINUM LOUVER SLATS

A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
   1. Nominal Slat Width: 1 inch (25 mm) for miniblinds.
      a. Slat Spacing: Every 18 mm for 16.7 slats or more per foot (18 mm).
   2. Slat Finish: Color as indicated on the Drawings
   3. Nominal Slat Thickness: Not less than 0.006 inch.

B. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends; capacity for one blind per headrail, unless otherwise indicated.

C. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends bottom contoured for minimizing light gaps; with enclosed and protected ladders and tapes to prevent their contact with sill.

D. Tilt Control: Consisting of enclosed worm gear mechanism and linkage rod, for the following operation:
   1. Tilt Operation: Manual with clear plastic wand.
   2. Length of Tilt Control: Full length of blind.
   3. Tilt: Two-direction, positive stop or lock out limited at an angle of 60 degrees from zero-degree horizontal, both directions.

E. Lift Operation: Lift operation is not required.

F. Ladders: Evenly spaced to prevent long-term louver sag.
   1. For Blinds with Nominal Slat Width 1 Inch (25 mm) or Less: Braided string.

G. Mounting: Ceiling mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.

2.03 HORIZONTAL LOUVER BLINDS FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029, unless otherwise indicated, for each horizontal louver blind designed to be self-leveling and consisting of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
   1. Lifting and Tilting Mechanisms: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Blind Units Installed between (Inside) Jambs: Width equal to 1/4 inch (6 mm) per side or 1/2 inch (12 mm) total, plus or minus 1/8 inch (3 mm), less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch (6 mm), plus or minus 1/8 inch (3 mm), less than head-to-sill dimension of opening in which each blind is installed.
   2. Blind Units Installed Outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, and operating hardware, and for hardware position and blind mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:
   1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 HORIZONTAL LOUVER BLIND INSTALLATION

A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 2 inches (50 mm) to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

B. Flush Mounted: Install blinds with louver edges flush with finish face of opening if slats are tilted open.

3.03 ADJUSTING

A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean blind surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

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SECTION 122400
ROLLER SHADE SYSTEM

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Manually operated roller shades.

1.02 RELATED REQUIREMENTS

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

1.03 RELATED SECTIONS

A. Section 092116 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for blocking, installation of shade pockets, closures and related accessories.

B. Section 095100 - Acoustical Ceilings: Coordination with acoustical ceiling systems for blocking, installation of shade pockets, closures and related accessories.

C. Division 16 - Electrical: Electric service for motors, and motor controls.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details, locations and installation methods of shades, motor, motor controllers and switches.
   5. Typical wiring diagrams including integration of motor controllers.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, power and control wiring diagrams, and relationship to adjacent work.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

D. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section.

B. Installer for Roller Shade System - Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

F. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.

G. Turn-Key Single-Source Responsibility for Wiring Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
   1. Main General Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
   2. Main General Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
   3. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
   4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
   5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Power and control wiring shall be complete and certified, fully operational with uninterrupted communication on the lines and minimal noise certified by a commissioning agent (by others).

1.08 WARRANTY

A. Motorized Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Manual Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc.; Contact Cherie Simmons, Business Development Manager, MechoSystems Headquarters, 42-03 35th Street, Long Island City, NY 11101-2301, email Cherie.simmons@mechosystems.com, Office – 1.718.729.2020, Mobile – 1.770.519.0570; or a

comparable product by the following:
a. Hunter Douglas Contract; RB 500 with Somfy Digital Network RS485
1) 13915 Danielson Street, Suite 100
2) Poway, CA 92064
3) Phone – 800.727.8953
2. Fax – 800.205.9819

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.02 SCHEDULE

A. Roller Shade Schedule: Refer to the Drawings for locations.
1. Shade Type WT-5: Manual interior solar roller shades at interior storefront systems and windows and above door(s) in interior storefront systems where manual shades are scheduled to be installed; Include the following as scheduled and as indicated on the Drawings.
a. Fascias.

2.03 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets shall not be acceptable.
1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
a. Hembar shall be heat sealed on all sides.
b. Open ends shall not be accepted.
2. Shade band and Shade Roller Attachment:
a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" Spline mounting, without having to remove shade roller from shade brackets.
c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

2.04 SHADE FABRICATION

A. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate without the use of intermediate seams. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
1. Bottom hem sealed with aluminum bar.

2.05 COMPONENTS

A. Access and Material Requirements:
1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delran engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.

B. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).
4. All bands within a single motor group shall be aligned within 7/8 inch.

2.06 SHADE CLOTH

A. Shade Cloth Schedule:
   1. Designation on Drawings: WT-5
      a. Visually Transparent Single-Fabric Shadecloth:
         1) MechoShade Systems, Inc.(Basis of Design):
            (a) Soho "1600" series, 0.010 diameter (0.254 mm) non-raveling vinyl/polyester yarn, fabric thickness 0.025 inches (0.635 mm).
            (b) Openness Factor: 3% open.
            (c) Color: as indicated on drawings
         2) HunterDouglas Contract:
            (a) SheerWeave "4600" Series, 22% Polyester, 78% PVC on Polyester.
            (b) Openness Factor: 3% open.
            (c) Color: Pewter

2.07 ACCESSORIES

A. Fascia:
   1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
   2. Fascia shall be able to be installed across two or more shade bands in one piece.
   3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
   4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
   5. Notching of Fascia for manual chain shall not be acceptable.
   6. 6. Fascia color: to match storefront

2.08 MANUAL SHADE SYSTEM

A. Basis of Design: Subject to compliance with requirements, provide MechoShade Systems, Inc.; Mecho/5X with single operator for simultaneous alignment of all bands across a window assembly or comparable product from the following:
   a. Hunter Douglas Contract; RB500 Heavy Duty+ Clutch-Coupled Shade.
      1) All aluminum accessory finishes to match storefront.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Test electrically operated shades for proper operation. Repair or replace units, which do not perform correctly.

E. Test automated tracking control system for proper operation. Repair or replace units, which do not perform correctly.

F. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 123661.16
SOLID SURFACING COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid-surfacing-material countertops and backsplashes.

1.02 RELATED REQUIREMENTS

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

B. Section 061000 - Rough Carpentry: for wood furring, blocking, shims, required for installing solid-surface materials and concealed within other construction before installation.

C. Section 079200 - Joint Sealants: for mildew resistant silicone sealant.

1.03 SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in solid surface countertops.

C. Samples: For each type of material exposed to view.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

B. Fabricator/Installer qualifications:
   1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

C. Applicable Standards:
   1. Standards of the following, as referenced herein:
      a. American National Standards Institute (ANSI)
      b. American Society for Testing and Materials (ASTM)
      c. National Electrical Manufacturers Association (NEMA)
      d. NFS International
   2. Fire Test Response characteristics:
      a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
         1) Flame Spread Index: 25 or less.
         2) Smoke Developed Index: 450 or less.

1.05 DELIVERY STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.
   1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.06 WARRANTY

A. Provide manufacturer’s warranty against defects in materials.

1. Warranty shall provide material and labor to repair or replace defective materials.

B. Manufacturer's Warranty Period:
1. Ten years from date of substantial completion.

PART 2 PRODUCTS

2.01 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:
1. Front: Radius edge with apron, 3/8-inch (9.5-mm) radius, see Drawings for apron height.
2. Backsplash: Radius edge with 3/8-inch (9.5-mm) radius, see Drawings for backsplash height.
3. Endsplash: Matching backsplash.

B. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.

C. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

2.02 COUNTERTOP MATERIALS

A. Substrates:
1. Composite Wood and Agrifiber Products: Provide products that comply 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," including 2004 Addenda.
2. Particleboard: ANSI A208.1, [Grade M-2] [Grade M-2-Exterior Glue], made with binder containing no urea formaldehyde.
3. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

B. Adhesives: Adhesives shall comply 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."

C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin complying with ANSI SS1 over continuous substrate.
1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.

D. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

E. Manufacturers:
1. Subject to compliance with requirements, provide products by one of the following:
a. Avonite Surfaces; www.avonitesurfaces.com/#sle.
b. Dupont: www.corian.com/#sle.
c. Formica Corporation: www.formica.com/#sle.
d. LG Hausys America, Inc; HI-MACS 12mm: www.lghausysusa.com/#sle.
e. Samsung Chemical USA, Inc.
f. Wilsonart: www.wilsonart.com/#sle.

F. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.

G. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

H. Type: Provide Standard Type unless Special Purpose Type is indicated.

I. Color/Pattern Family: Solid color, light colors.

J. Color and Pattern: As indicated on drawings.

K. Other Components Thickness: 1/2 inch (12 mm), minimum.

L. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.

M. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

N. Skirts: As indicated on drawings.

O. Fabricate in accordance with manufacturer's standard requirements.

PART 3 EXECUTION

3.01 FABRICATION

A. Fabricate tops and wall panels up to 144 inches (3,657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

B. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.

C. Join lengths of tops using best method recommended by manufacturer.

D. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.

E. Rout a 1/8 inch (3 mm) drip groove at underside of exposed overlapping edges, set back 1/2 inch (13 mm) from face of edge.

F. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

G. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

3.02 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.03 CLEANING

A. Clean countertops surfaces thoroughly.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 124813
ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of Owner-Furnished vinyl foot grid. Installation material, including leveling compound, shall be provided by the General Contractor.

1.02 RELATED REQUIREMENTS

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

1.03 QUALITY ASSURANCE

A. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.04 PROJECT CONDITIONS

A. Field Measurements: Verify blocked-out openings in floors by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating floor mats and frames without field measurements. Coordinate floor construction to ensure that actual opening dimensions correspond to established dimensions. Provide dimensions to the Owner’s supplier.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Ultra Entry by Mats Inc. as distributed by Canterbury Distributors Ltd. Provide inserts in colors noted on Finish Schedule(s).

2.02 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by product manufacturer for applications indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, and floor conditions, and floor recesses for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install leveling bed as required to set mat tops at proper elevations with adjacent flooring material

B. Install units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.03 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

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SECTION 211300
FIRE-SUPPRESSION SPRINKLER SYSTEMS

THE SPRINKLER DESIGN AND INSTALLATION SHALL BE IN ACCORDANCE WITH FM GLOBAL DESIGN GUIDELINES IN ADDITION TO NFPA CRITERIA. SPRINKLER DESIGN DENSITIES SHALL BE IN ACCORDANCE WITH SPEC SECTION 1.3.

PRIOR TO SYSTEM DESIGN, THE SPRINKLER DESIGNER SHALL CONTACT KEN BUHLER ASSOCIATES TO DISCUSS MEASURES TO AVOID COMMON DEFICIENCIES NOTED DURING THE PLAN REVIEW.

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. The work covered by this section includes the furnishing of all labor, material, equipment, devices and appurtenances for the design and installation of an approved sprinkler system as specified herein.

1. All work shall be installed in accordance with FM Global Loss Prevention data sheets 2-0 and 3-26, the 2016 edition of NFPA No. 13 "Sprinkler Systems", 2016 Edition of NFPA No. 33 “Spray Application Using Flammable or Combustible Materials”, and all applicable local Code Requirements.

2. The scope of work shall include connections to the new fire service lines. Coordinate locations and distance from buildings with site contractor.

3. The design and installation of all underground water lines serving the sprinkler systems shall, at a minimum, comply with NFPA, FM, and local requirements. Contractor shall review the drawings for the underground fire lines to ensure that the design is in accordance with the above mentioned codes and standards. Any items noted that do not comply shall promptly be reported to the general contractor, project architect, and Ken Buhler Associates. The provisions contained here must be fully coordinated with other specifications and drawings that relate to the underground utilities for the project. The most restrictive of all sections, notes and drawings, in conjunction with all applicable codes having jurisdiction, shall be the level of installation and performance for the underground piping deliverance portion of the fire protection system. This includes all portions of the design and devices from the source of public supply, downstream.

4. Sprinkler protection shall be provided throughout the Production and Wholesale buildings. The Guard House and Car Wash are not to be sprinklered.

5. The design and installation shall be in accordance with this section and all sections of NFPA #13 and FM Global Standards for wet and dry pipe systems.

6. The work shall be installed, tested, and ready for operation.

7. Sprinkler design drawings and hydraulic calculations shall be prepared and furnished to all authorities having jurisdiction, including any third party review firms, for their approval.

8. The Sprinkler Contractor shall provide all required stamps, PE seals, fees, insurance, etc., for review and approval of the sprinkler design and installation.

9. The sprinkler system design and installation shall be in accordance with and approved by all authorities having jurisdiction (State and Local Authorities, Fire Marshals, third party review firms, etc.). Approval from all authorities having jurisdiction is a requirement of the installation regardless whether the items questioned are specified in the plans and specifications.

10. Contact Ken Buhler Associates at 631-360-3770 or rbuhler@kbafire.com for all questions relating to the work in this section. Any and all such communications are provided in a complementary and advisory capacity only. Any effect on the requirements of the work contained in this project shall be directed to the general contractor who then shall communicate with the Owner.

1.3 DESIGN CALCULATION INFORMATION:

A. The sprinkler system shall be designed as follows:

1. Auto repair, Service, and Cosmetic areas (Ordinary Hazard Group II per NFPA #13): 0.30 gpm/sq. ft. over 2500 sq. ft. on a maximum spacing of 100 sq. ft. per head using extra large orifice (Tyco model ELO-231 or similar with a K-factor of 11.2), standard response, 286° F. temperature rated heads. A hose stream allotment of 500 gpm shall be included in the hydraulic calculations.

2. Parts Storage Room and Parts Receiving Area (Extra Hazard Group I per NFPA #13), and Tire Storage Area (Extra Hazard Group I - Miscellaneous Tire Storage per NFPA #13): 0.30 gpm/sq. ft. over 2500 sq. ft. on a maximum spacing of 100 sq. ft. per head. Sprinkler heads shall be extra large orifice (Tyco model ELO-231 or similar with a K-factor of 11.2), standard response, 286° F. temperature rated heads. A hose stream allotment of 500 gpm shall be included in the calculations.

3. Photo Stations (Ordinary Hazard Group I per NFPA #13): 0.20 gpm/sq. ft. throughout each room, using 17/32" orifice, ordinary temperature rated (165° F), concealed sprinklers, equipped with white flat or flush cover plates, that are approved by FM Global for Hazard Class 2 (HC-2) occupancies per FM Guidelines (Reliable Series G5-80F, SIN RA3417 with a K-factor of 8.0). Sprinklers shall be installed on a maximum spacing of 130 sq. ft. A hose allotment of 250 gpm shall be included in the hydraulic calculations.

4. Wholesale Area in the Wholesale Building: Dry-pipe sprinkler system designed to provide a density of 0.20 gpm/sq. ft. over 3,500 sq. ft., using 17/32” orifice, dry pendent sprinklers on a maximum spacing of 130 sq. ft. per head. The dry pendent sprinkler heads shall be approved by FM Global for Hazard Category 2 (HC-2) occupancies per FM Guidelines and equipped with compatible recessed escutcheons, except by the overhead doors, where sprinkler heads shall be equipped with deep escutcheons. Ordinary temperature rated heads (155° F) shall be installed, except near the infrared heating units, where higher temperature heads are required as per NFPA #13. A hose allotment of 250 gpm shall be included in the hydraulic calculations.

5. Offices, Bathrooms, Locker Rooms, Corridors, and other light hazard areas per NFPA #13: 0.10 gpm/sq. ft. over 1500 sq. ft. using quick response, ordinary temperature rated sprinkler heads (155° F) on a maximum spacing of 225 sq. ft. per head. A hose allotment of 250 gpm shall be included in the hydraulic calculations in accordance with FM Global requirements if calculations are provided.

6. Canopy behind the Main Building: Dry pipe sprinkler system, designed to provide a density of 0.2 gpm/sq. ft. over the entire area of the canopy using 200° F rated, corrosion resistant sprinkler heads, on a maximum spacing of 130 sq. ft. per head. A hose allotment of 250 gpm shall be included in the hydraulic calculations.

7. Electrical Rooms, Janitor Closet, Valve Room, Storage Closets, Data/PBX Room, and Utility Closets (Ordinary Hazard Group I per NFPA #13): Install sprinklers on a maximum spacing of 130 sq. ft. Ordinary temperature rated sprinkler heads (155° F) shall be installed, except near heating units, where higher temperature heads are required per NFPA#13.

8. Spray Booths (Paint Booths), Closed Top Open Front (CTOF) Sanding Stations, Mixing Rooms, and associated areas (Extra Hazard Group II per NFPA #13): - Automatic sprinklers shall be installed below the ceiling filters within each booth, inside of the mixing rooms, behind the baffles, and in the exhaust ducts, including the under floor exhaust plenums, in all paint spray booths and sanding stations. Sprinklers shall also be installed in the return air plenums above the ceiling filters in the paint booths. See sketches at back of specification section 211300 for sprinkler and pipe locations.

   a. Sprinklers in the paint spray areas, plenums, and mixing rooms shall be designed to discharge a minimum of 0.40 gpm/sq. ft. over the entire paint booth or sanding station using extra large orifice (Tyco model ELO-231 or similar with a K-factor of 11.2) heads.

   b. Sprinklers in the exhaust ducts and vertical exhaust stacks for each booth shall be designed to provide a minimum flow of 30 gpm per head at a minimum pressure of 15 psi using 17/32 in. orifice (8.0 K- factor) heads.

   c. Each paint booth, sanding station, and Mixing Room shall be treated as a separate area for the purposes of calculating sprinkler demands and pipe sizes.

   d. The flow from all sprinklers throughout the booth, including the heads in the plenums and exhaust ducts, shall be included in each set of hydraulic calculations.

   e. Hose stream allotments of 500 gpm shall be included in the hydraulic calculations.

B. The area of sprinkler operation selected for hydraulic calculations shall be the most hydraulically demanding area as per Factory Mutual Standards.

C. If roll grooved piping is used, additional pressure loss in couplings and fittings due to reduced cross section at grooves shall be reflected in the calculations.

D. Hydraulics shall be plotted on a graph along with water supply data. A safety margin or pressure cushion of at least 10% of the available pressure or as required by local fire officials, whichever is larger, shall be provided with water flow versus total demands. **The pressure cushion shall be shown on the water supply graph.**

1.4 HYDRANT FLOW TEST DATA:

A. A hydrant flow test was performed on February 1, 2023, using hydrants connected to the 12" water line in Weir Creek Boulevard. Pressures were recorded on the first hydrant southeast of Eltham Road on Weir Creek Boulevard, and flows were measured using the next hydrant to the southeast. The effective point of the flow test is at first hydrant southeast of Eltham Road on Weir Creek Boulevard, at an approximate grade elevation of 92 ft.

The results are as follows:

64 psi Static 1711 gpm Flow
59 psi Residual

If required by local fire and/or water officials, water flow test data must be adjusted to take into account daily and seasonal pressure fluctuations. Pressure variations due to water pumping stations, elevated storage water tank levels, maximum peak day demand, etc., must be taken into consideration. The sprinkler systems shall be designed based on minimum expected fire flows.

B. **Hydraulic calculations shall include friction loss and elevation difference from effective point of the flow test to the sprinkler riser.**

1.5 SHOP DRAWINGS:

A. Within thirty (30) days of the Contract Award, a complete set of sprinkler plans and hydraulic calculations shall be prepared and submitted to all applicable authorities for their review.

B. Plans shall indicate sizes, lengths, locations, and configurations of all interior and underground pipe, sprinkler heads, hangers, fittings, risers, hydrants, valves, valve pits, meters, fire department connections, and related equipment starting at the connection to the existing public mains. Manufacturers and models of all meters and backflow preventors shall be indicated.

C. Plans shall contain information pertaining to NFPA occupancy and use (See spec section 1.3), and the applicable NFPA code sections shall be referenced in any areas where sprinkler protection is omitted.

D. Prior to fabrication of material, electronic files of the shop drawings with hydraulic calculations and product description information are to be submitted to Pieper O'Brien Herr Architects through the Procore website. After review, the sprinkler work may proceed if found in compliance with the plans and specifications. Plans shall be reviewed by Ken Buhler Associates and returned to the Architect within 15 working days of KBA receiving the submittal.

E. For equipment to be installed, product description data sheets, technical bulletins, etc., shall be submitted for review and compliance.

1.6 SYSTEM DESCRIPTION:

A. All piping and sprinkler heads shall be coordinated with lights, ductwork, structural framework, roof drains, electrical equipment, gas lines, and any other obstructions to the sprinkler installation, regardless of dimensions or location shown.

B. Sprinklers shall be positioned with respect to obstructions and ceilings in accordance with the 2016 edition of NFPA #13.

C. Cutting or patching of structural members without prior approval of the Architect shall be prohibited. Where sleeves occur through concrete beams, provide the General Contractor with sleeves of the correct sizes, prior to the pouring of the beams. Where chases occur in masonry walls, layout accurately for the Masonry Contractor, who shall cut the chases.

D. Sprinkler contractor shall maintain the integrity of the rated fire walls. All openings around sprinkler pipe shall be sealed by the sprinkler contractor with approved fire safing material to maintain the fire rating of the wall penetrated or opened.

E. Sprinkler feed mains and branch lines shall not be installed inside or directly above the Cash Office, Electrical, and PBX/Data Rooms. Sprinkler protection in these areas shall be provided utilizing 1 in. armovers or by extending 1 in. pipe from the end of a branch line directly into the rooms.

F. Sprinklers shall be positioned to provide adequate coverage on all sides of the RTUs, ducts, exhaust fan duct drops, concentric diffusers and any other potential obstructions to sprinkler discharge located at the exposed ceilings and/or less than 18 in. below the sprinkler deflectors.

G. Sprinkler protection shall be installed underneath the duct drop diffusers for the RTUs in the Service, Cosmetic, and Storage Areas.

H. Pendant sprinkler heads in suspended ceilings shall be installed in the center of the 2ft. by 2 ft. squares in the tiles and aligned in both directions within the area of installation.

I. Sprinklers shall be positioned to provide adequate coverage below the open overhead doors and tracks in the Wholesale Area. Heads by the doors shall be equipped with deep escutcheons and positioned by the doors in accordance with the ceiling mounted obstruction requirements indicated in NFPA #13 and FM Global Data Sheet 2-0.

J. Provide and install intermediate temperature rated (200° F) dry sidewall sprinklers through the wall for exposure protection from the new and used Oil Storage tanks located outside at the exterior wall of the Service area. Locate the heads in the middle of smooth face section of the CMU wall at approximately 13' above grade.

K. The sprinkler installation shall be coordinated with the intake and exhaust ducts, and all related equipment for the Paint Spray Booths and CTOF Sanding Stations. Sprinklers and pipe shall be positioned to provide adequate coverage on all sides of the ducts, and the pipe shall be positioned so as not to interfere with the duct locations above the booths.

L. Two sprinkler risers are required for the ceiling sprinkler systems in the Production/Service Building.

M. Paint Booths and CTOF Sanding Stations:

1. Sprinklers below the ceiling air filters inside the paint booths and sanding stations shall be located in the two center filter beams or in the middle of the metal panels between the lights. Pipe shall not penetrate the filters.

2. Sprinklers in the exhaust ducts for the paint booths and sanding stations shall be installed on a maximum horizontal spacing of 12 ft. between heads in all horizontal runs. Sprinklers shall be located at the top of all duct offsets.

3. All sprinkler and pipe penetrations in the paint booths and sanding stations, including the overhead and under floor plenums, filter beams, etc., shall be sealed.

4. The sprinklers in the paint spray booths and CTOF sanding stations, including the ducts and under floor exhaust plenums, shall each be controlled by an independent sprinkler control valve for each unit.

5. High temperature rated heads (286° F.) shall be installed throughout the spray areas, including exhaust ducts.

6. A 360 degree rated sprinkler shall be installed in the fresh air intake/return air plenums at the top of the spray booths.

N. Sprinkler protection shall be installed below any ductwork and other fixed obstructions exceeding 48 in. in the least dimension that interfere with the discharge from the sprinklers above.

O. Provide and install dry pipe sprinkler systems in the Wholesale Area of the Wholesale Building and underneath the canopy at the rear of the Production Building. The dry pipe valve for the Wholesale Area shall be located in the Valve Room. The dry pipe valve for the canopy shall be fed from the ceiling sprinkler system and located in the back of Vehicle Prep Area 73, by columns 1, C-D.3. The dry pipe systems shall be complete with dry pipe valves, air compressors, air maintenance devices, monitoring equipment, drains, and test connections.

P. Photo Stations and related areas:

1. Sprinklers in the Photo Booths shall be installed on a maximum spacing of 130 sq. ft. per head.

2. Sprinkler heads shall be located in the flat sections of the gypsum board ceilings in the photo stations.

3. Unless there are state or local requirements requiring sprinkler protection below the perimeter light shelf, sprinklers shall not be installed underneath the light shelf at the perimeter of the Photo Booth. The light shelf at the perimeter of the Photo Booth is less than 4 feet wide and located more than 18 inches below the sprinkler deflectors. Sprinkler protection is permitted to be omitted below the shelf in accordance with section A.8.6.5.1.2 and figure A.8.6.5.1.2 in the Annex from NFPA #13.

1.7 AS-BUILT DRAWINGS:

A. Upon completion of his work, the Contractor shall furnish to the Architect three (3) sets of "As-Built" drawings of the sprinkler work as actually installed.

B. An electronic file of the "As-Built" sprinkler drawings, in an AutoCAD compatible format, shall be furnished to Ken Buhler Associates upon completion and acceptance of the system.

C. A set of As-Built sprinkler plans, inside a plastic pouch, shall be provided in the Sprinkler Valve Room.

1.8 MATERIALS AND EQUIPMENT LISTS:

A. For equipment to be installed, product description data sheets, technical bulletins, etc., shall be submitted for review and spec compliance. The Contractor shall submit for approval a complete list of all materials, equipment and accessories proposed for installation. Approval of materials and equipment will be based on manufacturer's published data and will be tentative subject to submission of complete shop drawings.

1.9 WARRANTY:

A. The installation shall be guaranteed for workmanship and free of leakage for a period of one year and twenty days after completion and acceptance of the system.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. All materials and equipment furnished, except for the concealed sprinkler heads, which are to be FM Approved for Hazard Category 2 occupancies, shall be both UL Listed and FM approved.

2.2 SPRINKLER HEADS:

A. Sprinkler heads beneath finished ceilings shall be chrome plated, semi-recessed, pendant heads with compatible, UL Listed and FM Approved escutcheons. Heads shall be installed so that mounting plates are recessed at approximately 1/4 inch in the ceiling. Do not install sprinklers with mounting plates located flush with, or below ceiling tiles.

B. Sprinkler heads beneath the finished ceiling in the Wholesale Area shall be dry pendent sprinklers equipped with compatible UL Listed and FM Approved recessed escutcheons, except by the overhead doors, where sprinklers with deep escutcheons shall be installed to provide coverage below the open overhead doors and tracks. K=8.0 dry pendent sprinklers can be utilized. At the time that the specifications were developed, the Victaulic model V3607 and V3608 sprinkler heads are the only K=8.0 dry pendent sprinklers that are UL Listed and FM Approved.

C. Sprinkler heads beneath the finished ceilings in the Photo Booths shall be 17/32" orifice, concealed sprinklers equipped with compatible white, flat or flush cover plates that are approved for FM Hazard Category 2 occupancies. At the time that the specifications were developed, the only concealed sprinklers with flat cover plates that are FM Approved for ordinary Hazard (HC-2) occupancies, are the Reliable Series G5-80F sprinklers having a K-factor of 8.0 (SIN RA3417), equipped with G5 or G5 SR Gasket cover plates.

D. Quick response sprinklers shall be installed in offices, restrooms, and all other areas designated as light hazard per NFPA #13.

E. Sprinklers at the exposed roof deck shall be brass upright heads.

F. The sprinkler heads in the circular exhaust ducts for the paint booths and sanding stations shall be dry pendant and/or dry sidewall heads.

G. The sprinkler heads throughout the paint spray booths and sanding stations, including the exhaust ducts and under floor plenums, shall be equipped with coverings to protect the heads from paint overspray. Coverings shall consist of cellophane bags having a maximum thickness of .003 in., or thin paper bags.

2.3 PIPE:

A. All piping shall be new and approved for 175 psi working pressure conforming to ATSM specifications, and UL listed and FM approved for fire sprinkler installation.

B. Threaded lightwall pipe and/or Press-fit pipe systems shall not be used.

C. Internally galvanized pipe shall be provided for the dry pipe systems.

2.4 PIPE HANGERS:

A. Furnish and install hangers and supports per NFPA #13, structural steel manufacturer's requirements, and authorities having jurisdiction.

B. Hangers shall be supported from the top chord of the structural steel members. Pipe hangers shall not be hung from or attached to the roof deck or joist bridging.

C. Attach piping in excess of 2-1/2 in. diameter at structural joist panel points only; or provide structural reinforcement.

D. Piping 4 in. or larger:

1. Pipe running parallel to the structural steel shall be centered between two joists and supported from the joists on both sides of the pipe using trapeze style hangers.

2. No more than one main running parallel to the joists shall be installed within a joist bay.

3. Sprinkler mains running parallel to the joists shall not be installed within the same joist bays as the roof drains.

4. At least one open joist bay shall be maintained between two sets of pipes running parallel to the joists.

5. Supports for pipe 4 in. or larger running perpendicular to the structural steel shall not be attached to the same joists that are supporting mains installed parallel to the structural steel.

6. In areas where multiple pipes that are 4" or larger are installed in close proximity and perpendicular to the structural steel, the hangers for each pipe shall be attached to alternating joists.

7. Supports for 8 in. pipe running perpendicular to the structural steel shall be provided at each joist that the pipe crosses. Hangers shall be attached to the top chords of the joists, within 6 inches of the joist panel points

8. Hangers for 8 in. pipe running parallel to the structural steel shall be positioned on maximum spacings of 10 ft. between hangers. The pipe shall be centered between two joists and hangers shall be attached to the top chords of the joists on both sides of the pipe, within 6 inches of the joist panel points.

E. Provide earthquake bracing as required per NFPA #13 in locations designated as earthquake prone areas.

2.5 FIRE DEPARTMENT CONNECTION:

A. The fire department connections shall be installed on the exterior walls of the buildings as indicated on the Architectural Drawings. The pipe for the FDCs shall be connected to the sprinkler systems in the Valve Rooms and arranged to feed each riser without recirculating water into the underground fire line. A check valve shall be provided on the line feeding the sprinkler systems, and a ball drip shall be installed at the low point of the pipe by the FDC inlets. Pipe sizes shall be in accordance with Fire Department Requirements.

B. Fire department connection threads shall be compatible with the local fire department. A 4 in. Storz inlet, with a 30-degree downward elbow, is required. The fire department connection inlets shall be equipped with Storz locking caps.

2.6 SPARE SPRINKLER HEADS:

A. A supply of spare sprinklers in a mounted cabinet shall be provided at the risers in each building in accordance with NFPA #13. An index shall be provided on each cabinet, listing the quantity, type (SIN), temperature rating, and general description of each sprinkler provided. Spare sprinklers shall be the same manufacturer, type, SIN, finish, and temperature ratings of the heads that are installed.

2.7 BACKFLOW PREVENTERS AND METERS:

A. Meters, detector check valves, backflow preventers, fire department connections, vaults and/or pits, etc., shall be installed in accordance with requirements of the water company and/or building officials. These devices shall be complete with the required shut off valves.

NOTE: State approved double check detector backflow prevention assemblies are required. The devices shall be installed in the Valve Rooms of each building. The pressure losses for the equipment shall be included in the hydraulic calculations.

The backflow assemblies shall be compact backflow preventers equipped with butterfly valves, having a low associated pressure loss, that are approved by all authorities having jurisdiction for vertical installation (Ames Maxim Series, Colt Series, Deringer, or equivalent) and, if needed, installed in the vertical position. The highest test port on the backflow device shall be located no higher than 5 ft. AFF. The location and installation of the device shall be coordinated with all other equipment in the room so that adequate clear space is provided around the risers.

B. Means shall be provided to perform forward flow testing of the backflow devices at the designed flow rate of the fire protection systems, without shutting down the system to install the test equipment. A test header equipped with three, 2-1/2” capped hose valves, or other connections, shall be installed in accordance with NFPA and local requirements on a wet sprinkler riser in each Valve Room, above the flow switch.

2.8 SPRINKLER SHUTOFF VALVES:

A. Any required sprinkler shutoff valves shall be OS&Y or butterfly valves complete with tamper switches.

B. All interior valves shall be accessible and located at a maximum distance of 6 ft. above the finished floor.

C. The sprinkler control valves for the paint booths, CTOF sanding stations, and dry pipe system shall be located in the areas designated on the Fixture & Equipment Plan, and at least 5 ft. away from all booth openings.

2.9 DRY SYSTEM AIR COMPRESSOR:

A. The air compressors serving the dry pipe sprinkler systems shall be riser mounted air compressors, listed for use in automatic sprinkler systems. The compressors shall be sized to meet NFPA and FM standards, and all local requirements. Electrical requirements shall be coordinated with all other trades.

B. The electrical wiring shall be in accordance with NFPA 70 Article 30.

C. Compressor disconnecting means shall **not** be a general use light switch or cord and plugged connector. An industrial duty disconnect shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. All work is to be installed in accordance with NFPA codes and FM specifications and requirements.

B. Cutting structural members for passage of pipes or for pipe hanger fastening will not be permitted.

C. Any welding of galvanized piping and components shall be done in accordance with applicable standards, and appropriate safety precautions shall be taken to ensure that no one is exposed to toxic fumes or other health endangering conditions.

3.2 FIELD SUPERVISION:

A. The sprinkler Contractor shall have a responsible representative of his organization at the site of the work for coordinating this installation with other trades. Details of proposed departures due to field conditions shall receive written approval of the Owner's Representative.

3.3 ALARMS:

A. Provide and install local sprinkler water flow alarms mounted on the exterior walls in accordance with NFPA and Fire Department requirements.

B. Furnish and install valve tamper devices on all sprinkler control valves and waterflow devices on all risers ready for electrical connection by others. Waterflow devices shall be equipped with double pole contacts. The dry pipe systems shall also be monitored for low air pressure.

3.4 PIPING:

A. Sprinkler piping shall be installed concealed in all finished areas containing suspended ceilings.

B. All sprinkler pipe in areas with exposed ceilings shall be installed as high as possible. Mains shall be located tight to or above the bottom of the steel joists. Branch lines shall be located above the bottom of the joists and within 18 inches of the roof deck. The sprinklers shall be installed so that the deflector distances below the roof deck are in accordance with code requirements without the use of riser nipples.

C. Sprinkler pipe shall not be installed above electrical panels or transformers.

D. Sprinkler pipe shall not be installed below the skylights.

E. Before connecting sprinkler systems to underground supply connections, the supply connection shall be flushed out thoroughly in accordance with requirements of NFPA No.13, FM and AWWA requirements.

F. Auxiliary drains shall be provided at all low points in the systems. Auxiliary drains shall not be installed in finished public areas.

G. Provide inspector's test valves and orifices for the sprinkler systems. Extend discharge pipe to outside of building, provide escutcheons, and paint pipe to match adjacent colors. Inspector's test valves shall be in accessible locations, located outside of all finished public areas.

H. The wet ceiling sprinkler systems shall each be equipped with a pressure relief valve.

I. The sprinkler systems shall be equipped with automatic air vents located near high points in the wet sprinkler systems in accordance with NFPA #13.

J. Provide splash blocks below all inspector's test orifices, auxiliary and main drain openings, etc., that will discharge onto dirt or other loose material. Direct the discharge to impinge on the splash block. The splash blocks shall be installed prior to testing and inspections of the systems.

K. Provisions shall be made to facilitate flushing system such as by providing a flushing connection consisting of a capped nipple 4" long at the end of a cross main.

L. Piping designed as part of the dry pipe systems shall be pitched per the requirements of NFPA 13, 2016 edition. All dry piping shall pitch to a low point drain. Low point drains shall be provided as needed.

3.5 NAME PLATES AND SIGNS:

A. Furnish hydraulic nameplate data and other signs as required.

3.6 PAINTING:

A. Prior to painting by other trades, all sprinkler heads located at the exposed roof deck in the area to be painted shall be protected with a plastic covering to prevent any paint from being applied to the sprinkler release mechanism. The sprinkler contractor shall remove all labels, stickers, tags, excess pipe dope, teflon tape, oil residues, and grease from the sprinkler pipe before the system is to be painted.

B. After painting has been completed, and as directed by the General Contractor, the protective coverings shall be removed from the sprinkler heads by the painting contractor. Any sprinkler heads found with paint residue on the release mechanism shall be replaced with new heads at the sole expense of the Sprinkler Contractor.

C. A letter certifying that the protective coverings have been removed from all sprinkler heads and that all sprinkler head mechanisms are free of paint shall be submitted by the Sprinkler Contractor to the General Contractor and Ken Buhler Associates, Inc.

3.7 TESTS AND INSPECTIONS:

A. The sprinkler contractor shall perform all fire protection and related systems acceptance tests witnessed by the general contractor and/or the owner's testing agency. Testing will occur after all systems are completed. The contractor shall provide all equipment necessary to satisfactory perform all test procedures. If any systems fail, the systems shall be repaired and retested.

1. The sprinkler contractor shall ensure that whenever the inspectors test valve is operated, the main drain test performed, and/or whenever the sprinkler system is drained; the water is piped to discharge directly into a field drain. All rust, dirt, or other debris produced by the above operations shall promptly be washed off the finished paved areas by the sprinkler contractor. If the water cannot be piped to a field drain, the sprinkler contractor shall make arrangements prior to the above operations being performed, to immediately clean all resultant debris and residue from the finished paved areas after the water is discharged to prevent staining.

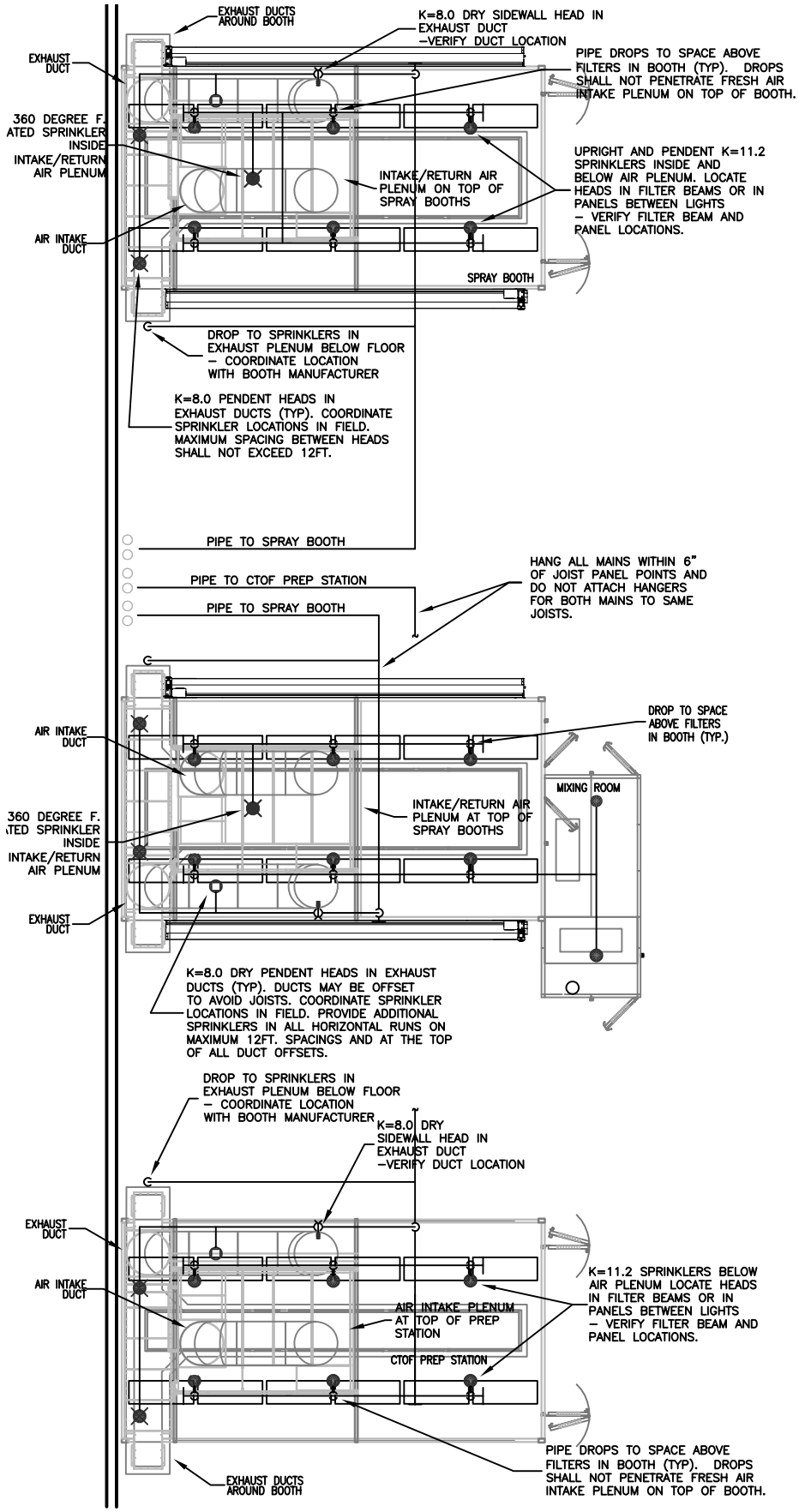
B. The Owner's representative and Inspecting Authorities shall be notified of tests and shall be represented at such tests if they so desire. Costs of all tests shall be paid by the Contractor.

C. After FINAL PROJECT COMPLETION, a hydrostatic test (200 psi for 2 hours) shall be provided by the contractor and witnessed by the owner's testing agency. The contractor shall notify the owner's representatives to arrange for the testing agency to witness all required tests. A Sprinkler Contractor's Material Test Certificate (NFPA Form No. 85A), signed by the owner's testing agency, shall be furnished indicating hydrostatic pressure tests.

D. All underground pipe shall be thoroughly flushed to remove any and all foreign material prior to connection to the interior sprinkler piping. The flushing of the mains shall be in complete accordance with NFPA, FM, and AWWA requirements and coordinated with the Site Contractor and the General Contractor.

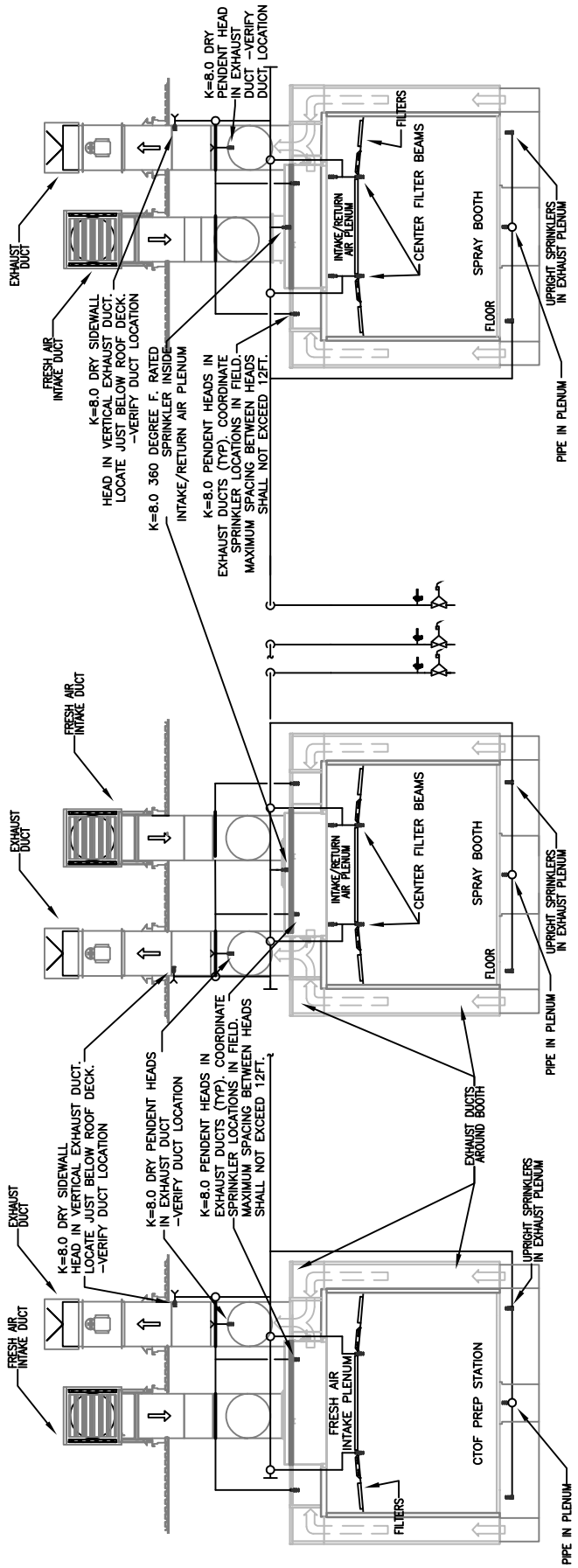
E. The sprinkler contractor shall perform, in coordination with other separate contractors through the general contractor, tests on the underground portions of the fire service system. Such tests shall be completed at a minimum standard for Factory Mutual or NFPA or per the authorities having jurisdiction over the project. The full test procedures recommended by each of these standards shall be followed fully. The tests must be certified in the presence of the Owner's testing representatives.

F. A Sprinkler Contractor's Material Test Certificate shall be furnished indicating hydrostatic pressure tests and flushing of the underground water mains. The minimum test certification form (NFPA Form 85B) is included and attached hereto. This form, or the most recent modification thereto, shall be provided to the Owner and any jurisdiction that may require such evidence. The sprinkler contractor shall obtain and use the most recent form(s) that may replace the attached. Flushing and testing of the underground mains shall be witnessed by owner's testing agency.



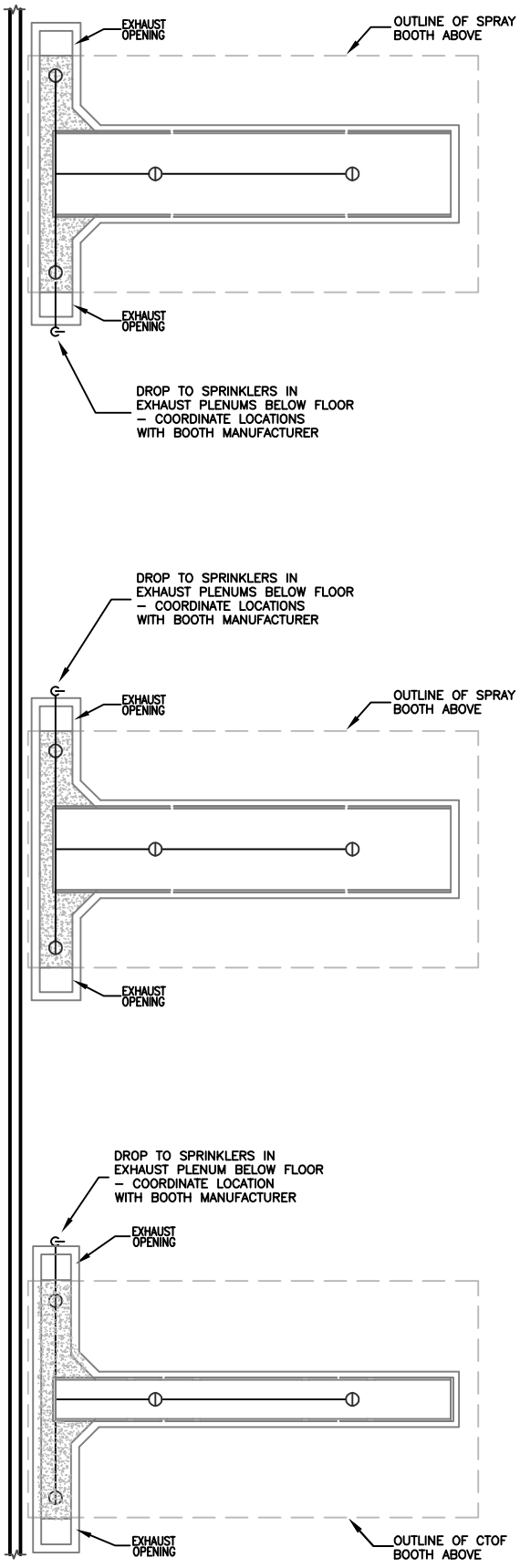
PAINT SPRAY BOOTHS AND CTOF PREP STATION PLAN – THREE BOOTHS

3/32"=1'-0"



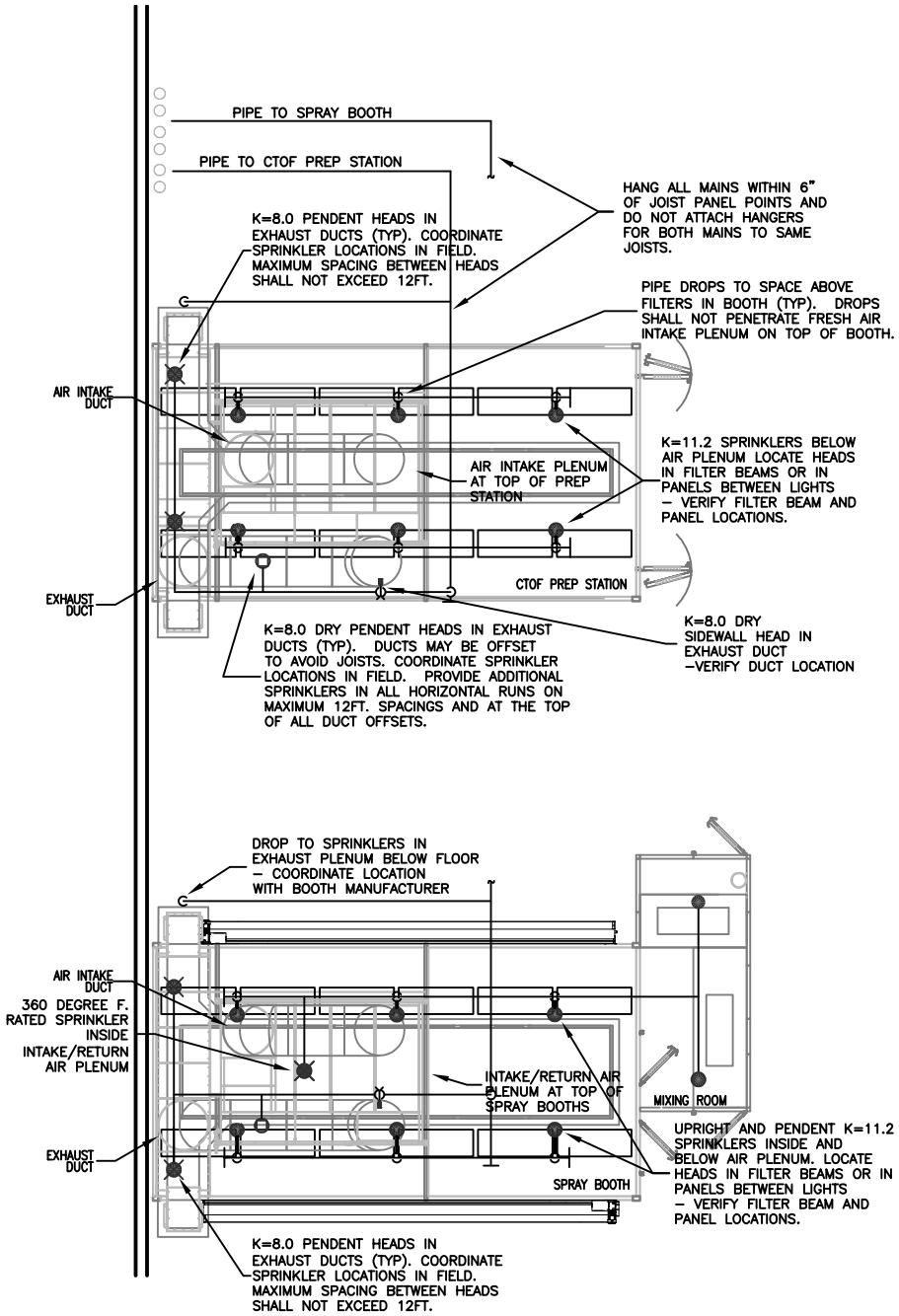
PAINT SPRAY BOOTHS AND CTOF PREP STATION SECTIONS – THREE BOOTHS

3/32"=1'-0"



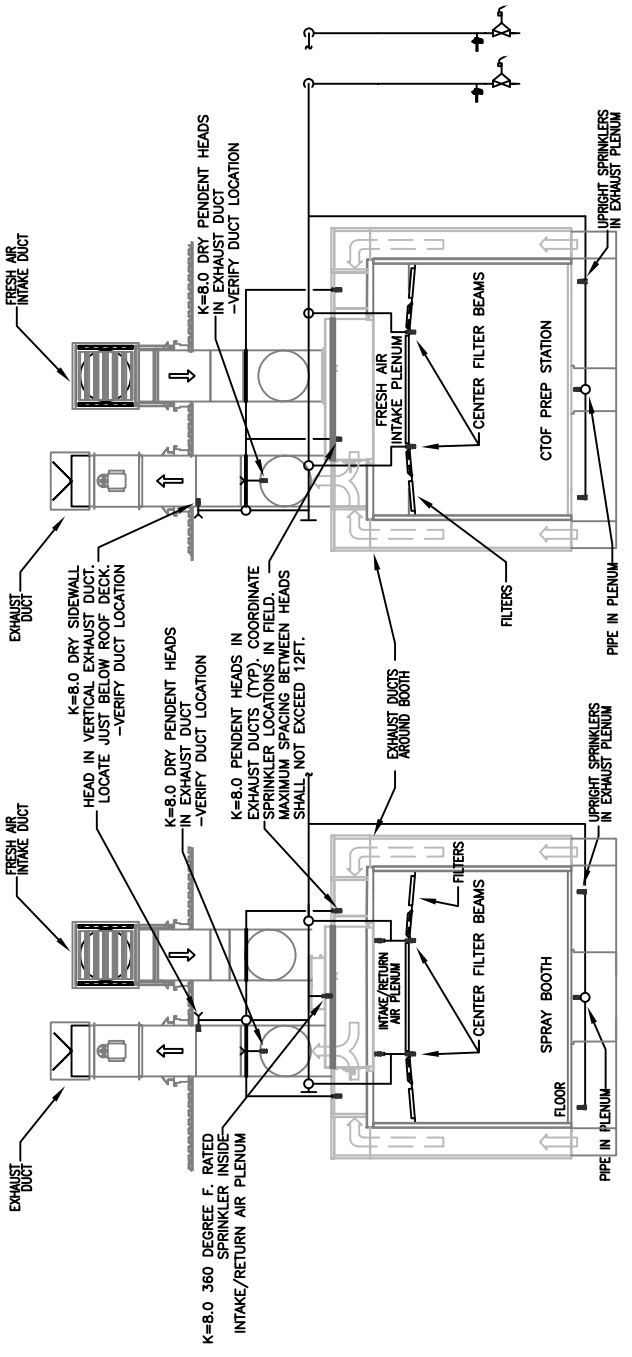
PAINT SPRAY BOOTHS AND CTOF PREP STATION UNDER FLOOR PLENUMS THREE BOOTHS

3/32"=1'-0"



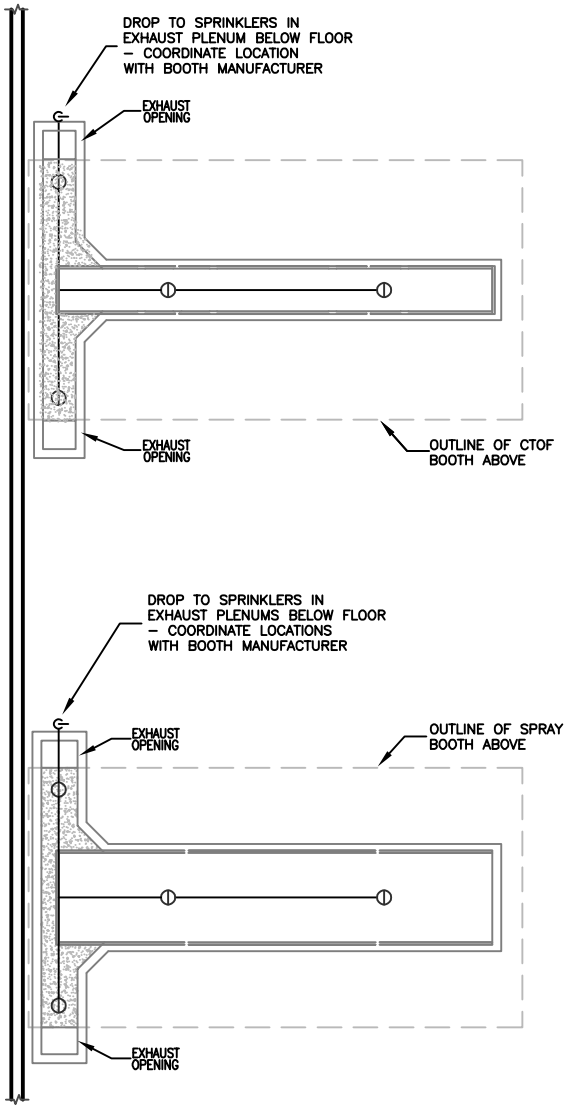
PAINT SPRAY BOOTH AND CTOF PREP STATION PLAN – TWO BOOTHS

3/32"=1'-0"



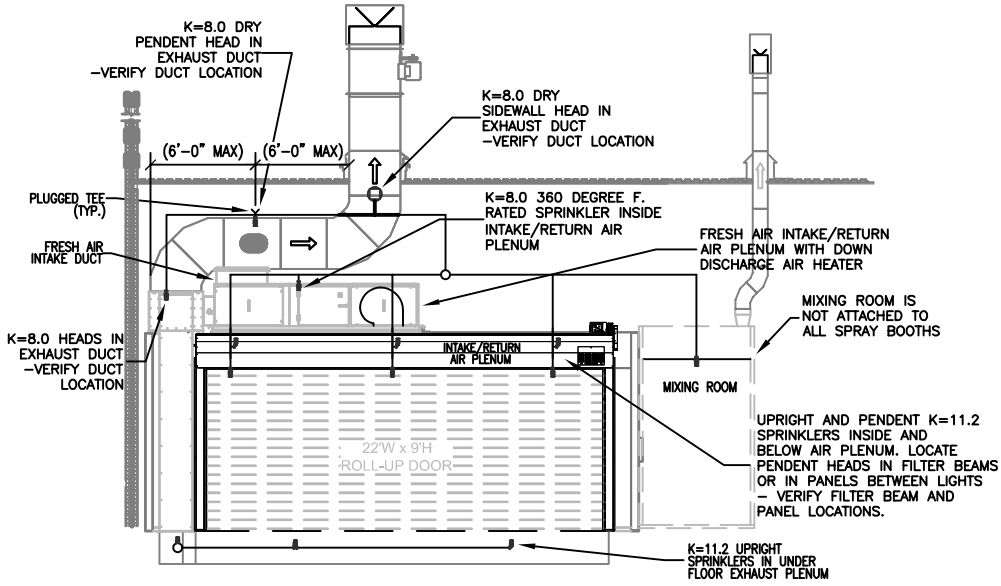
PAINT SPRAY BOOTHS AND CTOF PREP STATION SECTIONS – TWO BOOTHS

3/32"=1'-0"



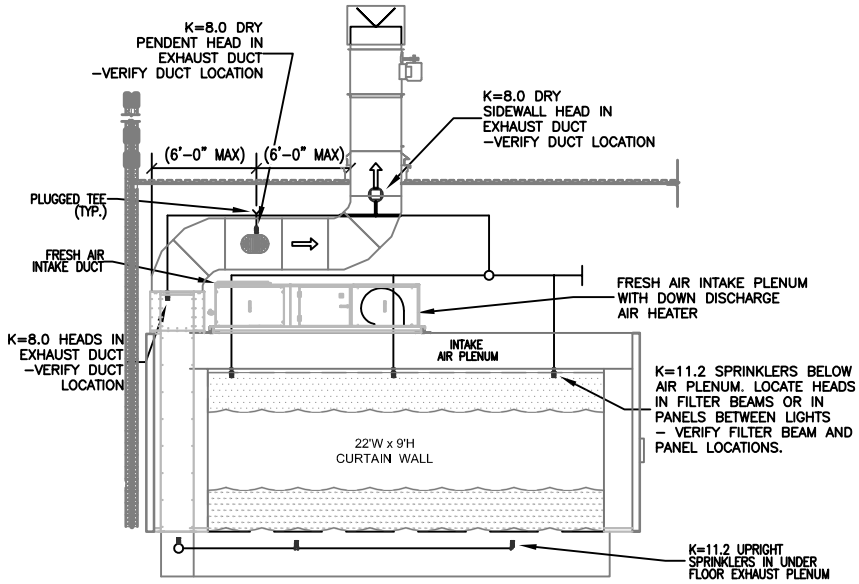
PAINT SPRAY BOOTHS AND CTOF PREP STATION UNDER FLOOR PLENUMS TWO BOOTHS

3/32"=1'-0"



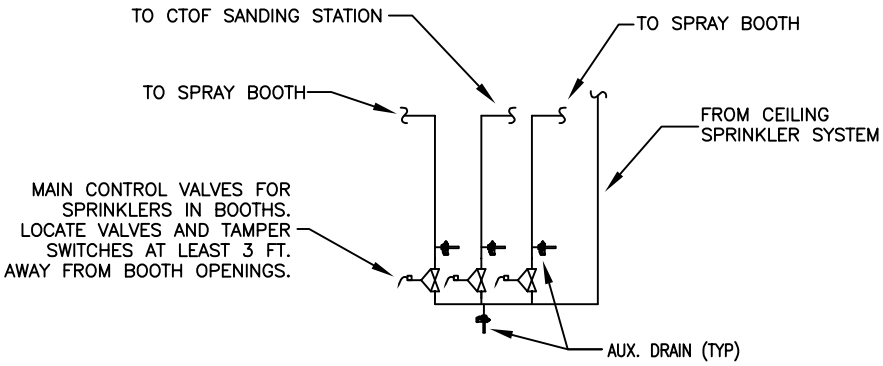
TYPICAL SPRAY BOOTH SIDE SECTIONAL VIEW

3/32"=1'–0"



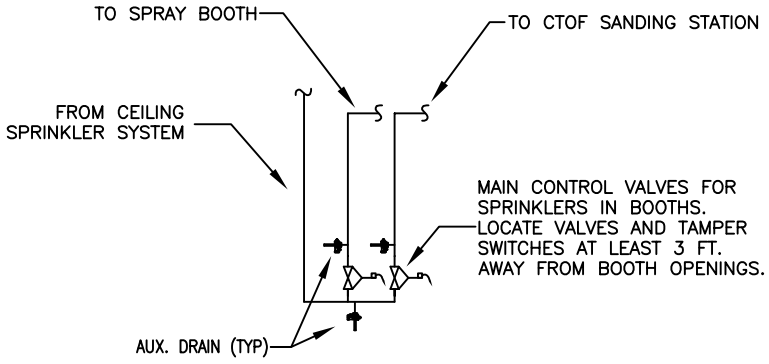
TYPICAL CTOF BOOTH SIDE SECTIONAL VIEW

3/32"=1'–0"



RISER MANIFOLD FOR THREE SPRAY BOOTHS

NO SCALE



RISER MANIFOLD FOR TWO SPRAY BOOTHS

NO SCALE

DRAWINGS ARE FOR REFERENCE ONLY. MINIMUM SPRINKLER REQUIREMENTS ARE SHOWN. LOCAL AUTHORITIES MAY REQUIRE ADDITIONAL PROTECTION.

SPRINKLERS AND PIPE SHALL BE COORDINATED WITH ALL EQUIPMENT INCLUDING DUCTS, LIGHTS, BAFFLES, FILTERS, ETC.

SPRINKLER DESIGN AND INSTALLATION SHALL COMPLY WITH NFPA CODES, FACTORY MUTUAL REQUIREMENTS, AND SPRINKLER SPECIFICATION 15500.

SYSTEMS SHALL EACH BE DESIGNED TO PROVIDE A DENSITY OF .4 GPM PER SQ. FT. OVER THE ENTIRE PAINT BOOTH OR PREP STATION.

SPRINKLER PIPING SHALL BE SIZED IN ACCORDANCE WITH CONTRACTOR'S HYDRAULIC CALCULATIONS.

ALL EQUIPMENT SHALL BE UL LISTED AND FM APPROVED.

SPRINKLER CONTROL VALVES SHALL BE EQUIPPED WITH TAMPER SWITCHES. ALL TAMPER SWITCHES AND OTHER ELECTRICAL EQUIPMENT SHALL BE LOCATED AT LEAST 3 FT. FROM ALL BOOTH OPENINGS.

SPRINKLERS IN EXHAUST DUCTS AROUND BOOTHS SHALL BE 286 DEGREE F. RATED LARGE ORIFICE (K=8.0) HEADS.

SPRINKLERS IN BOOTHS, AS WELL AS THE PLENUMS ABOVE AND BELOW THE BOOTHS, SHALL BE EXTRA LARGE ORIFICE (K=11.2) HEADS.

SPRINKLERS IN ROUND EXHAUST DUCTS EXTENDING THROUGH ROOF SHALL BE 286 DEGREE F. RATED, K=8.0, DRY PENDENT OR DRY SIDEWALL HEADS CONNECTED TO TEE FITTINGS.

A 360 DEGREE F. RATED SPRINKLER SHALL BE INSTALLED IN THE EXHAUST/RETURN AIR PLENUMS ABOVE THE PAINT SPRAY BOOTHS.

SPRINKLER HEADS THROUGHOUT THE SPRAY BOOTHS, CTOF PREP STATION, AND EXHAUST DUCTS, INCLUDING THE UNDER FLOOR PLENUMS SHALL BE EQUIPPED WITH PROTECTIVE COVERINGS (CELLOPHANE BAGS HAVING A MAXIMUM THICKNESS OF .003 IN., OR THIN PAPER BAGS) TO PROTECT THE HEADS FROM PAINT OVERSPRAY.

ALL SPRINKLER AND PIPE PENETRATIONS IN THE PAINT BOOTH, PREP STATION, DUCTS, FILTER BEAMS AND WALLS SHALL BE SEALED.

END OF SECTION 211300

Contractor's Material and Test Certificate for Underground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property name	Date
Property address	

Plans	Accepted by approving authorities (names)		
	Address		
	Installation conforms to accepted plans	❑ Yes	❑ No
	Equipment used is approved If no, state deviations	❑ Yes	❑ No
Instructions	Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment? If no, explain	❑ Yes	❑ No
	Have copies of appropriate instructions and care and maintenance charts been left on premises? If no, explain	❑ Yes	❑ No
Location	Supplies buildings		
Underground pipes and joints	Pipe types and class / Type joint		
	Pipe conforms to _____ standard Fittings conform to _____ standard If no, explain	❑ Yes ❑ Yes	❑ No ❑ No
	Joints needing anchorage clamped, strapped, or blocked in accordance with _____ standard If no, explain	❑ Yes	❑ No

Test description

Flushing: Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at one of the flow rates as specified in 10.10.2.1.3.

Hydrostatic: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) or 50 psi (3.5 bar) in excess of the system working pressure, whichever is greater, and shall maintain that pressure ±5 psi (0.35 bar) for 2 hours.

Hydrostatic Testing Allowance: Where additional water is added to the system to maintain the test pressures required by 10.10.2.2.1, the amount of water shall be measured and shall not exceed the limits of the following equation (for metric equation, see 10.10.2.2.6):

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

L = testing allowance (makeup water), in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

Flushing tests	New underground piping flushed according to _____ standard by (company) If no, explain	❑ Yes	❑ No
	How flushing flow was obtained: ❑ Public water ❑ Tank or reservoir ❑ Fire pump	Through what type opening: ❑ Hydrant butt ❑ Open pipe	
	Lead-ins flushed according to _____ standard by (company) If no, explain	❑ Yes	❑ No
	How flushing flow was obtained: ❑ Public water ❑ Tank or reservoir ❑ Fire pump	Through what type opening: ❑ Y connection to flange and spigot ❑ Open pipe	

Hydrostatic test	All new underground piping hydrostatically tested at _____ psi for _____ hours	Joints covered ❑ Yes ❑ No
Leakage test	Total amount of leakage measured _____ gallons _____ hours	
	Allowable leakage _____ gallons _____ hours	
Forward flow test of backflow preventer	Foward flow test performed in accordance with 10.10.2.5.2: ❑ Yes ❑ No	

Hydrants	Number installed	Type and make	All operate satisfactorily ❑ Yes ❑ No

Control valves	Water control valves left wide open If no, state reason	❑ Yes ❑ No
	Hose threads of fire department connections and hydrants interchangeable with those of fire department answering alarm	❑ Yes ❑ No
Remarks	Date left in service	

Signatures	Name of installing contractor		
	Tests witnessed by		
	For property owner (signed)	Title	Date
	For installing contractor (signed)	Title	Date

Additional explanation and notes

SECTION 22 50 10

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. Each Section within Division 22 & 23, Mechanical, shall conform to the requirements of Section 22 50 10, Mechanical General Provisions.

B. Reference within General Conditions shall be construed to include applicable requirements of Division 1.

1.2 ARTICLES INCLUDED

A. Definitions
B. Laws and Regulations
C. Permits, Fees and Notices
D. Applicable Publications
E. Scope of Work
F. Description of Systems
G. Design Conditions
H. Record Drawings
I. Intent of Drawings and Specifications
J. Submittals
K. Substitutions and Product Options
L. Manufacturers' Instructions
M. Transportation and Handling
N. Storage and Protection
O. Cutting and Patching
P. Cleaning Up/Removal of Debris
Q. Starting of Mechanical Systems
R. Operating and Maintenance Data
S. Guarantee of Work

PART 2 - ARTICLES

2.1 Definitions:

A. The term "as indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have the same meaning as "indicated", and are used to assist the reader in locating particular information.

B. The term "provide", means furnish and install as part of the work covered in Division 22 & 23.

C. The term "furnish", means supply to the project only, for installation under other Divisions as part of this contract.

D. The term "install", means to place and put in service equipment furnished under other Divisions as part of this contract.

E. The term "Owner's Representative" when referenced herein shall be the Engineer unless otherwise noted.

F. For additional definitions refer to the General Conditions.

2.2 Codes, Laws and Regulations: Comply with the following:

A. 2018 Virginia Mechanical Code (IMC 2018 amended)
B. 2018 Virginia Plumbing Code (IPC 2018 amended)
C. 2018 Virginia Energy Code (IECC 2018 amended)
D. 2018 Virginia Fuel Gas Code (IFGC 2018 amended)
E. All current state and local amendments shall apply
F. SMACNA Standards

2.3 Permits, Fees and Notices:

A. Comply with the General Conditions.

B. The work of this Division shall include obtaining all required permits and making all required notices in a timely fashion for all work covered under this Division.

C. All fees associated with requirements of the work under this Division shall be a part of the costs of this Division unless otherwise required under the General Conditions or specifically negotiated in advance with the Owner.

2.4 Applicable Publications:

A. Where publications are listed in each Section, they form a part of that Section to the extent referenced.

B. When a standard is specified by reference, comply with the requirements and recommendations stated in that standard, except when its requirements are modified by the Contract Documents, or applicable codes establish stricter standards.

C. When a code is not specified by reference in a Section, the work of that Section shall comply with applicable codes listed in the General Conditions.

D. The publication date is the publication in effect as of the bid date, except when a specific publication date is specified.

E. Obtain copies of referenced standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

2.5 Scope of Work:

A. The work to be performed under this Division includes the satisfactory completion of PLUMBING, HEATING, VENTILATING, and AIR CONDITIONING work as indicated in

the Contract Documents.

2.6 Description of Systems:

A. Plumbing and Fire Protection - Work shall be performed under Division 15 and see the Contract Document Drawings for a description of this work.

2.7 Record Drawings:

A. For record drawing requirements refer to the General Conditions.

B. Unless specifically excluded from doing so under the General Conditions, trades under this Division shall maintain one (1) set of blue line or black line prints of the Contract Drawings for the work under this Division at the job site. All changes in the location, routing, sizing and/or arrangement that are made for any reason during the course of the construction, shall be recorded on those prints so as to reflect the final installation, "as-built". Upon completion of the project, a second set of similar prints shall be neatly marked to show the work "as-built" and both sets shall be delivered to the Engineer.

2.8 Intent of Drawings and Specifications:

A. The implied and stated intent of the drawings and project manual is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.

B. The drawings are diagrammatic, intending to show general arrangements and location of system components, and are not intended to be rigid in every detail.

C. Due to the small scale of the drawings and to unforeseen job conditions, all required offsets and fittings may not be shown, but they shall be provided at no change in Contract price.

D. Where conflicts are discovered between these Contract Documents and field conditions, the Contractor shall notify the Engineer immediately. The Contractor shall await instructions from the Owner or his representative before proceeding.

E. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

F. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.

G. Close coordination and cooperation shall be mandatory in the location and installation of all piping, ductwork wiring and equipment with respect to all other trades to eliminate conflicts. The Contractor shall determine the exact location of all piping and equipment with respect to slabs, beams, columns, suspended ceilings, light fixtures, sprinkler piping, ducts, etc., from dimensioned architectural and structural contract drawings, utilizing reviewed and accepted shop drawings of equipment to be installed.

H. The specifications for the overall construction delineate various items of work under separate trade headings. It shall be the General Contractor's responsibility to determine actual separation of work between trades, so as to ensure a final installation complete in all respects.

2.9 Submittals:

A. Submit shop drawings, product data and samples in accordance with the General Conditions.

B. Note that the approval of shop drawings, or other information submitted in accordance with the requirements specified, does not assure that the Engineer, Architect or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved or the ability of the material or equipment involved or the mechanical performance of equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict, unless a letter requesting such change is submitted and approved on the Engineer's letterhead.

C. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission of and the dates that reviewed shop drawings, product data and samples will be needed.

D. Shop drawings shall be presented in a clear and thorough manner.

E. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.

F. Prepare product data as follows:

1. Clearly mark each copy to identify pertinent products or models.
2. Show performance characteristics and capacities.
3. Show dimensions and clearances required.
4. Show wiring or piping diagrams and controls.
5. Show where and indicate boldly where at variance with contract documents.

G. Manufacturer's standard schematic drawings and diagrams:

1. Modify drawings and diagrams to delete information which is not applicable to the work.
2. Supplement standard information to provide information specifically applicable to the work.

H. Product samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices, access panels, adjustments.

2. Color, finish and size.

I. Unless required otherwise by the General Conditions, the number of submittals required shall be as follows:

1. Shop Drawings: Submit the number of opaque reproductions which the Contractor requires, plus two copies which will be retained by the Owner's Representative.

2. Product Data: Submit the number of copies which the Contractor requires, plus two which will be retained by the Owner's Representative.

3. Samples: Submit the number stated in the respective specification section.

J. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The project title and number
3. Contract identification
4. The names of:

   a. Contractor
   b. Supplier
   c. Manufacturer

5. Identification of the product, with the applicable specification section and/or Contract Document description clearly indicated.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards.
9. Identification of deviations from Contract Documents.
10. An 8" x 3" blank space for Contractor and Owner's Representative stamps.
11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

K. For resubmission requirements the Contractor shall:

1. Make any corrections or changes in the submittals required by the Owner's Representative and resubmit until approved. **DO NOT INCLUDE PREVIOUSLY NON-APPROVED OR APPROVED SUBMITTALS IN THE SAME FILE AS THE RESUBMITTED ITEM. THE RESUBMITTED ITEMS MUST BE INDEPENDENT SUBMITTALS. RESUBMITTALS BURIED IN A PREVIOUS SUBMITTAL WILL BE RETURNED UNREVIEWED.**

L. Shop Drawings and Product Data:

1. Revise initial drawings or data, and resubmit as specified for the initial submittal. Clearly identify required revisions.

2. Indicate any changes which have been made or other than those requested by the Owner's Representative.

M. Samples: Submit new samples as required for initial submittal.

N. The Contractor shall distribute reproductions of shop drawings and copies of product data which carry the Owner's Representative stamp of approval to:

1. Job site file
2. Record documents file
3. Other affected contractors
4. Affected subcontractors
5. Supplier, fabricator or vendor

O. The Contractor shall distribute samples which carry the Owner's Representative stamp of approval as directed by the Owner's Representative.

P. The Owner's Representative shall:

1. Review submittals in accordance with schedule.

2. Affix stamp and initials or signature, and indicate requirements for resubmittal, or approval of submittal.

3. Return submittals to Contractor for distribution, or for resubmission.

2.10 Substitutions and Product Options:

A. Products List:

1. Submit in accordance with the requirements of the General Conditions.

2. Within 30 days after Contract Date, submit to Owner's Representative a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor.

B. Product Selection:

1. Individual specification sections list under "Acceptable Manufacturers", products found acceptable for this project. The names listed are manufacturers whose products meet the minimum acceptable standards that this project dictates. The list is furnished as a guide. The Contractor at his option, may substitute for any of the products required, provided that the substitution meets or exceeds the standards specified and that the requirements of "Substitutions" are complied with.

C. Substitutions:

1. Submit in accordance with the requirements of the General Conditions.

2. For a period of 60 days after Contract date, Owner's Representative will consider written requests from Contractor for substitution of products.

3. Submit a separate request for each product, supported with complete data, with drawings and samples as appropriate, including.

a. Comparison of the qualities of the proposed substitution with that

specified.

b. Changes required in other elements of the work because of the substitution.

c. Effect on the construction schedule.

d. Cost data comparing the proposed substitution with the product specified.

e. Any required license fees or royalties.

f. Availability of maintenance service, and source of replacement materials.

4. Owner's Representative shall be the judge of the acceptability of the proposed substitution.

D. Contractor's Responsibility:

1. A request for a substitution implies that the Contractor has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.

2. Will provide the same warranties or bonds for the substitution as for the product specified.

3. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects at no additional cost to the Owner.

4. Absorb all costs incurred by the substitution when affecting other trades, including but not limited to electrical, structural and architectural, etc.

5. Absorb any cost incurred by the Owner's Representative in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting Contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or incorrectly sized equipment. In the event of additional engineering costs the billing structure shall be agreed upon prior to review by all involved parties.

6. Owner's Representative will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of the decision to accept or reject the requested substitution.

2.11 Manufacturer's Instructions:

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved and the Owner's Representative.

B. Maintain one set of complete instructions at the job site during installation and until completion.

C. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

D. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for further instructions.

E. Do not proceed with work without clear instructions.

F. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory steps or installation procedure unless specifically modified or exempted by Contract Documents.

2.12 Transportation and Handling:

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to insure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods which prevent soiling or damage to products or packaging.

2.13 Storage and Protection:

A. Store products in accordance with manufacturer's instructions.

1. Store products subject to damage by the elements in weather tight enclosures. Equipment, devices and materials to be installed inside the building shall be stored in weather tight trailers, or under secure (dry) roofing within the building.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. Exterior storage:

1. Store fabricated products above the ground on blocking or skids, to prevent soiling or staining. Upon delivery to site, immediately cover, and maintain coverage over, products which are subject to deterioration with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

2. Store loose granular materials in a well drained area on solid surfaces to prevent mixing with foreign matter.

3. Arrange storage in a manner so as to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and are free from damage or deterioration.

C. Protection and Installation:

1. Provide temporary coverings as necessary to protect installed products from damage from traffic and construction activity during subsequent construction operations. Remove when no longer needed.

2.14 Cutting and Patching:

A. Cutting and patching shall be in accordance with the General Conditions.

B. Unless specifically required otherwise in the General Conditions, the General Contractor shall be responsible for all cutting and patching. This Contractor shall provide the General Contractor with all necessary sizes, locations, arrangements, details and data required for the proper construction of recesses, chases, pockets, openings, holes, etc. necessary to install the work covered under this Division. This Contractor shall locate all sleeves necessary to install the work covered under this Division. Location data shall be furnished to the General Contractor well in advance of general construction so as not to cause delay in construction or the cutting and patching of new work.

2.15 Cleaning Up/Removal of Debris:

A. Comply with the General Conditions.

2.16 Starting of Mechanical Systems:

A. Provide material and labor required to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.

B. Provide information and assistance required, cooperate with test, adjust and balance services.

C. Comply strictly with specified procedures in starting up mechanical systems.

D. Provide such periodic continuing adjustment services as necessary to insure proper functioning of mechanical systems after occupancy of the project, and for a period of one year after date of substantial completion.

E. Refer to the Contract Documents for coordination with the Owner’s Service Consultant, including the submission of start-up reports within the Operation and Maintenance manuals.

2.17 Operating and Maintenance Data:

A. Quantity: 3

B. Format: 8-1/2" x 11 loose leaf binder.

C. Content:

1. Maintenance and Service Contracts: Provide a list, with each product, name, address and telephone number of:

a. Subcontractor or installer.

b. Maintenance contractor, as appropriate.

c. Identify area of responsibility of each.

d. Local source of supply for parts and replacement.

2. Table of Contents: List all products in the order in which they appear in the specifications and label accordingly, i.e.: 225100: Valves.

3. Sections: All sections shall be separated with an appropriate tabbed section divider with the appropriate specification section number. Provide the manufacturer's written installation and maintenance instructions for all items required.

4. Routine Maintenance: Provide a list indicating all routine maintenance procedures based on 3 month, 6 month, 9 month, 12 month intervals.

5. All copies shall be submitted to the Owner's Representative for approval.

2.18 Guarantee of Work:

A. Prohibition of Lead:

1. The presence and use of lead is strictly prohibited in potable water systems.

2. Potable water shall not be subject to contact with lead in any form.

3. The design and manufacture of all materials and equipment (piping, fittings, joints, connections, solders, fixtures, accessories, etc.) provided, shall not contain lead in any form.

4. Contractor shall be responsible for all costs involved in testing and certifying that potable water systems, materials and equipment are lead free.

B. Prohibition of Asbestos Products:

1. No asbestos-containing products and or building materials shall be used or installed on this project.

2. Where applicable, furnish manufacturer's written warranty for materials and equipment.

3. Materials and equipment, which have seasonal operational limitations, shall be guaranteed for one year from date of seasonally appropriate test, and

acceptance in writing by the Owner.

4. Comply with the General Conditions.

2.19 Grand Opening Day Assistance:

A. On the date established by the Owner, the mechanical subcontractor shall have on-site, for an eight-hour day, a qualified journeyman who is experienced with the materials and design requirements of the project as well as a service vehicle. The cost of this time and equipment shall be included in the Base Bid. Upon completion of this work, the journeyman shall prepare a “No Cost” service call invoice and have the invoice signed by the Carmax Auto Superstore LLC Operations Manager. This signed invoice shall be submitted to the General Contractor for processing to the Owner.

END OF SECTION 22 50 10

SECTION 22 50 20

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. The Contractor shall conform to the General Conditions.

B. Section 22 50 10: Mechanical General Provisions.

1.2 WORK INCLUDED

A. Electrical Work
B. Motors and Controllers
C. Underwriter's Label and Listing
D. Setting of Equipment
E. Painting
F. Waterproofing and Flashing
G. Firestopping and Smokestopping
H. Access Doors
I. Piping and Equipment Identification
J. Miscellaneous Iron and Steel
K. Welding
L. Plates and Escutcheons
M. Disposal of Waste Materials
N. Cutting and Patching
O. Items to be Installed Only
P. Pipe Sleeves

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.

1. American Institute of Steel Construction (AISC) Publications
2. American National Standards Institute (ANSI) Standards
3. American Society for Testing and Materials (ASTM) Publications
4. American Welding Society (AWS) Publications
5. Underwriters Laboratories, Inc. (UL) Standards
6. ASHRAE Standards

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Access Doors:

1. Inland-Ryerson - "Milcor"
2. Karp Metal Associates, Inc.
3. Birmingham Ornamental Iron Company

B. Piping and Equipment Identification:

1. Seton Name Plate Corp.

C. Fire and Smoke Stopping Material:

1. Dow Corning Corporation
2. General Electric Company
3. Nelson, A Unit of General Signal
4. 3M

2.2 ACCESS DOORS

A. Drywall Construction - Style DW with 16 gauge frame, 14 gauge panel and flush screwdriver operated cam lock.

B. Masonry Non-Fire Walls and Partitions - Style M with 16 gauge frame, 14 gauge panel and flush screwdriver operated cam lock.

C. Masonry Fire Rated Walls and Partitions - Fire rated with UL 1-1/2 hour "B" rating, 16 gauge frame, 20 gauge sandwich type insulated panel, self-latching lock having interior lock keyed to suit the requirements of the Owner.

D. Finish: Provide primed painted units to receive final finish coat in field.

E. Access doors may not be installed in a tile wall.

2.3 CEILING MOUNTED ACCESS DOORS

A. Ceiling mounted access door shall be as specified under Division 8.

2.4 SLEEVES

A. Pipes through floors: Form with schedule 40 steel pipe with water stop flange 4 in. wide in center of sleeve.

B. Pipes through CMU and concrete walls, beams, fireproofing and fittings: Form with schedule 20 steel pipe or 18 ga. galvanized steel.

C. Round Ducts thru cmu and concrete walls: Form with 18 ga. galvanized steel.

D. Rectangular Ducts thru CMU and concrete walls: Form with 18 ga. galvanized steel. Size large enough to allow for movement due to expansion and to provide fire stopping and smoke stopping, minimum 1/2 inch clear all sides.

F. Sleeves through exterior walls above and below grade sealed with rubber compression type seals similar to Link-Seal.

G. Furnish sleeve located in masonry walls to masonry contractor in advance of the time they are needed. Coordinate location.

H. Acceptable Manufacturers are Thunderline Corporation - Link Seal, Metraflex Company Metraseal

PART 3 - EXECUTION

3.1 ELECTRICAL WORK

A. Except as otherwise detailed or specified, all electrical devices, apparatus, controls, etc., furnished in this division, but which are not integral with the equipment served, shall be

installed under Division 16.

B. Except as otherwise detailed or specified, all interconnecting power wiring required to operate electrical devices and equipment furnished in this Division shall be provided under Division 16.

C. Requirements for electrical apparatus, devices, controls, etc., furnished in this Division shall conform to Division 16.

D. Control and interlock wiring required for electrical devices and equipment furnished in this Division shall be provided under Division 16.

3.2 MOTORS AND MOTOR CONTROLS

A. All motors furnished as a part of the work of this Division, unless otherwise specified, shall be furnished by the manufacturer of the equipment served and shall be mounted and aligned so as to run free and true. Each motor shall comply with Division 16 requirements.

B. Except as otherwise specified or scheduled on the drawings, each motor shall be designed to operate on 60 hertz AC power, and each motor shall be specifically wound for the utilization of voltage specified. Each motor shall have the capability of successful, continuous operation at rated load and frequency with a voltage variation of plus or minus 10 percent of the specified voltage.

C. HVAC equipment shall be furnished at the voltage and phase shown on the electrical drawings.

D. All motors shall be provided with a terminal box of adequate size to accommodate the required conduit and wiring. Wire nuts and lugs shall be provided under Division 16.

E. Unless otherwise specified, fan motor starters shall be provided under Division 16. All three phase fan motor starters are furnished and installed under Division 16.

F. Where motor controllers are specified to be furnished with the motors as a part of the work of this Division, they shall be furnished with the proper number of auxiliary contacts and other devices necessary to permit the interlocking and control sequence required. Controller operating coils shall generally be designed for 120 volt operation. Where necessary, control power transformers with one side fused and one side grounded shall be provided for this purpose. All three phase motors shall be provided with overload relay protection in all three phases.

3.3 UNDERWRITERS' LABEL AND LISTING

A. All electrical apparatus furnished under this Division shall be approved by the Underwriters' Laboratories and shall be so labeled and listed where required by Code Authority Having Jurisdiction.

3.4 SETTING OF EQUIPMENT

A. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility.

B. Set base mounted equipment on permanent and finished supports. Temporary support must be removed prior to completion.

C. All equipment must be installed in strict accordance with manufacturer's

recommendations and details on contract drawings. In case of any conflict submit details to Engineer in writing for review.

3.5 PAINTING

A. Except as otherwise specified or indicated on the drawings, all equipment furnished under this Division shall be furnished with a standard factory applied finish. All practical precautions shall be taken to prevent scars, scratches and damages during shipment, storage and construction. Touch up painting shall be provided to repair scars and scratches.

B. All nameplates bearing descriptive data and all nonferrous surfaces of materials and equipment provided under this Division shall be left unpainted and clean.

C. All bare iron surfaces of pipe, equipment, materials, hangers and supports installed under this Division shall be painted with one coat of rust inhibitive primer as specified elsewhere in other Divisions and Sections of these specifications.

D. Paint all visible interior surfaces of ductwork behind grilles, registers and diffusers with one coat of flat black paint.

E. Paint all wood backboards for mounting switches, controllers, etc., and wooden backboards within electrical and telephone closets and cabinets with one prime coat and one finish coat of gray enamel before any attachments are made to the boards.

F. All painting and sizing done under this Division shall conform to applicable quality control requirements set forth in Division 9.

G. Finish painting of walls, ceilings, doors, trims and other items of general construction is specified in Division 9 and is not a part of the work of this Division.

H. Finish painting of any exposed work provided under this Division shall be performed under Division 9 and is not a part of the work of this Division.

3.6 WATERPROOFING AND FLASHING

A. Waterproofing and flashing will be provided under Division 7.

B. Coordinate all required work with other trades.

3.7 FIRE STOPPING AND SMOKE STOPPING

A. Except where detailed or specified otherwise, all pipes and ducts passing through floor slabs above the lowest floor slab, and through concrete or masonry walls, fire partitions and smoke or fire plenum barrier partitions, shall have the total annular space between all pipes or ducts and the sleeves packed full with mineral wool or UL listed and approved fire stopping sealant. Care shall be exercised to compact the mineral wool fill deep enough to assure approved fire stopping without interfering with pipe movement. After mineral wool has been installed around ducts or pipes, a 26 gauge sheet metal collar shall be secured around the perimeter of the duct or pipe to insure tightness and prevent migration of the mineral wool. The mineral wool shall be inorganic loose fill type, rated at 3200 degrees F. melting point and meet the requirements of both ASTM E-84 and UL 723 non-combustibility tests. The fire stopping sealant shall be a caulk of putty material meeting the requirements of both ASTM E-814 and UL 1479, "Standard Method of Fire Tests of Through-Penetration Fire Stops". The fire stopping sealant shall be applicable for specific installations as recommended by the material manufacturer. The installation

method shall be in strict accordance with the printed installation requirements by the material manufacturer.

3.8 ACCESS DOORS

A. Access doors in ducts and equipment requiring access to dampers and controllers will be furnished and installed under Division 15.

B. Where mechanical items requiring access are located above ceilings, access doors shall be furnished under this Division and installed under Division 8.

C. Access doors are not required in lay-in ceilings.

D. Mechanical items requiring access are located above lay-in ceilings, provide colored marker on room side of ceiling tile directly below mechanical item. Provide different color marker for each type of mechanical item, such as valves, dampers, controller, etc.

3.9 PIPING AND EQUIPMENT IDENTIFICATION

A. All piping insulated and unfinished, installed under this Division shall be identified where available for servicing and maintenance, including but not necessarily limited to; storage rooms, truss spaces, above removable ceilings, and where concealed behind access doors in ceilings and similar spaces. Identification shall be by means of snap on tags, showing alphabetical and color codes.

B. Identify the service and direction of flow in all piping systems at intervals of 10 feet or closer if required for clarity in congested areas, and at intervals of 40 feet or less on long open runs. Requirements for lettering shall conform to ANSI A13.1.

C. Seaton Setmark snap on are **THE ONLY** labels that are acceptable. **Stick on or self adhesive are not acceptable.**

Service	Background	Lettering	Other
Domestic Cold Water	Green	White	Arrow in direction of flow
Domestic Hot Water	Green	White	Arrow in direction of flow
Domestic Hot Water Return	Green	White	Arrow in direction of flow
Natural Gas	Yellow	Black	Pressure Indicated in psi where 2 psi or greater
Compressed Air	Blue	White	-
Storm	Green	White	-
Non-Potable Water	Purple	White	

Also see 15070/3.07.

D. All major items of equipment such as water heaters, fans, RTU’s etc. shall be permanently marked in an approved manner that identifies the piece of equipment and the area it serves. Lettering identifying the piece of equipment shall be a minimum 2" high. Magic marker is not acceptable.

E. Alphabetical code used to identify the various piping systems shall be in accordance with legend shown on the drawings.

F. Names used to identify major items of equipment shall be in accordance with names shown on the drawings.

3.10 MISCELLANEOUS IRON AND STEEL

A. Furnish and install necessary steel as required for pipe and equipment supports.

B. Steel members shall be generally cut, assembled, welded, cleaned and dried and given a prime coat of rust inhibiting paint on all surfaces.

C. Secure to building construction in an approved manner.

3.11 WELDING

A. In addition to welding procedures and qualifications specified elsewhere in this Division, all welders shall be qualified for the type welding involved in accordance with the procedures of the American Welding Society (AWS) or ASME Code and applicable state labor regulations. The Contractor shall provide fire extinguishing equipment and properly trained personnel in the use of the fire extinguishing equipment in the area of all welding. Fire extinguishing equipment shall be suitable for use on all materials within the welding area. The Contractor shall follow the fire prevention procedures listed in NFPA 51B Standard for Fire Prevention in Use of Cutting and Welding Processes.

3.12 PLATES AND ESCUTCHEONS

A. All exposed pipes, bare and insulated, that pass through floors, finished walls and ceilings of finished spaces shall be fitted with floor, wall and ceiling plates.

B. Plates and escutcheons shall not be installed in unfinished spaces such as: storage rooms, truss spaces and utility spaces.

C. Plates and escutcheons shall be sized to fit the bare pipe or insulation in a snug and neat manner. They shall be of sufficient size to cover sleeved openings for the pipes and of sufficient depth to cover sleeves projecting above the floors.

3.13 DISPOSAL OF WASTE MATERIALS

A. All materials excess to the requirements of this Division 15-Mechanical shall be removed from the project premises and site by the Contractor.

3.14 CUTTING AND PATCHING

A. All cutting and patching incidental to and required for the proper installation of the work of this Division shall be performed by the General Contractor and shall not be included in the work of this Division.

B. All work of this Division shall be completely and fully coordinated with the work of all other Divisions and trades including all phases of construction in order to minimize the amount of cutting and patching.

3.15 ITEMS TO BE INSTALLED ONLY

A. Duct mounted smoke detectors for RTU’s shall be furnished and wired by Division 16 and installed under this division.

B. Discharge temperature sensor shipped loose in control compartment of RTU's that are 100% outside air and have fresh air tempering (FAT): Mechanical contractor shall install the sensors in the supply duct approximately 36" below the roof deck. See detail on the drawings.

C. Mechanical contractor shall be responsible for connecting and/or installing any wiring harnesses that are shipped loose or partially installed in Lennox rooftop units. This includes motor operated outside air dampers, in particular, for units that are 100% outside air. It also includes the wiring harness for the interlock of the energy recovery ventilators (ERV) which ensure that any time the RTU fan is running, the ERV fans will also be running.

END OF SECTION 22 50 20

SECTION 22 50 70

PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTAL DATA

A. Shop drawings and operational data shall be submitted on the following items:

1. Backflow preventers.
2. Cleanouts.
3. Dielectric couplings.
4. Hangers and supports.
5. Valves.
6. Plumbing fixtures
7. Type of pipe for each service
8. Water Heaters.

1.2 CONNECTIONS TO ALL EQUIPMENT

A. The Contractor shall make plumbing connections to all equipment shown on the drawings and requiring plumbing connections whether such equipment is furnished under another section of the work, on this section of the work, or specified as Owner furnished. The Contractor shall install all water pipe, drainage pipe, and equipment hangers to match the equipment roughing.

1.3 TESTING

A. Concealed work to remain uncovered until required tests have been completed. If necessary, test on portions of the work may be concealed after being inspected and defects eliminated. Repair defects that are discovered as a result of inspection or test with new materials. Caulking of screwed joints, cracks or holes or plugging leaks will not be accepted. Repeat test after defects have been eliminated.

B. All soil, waste, vent and storm water piping shall be tested before fixtures are installed by capping or plugging the openings, filling the entire system with water and allowing it to stand thus filled for 30 minutes with loss of water. Every piping system or portion of a system being tested shall be provided with at least one pipe column extending not less than 10 (ten) feet above the piping being tested so that all joints and pipe tested shall have been submitted to a test of not less than a 10 (ten) foot head of water.

C. All potable water pipe shall be tested before fixtures and faucets or low pressure equipment are connected and before connecting to existing piping systems, by filling the system with water, and applying a hydrostatic pressure of 150 lbs. per square inch for a period of 30 minutes without leaks or loss of pressure.

D. Potable water system shall be disinfected per Federal Specification BB-C-120. Subsequent water samples must be sent to the local health department for testing. Local health department approval must be obtained before system is put into service.

E. The Contractor shall notify the Owner not less than 24 hours prior to each test.

F. Pressure test all compressed air pipe exterior to the building and below grade prior to cover up.

1.4 EXISTING UTILITIES

A. The locations, sizes and elevations of existing utilities as shown on the plans are based on information available during design. Before commencing with the work, the Contractor shall verify the actual condition and locations of said utilities and shall notify the Architect of any discrepancies. No work shall thereafter be performed until the Contractor has received authorization from the Architect.

PART 2 - PRODUCTS

2.1 STANDARDS FOR PLUMBING MATERIALS

A. Plumbing materials specified under Division 15 of these specifications shall comply with the applicable standards required by the materials section of the referenced plumbing code. See Mechanical General Requirements.

2.2 COPPER PIPE

A. Water pipe buried under building: Copper Tubing ASTM B88, Type L, annealed with wrought copper fittings and Grade 95TA solder joints. Pro Press fittings are not acceptable.

B. Water pipe above grade and HVAC condensate: Copper Tubing ASTM B88, Type L, hard drawn, with cast brass or wrought copper fittings and Grade 95TA solder joints. Propress fittings are acceptable for domestic water and HVAC condensate pipe only.

C. Sanitary waste & vent above slab: ASTM B75 or B-88 DWV with ASME B16.23 cast bronze or ASME B16.29 wrought copper fittings. Joints ASTM B32 solder grade 50B.

D. As an alternate to wrapped & coated black steel, type K seamless copper tubing may be used below grade for compressed air between buildings. Provide dielectric union at both ends of the pipe run where black steel connects to the copper.

E. Lead-free solder shall be comparable to the following:

1. Harris "Bridget".
2. Harris "Stay-Safe 50".
3. Silvabrite 100.

2.3 PVC

A. PVC Schedule 40 ASTM D2665 with ASTM D2665 fittings, solvent weld joints with ASTM D2564 solvent cement. All PVC pipe shall be solid core.

B. PVC may not be used for storm sewer and sanitary waste and vent above slab, except in the car wash building and the entry vestibules in the showroom building. PVC is also acceptable for pipe above and below slab in the Auction Building.

C. PVC may be used for sanitary waste and vent below grade, and storm sewer below grade.

2.4 CAST IRON SOIL PIPE

A. Coated cast iron soil pipe conforming to ASTM A74 shall be service weight hub and spigot pattern utilizing service weight hub and spigot fittings and shall be used on the following services. Joints shall be secured with neoprene compression gaskets.

1. Underground soil, waste & vent piping.
2. Underground storm sewer

B. Coated cast iron soil pipe shall be service weight no-hub pattern ASTM CISPI 301utilizing service weight no-hub pattern fittings and shall be used on the following service. Joints shall be secured with neoprene compression gaskets and stainless steel couplings with stainless steel bolts and nuts.

1. Above ground soil, waste and vent piping and interior rain leaders.
2. All above ground storm water, soil and waste piping joints shall be "Husky" or “Clamp-All" stainless steel couplings.

2.5 STEEL PIPE

A. ASTM A-53 or A106, Schedule 40, black steel pipe with 150 lb. malleable iron screwed fittings shall be used on the following services:

1. Above ground natural gas piping
2. Compressed air piping

Note: Galvanized steel is not acceptable for compressed air or natural gas.

ProPressG and Viega MegaPressG fittings are acceptable for natural gas piping up thru 3". Do not paint exterior fittings.

B. ASTM A53 or A106 Schedule 40 black steel with forged steel welding fittings with AWWA C105 polyethylene jacket or double layer half lapped 10 mil polyethylene tape. Protective pipe coating to be factory applied only. Joints to be welded and coated.

1. Below grade compressed air piping exterior to the building.

C. Fittings for pipe 1-1/2" and smaller in concealed locations shall be Schedule 40 forged steel socket welding fittings with welded joints. Black 150 pound malleable iron screwed type fittings may be used in exposed locations.

D. Fittings for pipe 3" and larger shall be black standard weight seamless steel welding fittings with welded joints.

E. Gas pipe shall not be installed below floor slabs.

F. Exterior gas and compressed air pipe above grade shall be coated with enamel rust prohibitive paint.

2.6 POLYETHYLENE PIPE (PE PIPE)

A. Gas pipe only, downstream of the gas meter, below grade and exterior to the building shall be ASTM D2513 PE. Pipe shall be marked “GAS” and “ASTM D2513”. Provide anodeless riser where terminated above grade, where required. Joints shall be heat fusion in accordance with manufacturers instructions. PE pipe is not acceptable for compressed air.

B. A yellow insulated copper tracer wire shall be installed along the entire length of plastic gas pipe below grade. The tracer wire shall terminate above grade at each end of the pipe. The tracer wire size shall be not less than 18 AWG and the insulation shall be suitable for direct burial.

C. Minimum bury depth is 24".

2.7 VALVES

A. Valves shall be rated for not less than 125 PSIG steam working pressure at 400 degrees Fahrenheit.

B. All gate valves shall be provided with means for packing while open and under pressure. Valves 2" and smaller shall be all bronze. Valves 2" and larger shall be iron body bronze mounted. Ball valves shall be full port type.

C. Ball valves shall be used for potable water piping 2" and smaller inside the building and all compressed air pipe.

D. Gate valves shall be used for potable water piping 2-1/2" and larger inside the building.

		Jenkins	Milwaukee	Nibco-Scott
E.	Gate valve 2" and larger	326	F2882	F-619
	Check valve 2" and smaller	1222	1509	S-413-Y
	Check valve 2.5" and larger	624	F2974	F-918-B
F.	Ball valves 1.5" and smaller	32A	BB1-100	S-585 or T585

Provide extended tee handles for all ball valves to clear insulation.

G. Plug Valves:

1. Gas Service: 1-1/2" and up: Cast iron body, flanged connection cast iron lever, bronze plug, and bronze bearings.

2. Based on DeZurik Series 400, BUNA stem seal and RS51 plug seal.

3. Acceptable manufacturers: Hammond, Rockwell

2.8 HANGERS AND SUPPORTS - GENERAL

A. A minimum of one pipe thread shall project through bottom end of hanger insert after hanger rod is installed. Hanger rods full size of hanger connection shall be used with all hangers.

B. Hangers rods shall be black steel and shall be attached to the building framing components. **ATTACHMENTS TO METAL DECK IS NOT ACCEPTABLE**. Provide beam clamps, brackets, through bolts, inserts, hanger rod support members and accessories for hanger installation. Unless otherwise noted, where piping is supported adjacent to walls or supported from walls, brackets shall be used and these brackets shall be anchored to the wall, from which the hanger rods shall suspend to support the pipe hangers.

C. Attach hanger rod supports to the vertical surfaces of concrete building members. Do not attach supports to horizontal concrete surfaces.

D. Hangers shall be sized to include insulation where the pipe is insulated.

E. All water piping inside the building wall at run out to plumbing fixtures shall be secured to rigid soil, waste and vent piping.

F. All natural gas pipe, and all waste & vent pipe and rain leaders larger than 3" shall have hanger length not exceeding 12". Pipe with hangers longer than 12" shall be longitudinally and laterally seismically braced per 2016 CBC.

2.9 HANGERS AND SUPPORTS - COPPER PIPE

A. Hangers for horizontal copper pipe shall be copper plated steel band with malleable iron nut as follows:

1. Michigan Hanger Co. No. 100.
2. Elcen fig. 89.
3. Grinnell fig. 70.

B. Hangers for vertical copper pipe not concealed in a building wall shall be copper plated, malleable iron split ring with wall plate and rod (maximum rod length 2.5").

1. Michigan Hanger Co. No. 456.
2. Elcen fig. 398 ring with flange.
3. Grinnell fig. CT-130R.

C. Water pipe inside pipe spaces or inside stud walls shall be supported from steel support members between studs or walls. Clamp pipe to steel support with "C" clamp. Wrap copper tube lines with dielectric tape to isolate copper from steel support member and "C" clamp. Unistrut Corporation P-2600 Uni-Cushion Rand pipe clamp will be acceptable.

D. Trapeze hangers are acceptable for multiple pipe runs. Where insulated pipe is installed on top of trapeze, insulation shall be hard self supporting type for a distance of 12" each side of trapeze. Provide 12" long 16 gauge galvanized steel saddle for bottom half of insulation circumference between insulation and trapeze. Uninsulated copper lines installed on top of trapeze shall be wrapped with Unistrut Uni-Cushion elastomer material and P-2600 clamp to isolate copper from steel trapeze and pipe clamp.

2.10 HANGERS AND SUPPORTS - PVC, CAST IRON AND STEEL PIPE

A. Hangers for horizontal cast iron pipe shall be clevis type hanger as follows:

1. Michigan Hanger Co. Fig. 400.
2. Elcen fig. 12.
3. Grinnell fig. 260.

B. Hangers for vertical cast iron pipe not concealed in a building wall shall be an off-set pipe clamp as follows:

1. Michigan Hanger Co. No. 700.
2. Elcen fig. 44.
3. Grinnell No. 103.

C. Cast iron soil, waste and vent piping shall be supported within 18" of each joint and at intervals not to exceed 5 feet on horizontal pipe.

D. Risers shall be supported at their bases and at floor intervals. Support clamps on risers shall be installed above the floor sleeve and shall have steel supports from clamps to floor.

2.11 HANGER SPACING

A. Above ground, horizontal pipe:

1. Copper or steel pipe shall be supported within 18" of each change of direction and at maximum intervals as listed in paragraph 3. below.

2. Cast iron pipe shall be supported at five (5) foot maximum intervals except that where ten-foot lengths of cast iron soil pipe are used, ten-foot (10-0") maximum intervals between supports are acceptable. All PVC pipe hangers shall be a maximum of 6'-0" on center.

3.

Copper Pipe	Steel Pipe	
2" pipe	5 feet	5 feet
3/4"	5	7
1"	6	7
1 1/4"	6	7
1 2"	6	9
2"	8	10
2 2"	9	11
3"	10	12
4" and larger	10	12

B. Above ground, vertical pipe:

1. Vertical copper pipe shall be supported at each floor level or 16'-0" on centers whichever is less. Additional pipe supports shall be provided for copper pipes 1-1/4 inch and smaller at intervals not to exceed 4'-0".

2. Vertical cast iron soil pipe shall be supported at their bases on concrete or brick piers and at each floor level or 15'-0" on centers whichever is less.

3. Vertical steel pipe shall be supported at every other floor level or 30'-0" on centers whichever is less.

4. Support clamps on vertical pipe at a floor level shall be installed above the top of the floor level.

2.12 FLOOR, WALL AND CEILING PLATES

A. Floor, wall and ceiling plates shall be installed on all uninsulated, exposed pipes where they pass through the floors, walls or ceilings. Plates shall have chromium finish. Plates shall be as follows:

1. Beaton and Corbin.
2. Ritter.

B. Omit escutcheons on glass pipe and pack annular space around pipe and caulk as hereinafter specified for sleeves.

2.13 UNIONS

A. Unions shall be provided in all piping connections to equipment to permit removal and replacement.

B. Flanged equipment connection constitutes union connection.

C. Unions on drainage pipes on fixture side of traps may be slip or flanged joints with soft rubber, leather or lead gaskets. All bathtub waste and overflow fittings shall gave sweat solder joints.

D. Unions in steel pipe shall be malleable iron unions with brass inserts, where pipe is 2" and smaller. Unions on lines 2 1/2" and larger to be flanged unions with ring gaskets.

E. Unions in copper tubing 1/2" and larger shall be copper flanged unions with ring gaskets. Unions in copper tubing 2" through 1 1/4" size shall be cast bronze or wrought copper screwed unions with solder connections.

F. Provide dielectric insulating unions and flanges where noted on drawings and between dissimilar metals. Dielectric union components shall be of temperature rating to match service temperature in piping system.

2.14 DIELECTRIC COUPLINGS

A. Provide dielectric couplings between copper pipe and steel or iron pipe.

2.15 CLEANOUTS - DWV PIPE

A. Cleanouts shall be accessible.

B. Cleanouts exposed in NO-HUB pipe shall be NO-HUB cast iron blind cleanout plug. Cleanouts for exposed pipe shall be Smith 4420 with raised head plug.

C. Cleanouts in walls shall be cast iron cleanout tee with bronze center tapped plug and round stainless access cover comparable to Smith 4532-Y.

D. Cleanouts flush with finished floors shall be adjustable type with round nickel bronze scoriated top.

1. Cleanouts in slab-on-grade shall be Smith 4028.

2. Cleanouts in tile floor shall have square top.

E. Cleanouts installed outdoors shall be Smith 4248. Exterior cleanoust shall be set in concrete. See civil drawings for detail.

2.16 BACKFLOW PREVENTERS

A. Backflow preventers shall be in-line, reduced pressure type equal to Watts 909QT(2" and smaller) and Watts 009QT (2-1/2" and larger) series and ASSE Standard 1013 labeled. Pipe drain full size to nearest floor drain and terminate with 2 inch air gap.

B. Provide air gap fitting, ball valve and bronze strainer in inlet pipe to each backflow preventer.

C. Provide backflow preventers where called for on the drawings and at every fixture or equipment connection not having a 2" air gap or integral vacuum breaker.

D. Upon completion of installation, backflow preventers shall be inspected and certified by a licensed inspector and submit copies of certification through Architect for review.

E. Acceptable manufacturers: Watts, Hersey and Febco.

2.17 PLUMBING FIXTURES

A. Fixtures shall be as indicated on the drawings.

B. Fixtures acceptable manufacturers are Kohler, American Standard & Eljer.

C. Acceptable sink manufacturers are Elkay, Just, Sterling or Dayton.

D. Fixtures shall be furnished with all required trim, valves, carriers, escutcheon plates shutoff valves, etc.

2.18 WATER HEATER (ELECTRIC TANK TYPE)

A. The heater shall be a glass-lined. Heater shall be listed with Underwriter's Laboratories and approved by National Sanitation Foundation. All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 1600 F. Tank shall be cathodically protected with adequate extruded magnesium rod.

B. The entire vessel is to be enclosed in a round steel enclosure with baked enamel finish.

C. Control compartment to be hinged and shall house 120 volt control circuit transformer, transformer fusing, magnetic contractor(s)immersion style operating thermostat(s), high limit thermostat(s), element fusing per N.E.C., and commercial grade sheathed manually in the event the temperature reaches 190 F. Foam insulation shall exceed latest requirements of ASHRAE 90.1-2013 for heat loss efficiency. Heater shall included ASME T &P relief valve and drain valve.

D. Acceptable Manufacturers are A.O. Smith, Rheem and State.

PART 3 - EXECUTION

3.1 GENERAL FOR PIPE INSTALLATION

A. Horizontal soil or waste piping and rainwater piping inside the building and to a point 5 feet beyond the building shall be installed with a minimum downward slope of 1/4" per 1 foot for piping 3" and smaller and 1/8" per 1 foot for piping 4" and larger. Verify existing tie-in location elevations before installing new pipes.

B. Vent and branch vent pipes shall be so graded and connected as to drip back to the soil or waste pipe by gravity.

C. Changes in direction in drainage piping shall be made by the appropriate use of 45 degree wyes, long or short sweep quarter bends, sixth, eighth or sixteenth bends, or be a combination of these or equivalent fittings. Single and double sanitary tees and quarter bends may be used to drainage lines only where the direction of flow is from the horizontal to the vertical.

D. Unions shall be used in the erection of screwed and/or sweat soldered piping connections to equipment.

E. Reducing fittings shall be used in making reductions in size of pipe. Reducing flanges and bushing shall not be used.

F. Allowance shall be made for contraction and expansion in all piping.

G. Underground pipe shall be installed with support on trench bottom for full length of pipe. Excavate for bells and fittings.

H. Connections between building stubs and piping systems specified under Utilities Division of the specifications shall be made under this Section of the work.

I. Site specific frost line shall establish the minimum bury depth for domestic water pipe, and suction, drain and sparger pipe at the car wash reclaim tank.

3.2 COPPER PIPE SOLDER JOINTS

A. Copper pipe solder joints shall be assembled according to the following steps.

1. Cut ends of pipe square so pipe can bottom into fitting without gaps. Ream inside of pipe to remove burrs and to return pipe to full inside diameter.

2. Clean end of pipe and inside of fitting solder cup using fine crocus cloth. Do not touch cleaned pipe of fitting with hand or glove.

3. Brush non-corrosive flux on pipe and inside of fitting solder cup.

4. Assemble with minimum rotation and wipe off excess flux. Heat uniformly both fitting and pipe until solder begins to melt.

5. Feed solder all around fitting until fine line appears between fitting and pipe. Remove heat and continue feeding solder until solder becomes solid.

3.3 CAST IRON HUB AND SPIGOT JOINTS

A. Cast iron hub and spigot joints shall be assembled according to the following steps.

1. Insert gasket into cleaned hub end of pipe.

2. Apply lubricant to spigot end of pipe and to surface of gasket.

3. Join pipe using jack type pipe joining tool to force spigot into bell until spigot touches bottom of bell, displacing body of gasket and forming compression seal between inside of bell and outside of spigot.

B. Caulked joints in cast iron drainage and vent pipe and fittings shall be made using lead and white oakum.

3.04 CAST IRON "NO-HUB" JOINTS

A. Cast iron "no hub" joints shall be assembled according to the following steps:

1. Push the two spigot ends of cast iron pipe into the neoprene sleeve until both spigots seat against the separator ring.

2. Position the stainless steel shield over the neoprene sleeve and alternately tighten the clamps. Use a torque wrench to torque the clamps to the manufacturer's torque specification for final tightening.

3.5 TRENCHING AND BACKFILLING

A. Where rock is encountered, trenches for underground piping shall be excavated to a grade 3" below the lowermost part of the pipe and backfilled with sand or gravel to pipe grade to provide uniform bearing.

B. After the piping has been installed, tested, and approved, the trenches shall be backfilled with sand or gravel to the pipe centerline. Hand backfill with earth and tamp to 12" above the pipe so as not to damage pipe. Remainder of earth backfill shall be done in 6 layers and mechanically tamped to achieve a minimum 95% compaction on a standard proctor.

C. Trenches 4'-0" and deeper shall be excavated with the sides sloped at a 45 degree angle beginning 1 foot above the trench bottom to prevent cave-ins.

3.6 CLEANING AND PAINTING

A. Upon completion of the plumbing work, all piping, insulation and equipment shall be cleaned of any oil, grease or dirt leaving surfaces ready for painting.

B. Finished surfaces on equipment shall be left with finish undamaged. Where surfaces have been damaged, they shall be refinished to their original state using the manufacturer's finish material.

3.7 PIPE IDENTIFICATION

A. Pipe shall be identified with contents for natural gas, domestic cold water, domestic hot water, storm sewer, compressed air, sanitary vent. Where pressure is 2 psi or higher, indicate pressure in psi on gas pipe.

B. Pipe markers shall be equal to Seton Setmark. See 22 50 20/3.09 for additional information.

3.8 ABOVE GRADE PIPING

A. All piping installed above grade shall be installed parallel to building walls unless specifically shown otherwise on the plans and shall be installed with a uniform slope or grade to eliminate undrainable low points.

3.9 HANDICAPPED FIXTURE PIPE SHIELDS

A. Provide safety covers on the drain, p-trap and hot water supply and stop valve under each handicapped lavatory or sink.

B. Safety covers shall comply with the Uniform Federal Accessibility Standards 4.19.4 GSA and shall be Handy Lav Guard by Truebro or comparable. All shields shall be white in color.

3.10 SERVICE CONNECTIONS:

A. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. If required by local authority, provide new backflow preventer. Provide sleeve in wall for service main and supported at wall, calked and made watertight. Provide sleeve around service main to 6 inch above floor and 6 inches minimum below grade.

C. Provide gas meter and regulators. Gas service distribution piping to have initial minimum pressure indicated on the gas summary table shown on the plumbing drawings. Co-ordinate gas requirements with the gas company.

END OF SECTION 22 50 70

SECTION 22 52 50

MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation, jackets and accessories.

B. Ductwork insulation, jackets, and lining.

1.2 SUBMITTALS

A. Product Data: Provide product description, list of materials and thickness for each service or equipment scheduled, locations, and manufacturer's installation instructions.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

A. Manufacturers:

1. Owens Corning SSL - II
2. Rubatex R - 180 - FS
3. Ceel Tite 320 PVC Jacket

B. Glass Fiber: ASTM C547; rigid molded, noncombustible.

1. 'K' Value : 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees
3. Vapor Barrier Jacket: White kraft paper reinforced with glass fiber yarn and bonded to aluminized film, secure with self sealing longitudinal laps and butt strips or with outward clinch expanding staples and vapor barrier mastic.

C. Jackets

1. PVC Plastic: One piece molded type fitting covers and sheet material, off white color.
   a) Thickness: 15 mil.
   b) Connections: Brush on welding adhesive. Pressure sensitive color matching vinyl tape.

2.2 DUCTWORK INSULATION

A. Manufacturers:

1. Owens Corning
2. Knauf

3. Manville

B. Flexible Glass Fiber: ASTM C518; flexible, non-combustible blanket.

1. R=5.6 installed, 2" thick.
2. Density: .75 lb/cu ft.
3. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, secured with pressure sensitive tape.

C. Duct Liner: ASTM C553; flexible, noncombustible blanket.

1. 'K' Value : ASTM C518, 0.26 at 75 degrees F, R=3.8
2. Density: 1.5 lb/cu ft.
3. Adhesive: Waterproof fire retardant type.
4. Liner Fasteners: Galvanized steel, self adhesive pad or welded with press on head.

D. Insulated Flexible Duct

1. R=4.2 minimum
2. Bidirectional reinforced metalized vapor barrier.
3. Equal to Thermaflex MKE

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify that duct work has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Continue insulation vapor barrier through penetrations.

C. Piping Insulation

1. Locate insulation and cover seams in least visible locations.
2. Neatly finish insulation at supports, protrusions, and interruptions.
3. Provide pipe insulation shield at hangers.
4. For insulated pipes conveying fluids above ambient temperature, provide standard jackets. Bevel and seal ends of insulation at equipment, flanges, and unions.
5. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet above finished floor, finish with PVC jacket and fitting covers.
6. For exterior applications, provide vapor barrier jacket. Insulate pipe, fittings, joints, and valves and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum steel jacket with seams located on bottom side of horizontal piping.
7. Insulation on pipe shall be continuous through all hangers and supports.

D. Duct Liner:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards

for spacing.

3. Seal liner surface penetrations with adhesive.
4. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.03 PIPING INSULATION SCHEDULE

	PIPE SIZE	THICKNESS
A. Glass Fiber Insulation		
Domestic hot water & hot water return	ALL	1"
Domestic cold water	ALL	½"

Note: Water pipe in the wet bay shall have pvc jacket over the insulation with all joints sealed water tight to a point 12 feet above the finished floor.

Rain Leaders	ALL	1/2" (minimum)
Primary and Secondary overhead horizontal pipe Insulation thickness 1” where ½” not available for pipe size		

Note: Domestic water pipe and rain leader pipe in the Car Wash Building is not required to be insulated.

B. Elastomeric Cellular Foam		
Cold Condensate Interior	ALL	½"

3.04 DUCTWORK INSULATION SCHEDULE THICKNESS

A. Supply Ducts above a ceiling 2" R=5.6 min

Supply ducts that are lined are also required to be wrapped where installed above a ceiling.

Round Return Duct 2"

B. Duct Liner 1"

1. All rectangular return duct.

2. Supply duct through first elbow or split

3. All rectangular supply duct, plenums and register takeoffs where exposed. **This includes Parts, FQC and Service.**

END OF SECTION 22 52 50

SECTION 22 54 05

OIL SEPARATOR/RECLAIM TANK

PART 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. The Contractor shall conform to the General Provisions.

B. Section 22 50 10: Mechanical General Provisions.

1.2 WORK INCLUDED

A. The work of this Section shall include the furnishing of all labor and materials for the complete installation of the oil separator and reclaim tank.

1.3 SHOP DRAWINGS

A. Submit shop drawings in accordance with Section 2250 10: Mechanical General Provisions.

B. Submittals shall include locations for all openings in the tank walls for float sensor, sparger, suction, car wash drain for pump back wash, vents, etc.

PART 2 - PRODUCTS

2.1 TANKS

A. Reclaim tank and oil separator 2,000 gallons and smaller shall be monolithic precast concrete, with all joints above the water line. Maximum invert elevation change thru the structures is 2".

B. See details on drawing P4.1 for additional information.

2.2 INTERIOR AND EXTERIOR COATINGS

A. The interior of the oil separator shall be coated with an epoxy-resin suitable for continuous submersion and resistant to gasoline, solvents and oils. The coating shall be equal to Concrete Sealants Inc ConSeal CS-90.

B. The exterior of the oil separator and the reclaim tanks shall have a water proof coating suitable for direct burial. The coating shall be a water based acrylic equal to Concrete Sealants Inc ConSeal CS-55.

C. Coatings may be field applied. Manufacturer’s application instructions shall be rigidly adhered to.

D. Submit coatings for review with the oil separator submittals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Oil Separator/Reclaim Tank:

1. Separator and reclaim tanks shall be constructed and placed in accordance with local codes.

2. Manhole covers shall be H20 load rated.

END OF SECTION 225405

SECTION 22 54 15

COMPRESSED AIR SYSTEM

PART 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. The contractor shall conform to the Mechanical General Conditions.

B. Section 22 50 10: Mechanical General Provisions.

1.2 WORK INCLUDED

A. The work of this Section shall include all labor and materials for the complete installation of a compressed air system to serve the buildings, including all valves, piping, controls, outlets, hose reels compressors, refrigerated air dryers, filters and receiver tank required for the proper installation and operation of the entire compressed air system as specified and shown on the drawings.

B. Contractor to verify location and accessibility of the building for setting compressors in place.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. The air compressor equipment shall be a complete factory tested package requiring, single electrical connection points, and single piping connections.

B. The air compressors and equipment shall be as sized and scheduled on the drawings.

C. Carmax Auto Superstore LLC has entered into an agreement with Kaeser for all air compressors in this facility. The air compressors shall be purchased directly from Kaeser by Carmax Auto Superstore LLC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install compressors and equipment in location shown. Arrange equipment and piping in the area to allow access for service.

B. The contractor shall certify that equipment has been installed in compliance with manufacturers instructions.

C. The compressor manufacturer shall conduct factory tests to verify that actual performance is within 5% of nominal rating. Certified test data shall be furnished without charge upon request. The compressor manufacturer shall provide start-up supervision by a qualified technical representative. The compressor manufacturer shall warrant all components and

their interconnections, as supplied, for a period of two years from their date of shipment.

D. **The general contractor shall ensure that for Service Building, the air compressor installer has a copy of drawings P3.0 7 P4.0, and in particular Detail 1/P4.0 Compressor Room Part Plan 1/P3.0. Similar for Auction Building.**

END OF SECTION 22 54 15

SECTION 22 54 30

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Floor drains.

B. Hydrants.

C. Trap Primers

D. Water hammer arresters

E. Roof drains

F. Water pressure reducing valve

G. Trench drains

H. Floor Sinks

I. Gas Pressure Regulators

1.2 RELATED SECTIONS

A. Section 15070 - Plumbing Piping.

1.3 REFERENCES

A. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

B. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

C. ANSI A112.21.1 - Floor Drains.

1.4 SUBMITTALS

A. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations of below slab waste pipe and furnish as built drawing as part of Closeout Documents..

1.6 OPERATION AND MAINTENANCE DATA

A. Submit as part of Closeout Documents..

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site. See architectural specofications.

B. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 – PRODUCTS

2.1 FLOOR DRAINS: FINISHED AREAS AND ALL TOILETS

A. Manufacturers:

1. Acceptable manufacturers

a. Jay R. Smith 2005-A
b. Josam 30000-A
c. Zurn Z-415

B. Lacquered galvanized cast iron body with flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer and trap primer connection. Strainer to be square where installed in a tile floor.

2.2 FLOOR DRAINS: CONCRETE FLOORS UNFINISHED AREAS

A. Manufacturers:

1. Acceptable manufacturers

a. Jay R. Smith 2230-B
b. Josam 32220
c. Zurn Z504Y

B. Cast iron body with flashing collar, round cast iron grate, slotted sediment bucket and trap primer connection.

2.3 HYDRANTS/ HOSE BIBS

A. Manufacturers:

1. Acceptable manufacturers

a. Woodford
b. Jay R. Smith
c. Josam

B. Hydrants shall be as scheduled on the drawings.

2.4 TRAP PRIMERS

A. Trap primers shall be as follows:

Misc. Floor Drains: Precision Plumbing Products PR500 W/ multiple outlets where required.

Toilet Rooms: water closet flush valves shall be furnished with trap primer fitting equal to Sloan VBF.

B. Trap Primers shall be accessible where installed in a wall or case. Furnish Jay R. Smith 4434 10"x10" minimum access panel. Access panels may not be installed in tile walls.

C. Sureseal type trap guards are preferred if locally approved.

2.5 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Hydrotrol
2. Josam 75000
3. Precision Plumbing Products
4. Watts Shoktrol

B. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure; equal to Hydrotrol by Jay R. Smith.

C. Where installed in wall or chase, furnish access panel equal to Jay R. Smith 4434, 8"x8" minimum. Access panels may not be installed in tile walls. Install arrestors above ceiling.

D. Water hammer arresters shall be sized based on fixture units **NOT THE SIZE OF THE PIPE IN WHICH THE ARRESTOR IS INSTALLED.**

2.6 PRIMARY ROOF DRAINS:

A. Manufacturers:
1. Jay R. Smith 1015 with deck clamp and adjustable extension
2. Zurn Z-100 with deck clamp and adjustable extension
3. Josam 21500 with deck clamp and adjustable extension

Showroom Vestibule roof drains to have horizontal discharge:

1. Jay R. Smith 1020 with deck clamp and adjustable extension
2. Zurn Z100-90 with deck clamp and adjustable extension
3. Josam 21500-66 with deck clamp and adjustable extension

B. Lacquered cast iron body with sump, removable polyethylene dome strainer, membrane flange and membrane clamp with integral gravel stop with adjustable under deck clamp, roof sump receiver, waterproofing flange.

C. Trim all excess roofing membrane inside the drain to fully expose the drain sump.

2.7 SECONDARY ROOF DRAINS:

A. Manufacturers:
1. Jay R. Smith 1070 with under deck clamp and adjustable extension
2. Zurn Z-100-W2 with deck clamp and adjustable extension
3. Josam 21500-AE-16 with extension and deck clamp

B. Lacquered cast iron body with sump, removable polyethylene dome strainer, membrane flange and membrane clamp with integral gravel stop with adjustable under

deck clamp, roof sump receiver, waterproofing flange, PVC standpipe cut to approximately 2".

C. Where external dam type of drain is used, trim all excess roofing membrane inside the drain to fully expose the drain sump

2.8 PRESSURE REDUCING VALVE:

A. Manufacturers:

1. Watts 223
2. Febco PRV-2
3. Wilkins Model 500

B. Bronze body construction, enlarged diaphragm, and serviceable in line, ASSE 1003.

2.9 TRENCH DRAINS / CATCH BASINS

A. Trench drain system shall be Poly Drain System by ABT, Inc. complete with precast polymer concrete channel sections that are interlocking one with the other. System shall be complete with all anchors, catch basins, accessories, etc. as required for a complete installation. Provide ductile iron grate #502 with removable lockdowns #811B. System shall be designed with minimum depth of channel sections as required to accommodate invert elevations indicated on plumbing drawings.

B. Catch Basins shall be Model No. 610 (19.6"L x 12.8"W x 32"D) except in car wash and wet bay (at pressure washer) use Model No. 611 (19.6"L x 12.8"W x 48"D) Grates to be black polymer coated. All catch basins to have stainless steel sediment basket.

C. Acceptable manufacturers for trench drains are ABT (Polydrain) with ACO Klassik Drain with integral cast-in galvanized steel edge rail, series 600 catch basins. Polypropylene trench drains are not acceptable.

D. **Furnish site specific sketch in submittal indicating number of sections, trench drain length, sections with sloped bottom, position of catch basin and relevant inverts.**

2.10 FLOOR SINKS

A. Acid resistant coated floor and indirect waste drains with nickel bronze top.

B. Acceptable manufacturers:

1. Jay R. Smith 3101C w/half grate, 8.5" square strainer & sediment bucket
2. Josam 49300-31 w/half grate, 8" square strainer & sediment bucket
3. Zurn 1900-23 w/half grate, 9" square strainer & sediment bucket

2.11 GAS PRESSURE REGULATORS:

A. Manufacturers:

1. Sensus
2. Maxitrol 325 series

B. Regulator shall have inlet pressure of 5 PSI. and outlet pressure of 7 IN WC unless otherwise noted. Regulators located inside the building may be vent limiting. Where not vent limiting

regulators installed inside the building shall have the relief port piped thru the roof and terminate with 180 degree elbow down approx 8" above the roof.

C. All pieces of gas fired equipment in buildings with supply pressure greater than 7 IN. W.C. require an external regulator with the exception of the CTOF/Paint Booth make up air units. The make up air units have an integral gas pressure regulator good for up to 5 psi entering gas pressure without requiring an external gas pressure regulator.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

END OF SECTION 22 54 30

SECTION 22 54 50

PLUMBING FIXTURES AND TRIM

SECTION 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. The Contractor shall conform to the General Conditions.

B. Section 22 50 10: Mechanical General Provisions.

1.2 WORK INCLUDED

A. The work of this section shall include furnishing all labor and material for complete installation of all plumbing fixtures with fittings, trim, supports and appurtenances as specified herein and shown on the drawings.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 50 10: Mechanical General Provisions.

SECTION 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The manufacturers scheduled on the drawings are those that the specifications and drawings are based on. Equipment by other manufacturers will be considered provided they are equal in every respect to those listed.

2.2 EQUIPMENT

A. See Plumbing drawings for fixture schedule.

SECTION 3 - EXECUTION

3.1 FIXTURES

A. All plumbing fixtures and trim shall be new as manufactured by firms regularly engaged in the manufacture of plumbing fixtures and trim of type, style and configuration required, whose products have been in satisfactory use and similar service.

B. Provide protection of all fixtures during construction from damage. Replace all damaged fixtures as directed by the Architect.

C. Each water supply connection to each fixture and each item of water consuming equipment shall be equipped with an accessible stop valve.

D. All flush valves shall be quiet diaphragm type with integral screwdriver stops, vacuum breakers and have non-hold-open watersaving feature.

E. All wall-hung fixtures shall be supported with floor mounted fixture supports designed and fitted to suit the fixture and building construction.

F. Contractor shall be responsible to coordinate and assemble the proper selection and installation of all necessary sleeves, stiffeners, nailer strips, supports, wall hangers, trap assemblies, supplies, drainage fittings, etc., for all fixtures and trim furnished.

G. All exposed bolt heads on water closets and urinals shall be covered with acorns or covers made from china, stainless steel, or chrome plated brass.

H. All plumbing fixtures and equipment shall be provided with all necessary stops, valves, traps, supplies and appurtenances required, except where specifically provided for by another contract.

I. All handicapped fixtures indicated and shown on the Plumbing and Architectural drawings shall comply with ADA.

J. Insulate hot and cold water supply pipes and waste pipe where exposed under lavatory per handicapped codes with white molded vinyl insulation kit.

K. Caulk all gaps between walls/floors and plumbing fixtures.

END OF SECTION 22 54 50

SECTION 23 55 35

REFRIGERANT PIPING AND SPECIALTIES

SECTION 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Pressure relief valves.
F. Filter-driers.

1.2 RELATED SECTIONS

A. Section 23 52 50 - Mechanical Insulation.
B. Section 23 56 71- Air Cooled Condensing Units.

1.3 REFERENCES

A. ARI 710 - Liquid Line Dryers.

B. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers

C. ARI 750 - Thermostatic Refrigerant Expansion Valves.

D. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

E. ASHRAE 34 - Number Designation of Refrigerants.

F. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

H. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.

I. ASME B31.5 - Refrigeration Piping.

J. ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.

K. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

L. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

M. AWS A5.8 - Brazing Filler Metal.

N. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

0. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASTM B31.5 unless indicated otherwise.

C. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

D. Valves
1. Use service valves on suction and discharge of compressors.
2. Use gage taps at compressor inlet and outlet.

E. Refrigerant Charging Valve: Use in liquid line between receiver shut-off valve and expansion valve.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9.

C. Welders Certification: In accordance with ASME SEC 9.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

D. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

SECTION 2 PRODUCTS

2.1 PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing to 7/8 inch OD: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Brazed

C. Pipe Supports and Anchors:
   1. Conform to ASME B31.5, ASTM F708
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron or carbon steel, adjustable swivel, split ring.
   3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   4. Vertical Support: Steel riser clamp.
   5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   6. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.2 REFRIGERANT

A. Refrigerant: ASHRAE 34;
   1. R-410

2.3 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator and plastic cap; for maximum working pressure of 430 psig, and maximum temperature of 200 degrees F.

2.4 VALVES

A. Service Valves:

   1. Forged brass body with copper stubs, brass caps, removable valve core, flared or solder ends, for maximum pressure of 500 psig.

2.5 FILTER-DRIERS

A. Single piece filter drier with non-replaceable media.

SECTION 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
1. Install in accordance with ASTM B31.5 ASTM F708.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

G. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

H. Fully charge completed system with refrigerant after testing.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings.

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Insulate piping; refer to Section 23 25 00

O. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide replaceable cartridge filter-driers.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 200 psig Test to no leakage.

3.4 SCHEDULES

A. Pipe Hanger Spacing

PIPE SIZE Inches	MAX. HANGER SPACING Feet	HANGER ROD DIAMETER Inches
½ to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8

END OF SECTION 22 55 35

SECTION 23 57 81

PACKAGED AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged air conditioning unit. Unit controls. Package air conditioning units will be furnished by the Owner and installed by the General Contractor. The General Contractor shall be responsible for unloading, storing the units and assembling the curbs. The General contractor shall verify the correctness of material delivery within seven days of delivery on site. The General Contractor shall notify the Owner in writing, of any deficiencies.

1.2 RELATED SECTIONS

A. Flashings and counter flashings.

B. Section 26 61 70 - Motor and Equipment Connections: Installation and wiring of thermostats and other controls components; wiring from unit terminal strip to remote panel.

C. Section 26 61 70 - Motor and Equipment Connections: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ARI 210 - Unitary Air-Conditioning Equipment.

B. 2018 Virginia Energy Code (2018 International Energy Code with Virginia amendments)

C. NFPA 70 - National Electrical Code.

D. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

1.4 SUBMITTALS FOR REVIEW

A. Section 01330 - Submittals

B. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Closeout Procedures/Operation and Maintenance Data: Submittals for project closeout to Owner.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.

B. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.8 WARRANTY

A. Provide a five year warranty to include coverage for refrigeration compressors.

B. Provide labor for all parts warranty related repairs or replacement.

1.9 EXTRA MATERIALS

A. Section 01770 - Closeout Procedure - Operation and Maintenance Data.

B. Provide one additional set of filters for each unit after completion of test and balance report.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lennox is the only acceptable manufacturer. High efficiency L series or Enlight series units only shall be used.

B. Carmax Auto Superstore LLC maintains a national account with Lennox. Units and curbs to be furnished by Lennox. Carmax Auto Superstore LLC will purchase units directly from Lennox. See drawings for additional information.

2.2 AIR CONDITIONING UNITS

A. General: Roof mounted units having gas burner, integral controls for direct connection to the control system, and electric refrigeration.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner or electric heat as scheduled, controls, CORE control option, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan. Selected units to have direct humidity control with hot gas reheat. Selected units to have demand ventilation. See drawings for additional information.

C. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Electrical.

D. Furnish factory roof curb. Curb to accommodate roof pitch by the use of tapered treated wood shims or curb matching the roof slope and shall provide a level mounting surface on

which to mount the unit. The mechanical contractor shall assemble and install the roof curbs which are furnished by Lennox.

2.3 FABRICATION

A. Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels with quick fasteners screwdriver operated flush cam type. Structural members shall be minimum 18 gage, with access doors or removable panels of minimum 20 gage.

B. Insulation: one inch thick neoprene coated glass fiber with edges protected from erosion.

C. Heat Exchangers: Aluminized or stainless steel (Bypass units, RTU's with ERV and 100% outside air units).

D. Supply Fan: Forward curved centrifugal type, resiliently mounted with direct drive or V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted motor or direct drive as indicated.

E. Air Filters: 2" thick glass fiber disposable media in metal frames. MERV 13 minimum.

2.4 BURNER (UNITS WITH GAS HEAT)

A. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot. 100% outside air units to have stainless steel heat exchanger and fresh air tempering. Furnish two stage gas heat when available as an option.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

2.5 ELECTRIC HEAT (UNITS WITH ELECTRIC HEAT)

A. Factory installed electric heat package.

B. Units with electric heat shall have single point electrical connection.

2.6 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.7 COMPRESSOR

A. Provide hermetic scroll compressors, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.

B. Timed off circuit to delay compressor start.

C. Provide step capacity control by cycling compressors.

2.8 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

C. Provide refrigerant pressure switches to cycle condenser fans.

2.9 MIXED AIR CASING

A. Dampers: Global economizer with fan powered exhaust or barometric relief, or two position motor operated damper motor as indicated on the drawings.

2.10 OTHER:

A. Through the bottom utility connection

B. Lennox Core Control System

C. Where energy recovery ventilator (ERV) is attached to a rooftop unit, it shall be supported from the roof with a flashed equipment curb.

D. **Mechanical contractor shall be responsible for installing and connecting any RTU wiring harnesses shipped loose with the RTU's. This will include control/interlock wiring for ERV's and outside air damper operators for units with bypass curbs & mixing boxes.**

E. Where units have humiditrol feature, a combination temperature & humidity sensor shall be furnished.

F. Where demand ventilation is specified, carbon dioxide sensors shall have display in ppm.

G. Service area RTU to have fresh air tempering (FAT). Discharge air temperature sensor is shipped loose in the unit and shall be field installed by the mechanical contractor in the supply air duct. See drawings for additional information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01310 - Project Management and Coordination: Verification of existing conditions prior to beginning work.

B. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.

C. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions. Mechanical contractor shall be responsible for installing any loose shipped RTU wiring harnesses; in particular for control of the outside air damper or control/power of energy recovery units for units serving the service areas.

B. Install in accordance with NFPA 90A

C. Start-up, testing and placing into operation shall be performed by the field representative of the manufacturer, and a certificate from the manufacturer shall be provided with the Operation and Maintenance manuals that certifies that the equipment has been installed in compliance with the recommendations of the manufacturer and is operating accordingly.

D. Where ERV’c and economizers connect to RTU, the joints shall be sealed with clear, exterior grade silicone in accordance with Lennox installation instructions. Penetration of the floor of the RTU by wire and conduit shall be sealed.

END OF SECTION 23 57 81

SECTION 23 58 00

DIRECT EXPANSION FAN COIL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged direct expansion fan coil units

1.2 RELATED SECTIONS

A. Motor and Equipment Section.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW

A. Product Data: Provide typical catalog of information including arrangements.

B. Shop Drawings:
1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, and cooling capacities matched with condensing unit.
3. Indicate mechanical and electrical service locations and requirements.,

1.5 SUBMITTALS FOR INFORMATION

A. Manufacturer's Instructions: Indicate installation instructions and recommendations.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Contract Closeout:

B. Project Record Documents: Record actual locations of components and locations of access doors required for maintenance.

C. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 WARRANTY

A. Provide five year manufacturers warranty for fan motors.

1.10 EXTRA MATERIALS

A. Provide two sets of filters and belts.

PART 2 - PRODUCTS

2.1 DIRECT EXPANSION FAN COIL UNITS:

A. Will be furnished direct from Carmax thru their National Account with Lennox. Lennox is the only acceptable manufacturer.

B. Coils: Evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220 degrees F. Provide drain pan under cooling coil, easily removable for cleaning, with drain connection. Number of coil rows can not be less than the basis of design.

C. Cabinet: 0.0598 inch steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation.

D. Finish: Factory apply baked on visible surfaces of enclosure or cabinet.

E. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct drive, variable speed.

F. Motor: Tap wound multiple speed with sleeve bearings, resiliently mounted.

G. Control: Multiple speed switch, factory wired, located in cabinet.

H. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.

I. Electrical Characteristics: Furnish U.L. Listed electric heaters where indicated on the drawings. Units with heaters to have single point electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Connect drain pan to condensate drain.

E. Suspend from roof structure with threaded rod. Furnish rubber neoprene vibration isolators.

3.2 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION 23 58 00

SECTION 23 58 50

HEATING EQUIPMENT

PART 1- GENERAL

1.1 GENERAL:

A. Gas fired unit heaters
B. Electric wall heaters
C. Radiant Ceiling Panels
D. Electric Duct Heaters
E. Electric Unit Heaters

PART 2 – MATERIALS

2.1 GAS FIRED UNIT HEATERS

A. APPROVALS:

1. Certified by CSA International
2. ISO 9001 Registered Manufacturing Quality System

B. EQUIPMENT WARRANTY

1. Heat exchanger aluminized steel 10 year limited warranty
2. All other covered components one year limited warranty

C. HEATING SYSTEM

1. 24V redundant combination gas control valve.
2. solid state electronic direct intermittent spark ignition
3. pressure switch to prove combustion air
4. combustion air inducer
5. tubular aluminized stainless steel heat exchanger
6. aluminized stainless steel in shot burner
7. limit control factory installed with fixed temperature setting
8. combustion inducer to prepurge heat exchanger. Blower motor to have sleeve bearings and be thermally protected.

D. CONTROLS

1. 24V main gas valve, main shutoff valve, gas pressure regulator, limit control, transformer, combination ignition/fan timer control board.
2. solid state control board
3. 120v/24v transformer

E. CABINET

1. Constructed of heavy gauge painted steel with inside cabinet insulation.
2. Adjustable louvers
3. Wiring junction box
4. 60 degree down discharge nozzle

F. ACCEPTABLE MANUFACTURERS

1. Lennox: furnished as part of the RTU national account submittal.

2.2 GAS FIRED UNIT HEATERS – SEALED COMBUSTION CHAMBER @ CAR WASH

A. HEAT EXCHANGER: Multicell four pass serpentine steel heat exchanger. Heat exchanger tubes to be 409 stainless steel.

B. BURNER: Single one piece burner assembly with single orifice. The burner shall have a continuous would close pressed stainless steel ribbon separating the flame from the burner interior. Unit shall have a ventori tube and orifice supplying fuel to a one piece burner housing.

C. CONTROLS: Single stage gas valve, direct spark ignition with electronic flame supervision with 100% lockout integrally controlled by a printed circuit control board. The board shall also incorporate diagnostic lights, DIP switches. All units shall be equipped with a safety limit switch.

D. COMBUSTION AIR AND VENTING: Factory installed power venter,. The combustion air supply pipe and flue exhaust pipe shall be run in parallel from the heater to a factory supplied concentric adapter assembly, which allos for a single roof penetration to the air inlet and vent terminal. The vent system shall include a vibration isolated power venter motor and wheel assembly and a combustion air pressure switch. A flame roll out switch shall be included.

E. CABINET: Low profile with powder coat paint finish on minimum G30 galvanized steel. Discharge louvers shall be spring held and adjustable. Maximum cabinet height is 21”.

F. ACCESSORIES: Downturn nozzle kit and vertical combustion air/vent kit including concentric adapter.

G. ACCEPTABLE MANUFACTURERS: Reznor UDZ or approved equal.

2.3 ELECTRIC WALL HEATERS

A. Wall mounted electric heater with the following features:

B. Combination return and supply grille

1. steel sheath type nickel chromium elements
2. thermal overload with automatic reset
3. Heater shall be U.L. 2021 Listed
4. Heater shall be equipped with built in circuit breakers.

C. ACCEPTABLE MANUFACTURERS:

1. Markel
2. Qmark
3. Chromalox

2.4 RADIANT CEILING PANEL

A. Panel shall be suitable for installation in sheet rock ceiling and be flush with ceiling. Provide required mounting hardware and mounting kit.

B. Heater shall be powdered graphite in plastic laminate with heavy duty copper buss bars running the entire length backed by 1" thick, 1 lb density high temperature fiberglass insulation and separated from the inside of the panel by dielectric insulation.

C. Panel assembly shall be prewired with 22 gauge formed galvanized steel back.

D. Furnish Optional Features:

1. White painted frame
2. Sealtite flexible conduit
3. Recess mounting kit for sheet rock ceiling
4. Factory applied white high temperature acrylic painted finish

E. Controls: Columbus Electric TPI TW145 tamper resistant line voltage thermostat. No alternate thermostats are aceptable.

F. Acceptable manufacturers: Aztec, Qmark, Indeeco.

2.5 ELECTRIC UNIT HEATERS

A. Heater shall be constructed of 18 gauge steel with powder coat paint finish.

B. Sheath element shall be copper clad steel with brazed fins and Nichrome element wire.

C. Heater shall have automatic over current heat limit protection.

D. Fan motor shall be totally enclosed. Louver blades shall be individually adjustable for directional air flow.

E. Heater shall be installed with vertical down air discharge and fan outlet perpendicular to the floor. Furnish V5100 vertical mount bracket.

F. Heaters shall be equal to Markel, TPI or Qmark.

2.6 ELECTRIC DUCT HEATERS

A. Multi-stage nickel chromium open coil flange type with the following:

1. Primary and secondary current overload protection
2. Control cabinet
3. Air pressure differential switch
4. ½" high density fiberglass insulation between the control cabinet and the heating section

B. Voltage & phase, duct size as indicated on the drawings.

C. Equal to Markel, Qmark or TPI

PART 3 - EXECUTION

3.1 Equipment shall be installed in accordance with the manufacturers instructions.

3.2 Equipment shall be furnished at the volt/phase indicated on the electrical drawings.

END OF SECTION 23 58 50

SECTION 23 58 51

CARBON MONOXIDE EXHAUST

PART 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

A. The Contractor shall conform to the General Conditions.

B. Section 22 50 10: Mechanical General Provisions.

1.2 WORK INCLUDED

A. Overhead Garage Exhaust System

1.3 QUALITY ASSURANCE

A. Firms regularly engaged in manufacture of equipment, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Comply with applicable portions of SMACNA "Round Industrial Duct Construction Standard" and "Accepted Industry Practice for Industrial Duct Construction".

C. Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

A. Submit shop drawings in accordance with Section 22 5010: Mechanical General Provisions.

B. Additional submittal requirements:

1. Submit manufacturer's technical product data for each system, including equipment and accessories. Data shall include dimensions and capacities of each item. Duplicate systems may be represented by a single submittal, marked and labeled accordingly.

2. Submit manufacturer's assembly-type shop drawings for each system, including interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components. Duplicate systems may be represented by a single submittal, marked and labeled accordingly.

3. Submit manufacturer's maintenance data including parts lists for each type of equipment. Include this data, product data, and shop drawings in maintenance manual in accordance with requirements of Division 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Overhead Garage Exhaust System:
1. Ventaire, Inc is the only acceptable manufacturer.

2.2 EQUIPMENT

A. Overhead Garage Exhaust System:

1. Provide a complete carbon monoxide exhaust removal system including all ductwork, fittings, flexible tubing with tailpipe adapters, and exhaust fan.

2. Each exhaust fan shall be Class 1 non-overloading belt drive utility blower, AMCA certified. The backwardly inclined non-overloading wheel shall be statically and dynamically balanced. The frame shall be welded steel construction. The blower shall be housed in a 20 ga. Weatherproof galvanized steel enclosure. Automatic closing backdraft dampers shall also be included. Fan blower and housing shall have polyurethane powder coat, Hi-Pro or equal coating. See 15870/2.2.

3. Tee fittings shall be 45 degree radius take-offs in the direction of airflow. **Straight tees are not acceptable. Saddle taps are not acceptable**. The takeoffs shall be manufactured fittings.

4. The flexible tube shall be constructed of 4 and 6 inch diameter. The tubing shall be capable of withstanding 250F interior and exterior temperatures and shall be flame retardant and oil resistant. Tubing maximum pressure drop .11 IN WC per foot at 300 cfm. Only acceptable manufacturer for flexible tubing is Ventaire, Inc, model VMX, color yellow/ blue wear strip. Tubing submitted without pressure drop data will be returned not reviewed. Flexible tube shall have a flanged connection to rigid duct. Hose clamps shall be covered with blue flexible rubber sleeve.

5. Exhaust tailpipe adapters shall be constructed of neoprene rubber.

6. Each station shall consist of flexible tubing and tailpipe adapter set as detailed above.

7. An interchangeable single/dual exhaust hose adapter shall be required. All 4" round drops shall have FG female quick connect and F575 single adaptor..

B. DUCT

1. The duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct, which when installed in accordance with manufacturer's instructions, will seal the duct joints without the use of duct sealer.

2. All duct and fittings shall be G-90 galvanized steel per ASTM A-653 and A-924. Duct shall have paint grip finish.

3. All duct and fittings shall be minimum 24 gauge with spiral lock seams, **minimum 4 inches negative static pressure class. This includes round and rectangular duct. Rectangular duct shall be minimum 16 MSG**.

4. Fittings:

a. **All round fittings shall come factory equipped with a double lipped U-profile EPDM rubber gasket. Gasket shall have flame spread/smoke developed rating of 25/50.**

b. Elbows from 3" to 12" diameter shall be two piece die stamped and continuously stitched welded. All elbows 14" diameter ands greater shall be standing seam gorelock construction and internally sealed.

c. The radius of all elbows shall be 1.0 times the elbow diameter.

d. All fittings that are of either spot welded or button punched construction

shall be internally sealed. Only full body fittings are acceptable for divided flow. The use of duct taps is not acceptable.

5. Duct shall be suspended from the roof steel using Gripple Industries Hang Fast system (1-800-GRIPPLE). Installation shall be in strict accordance with manufacturer's instructions. All spiral duct shall be anchored in the locations shown on the drawings to the roof steel to prevent any movement in the duct.

6. Duct system shall be equal to SPIROsafe by Lindab.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with manufacturer's written instructions. See Mechanical Drawings for additional information and details.

B. Duct shall be rigidly attached to the roof structure. Furnish additional miscellaneous steel to support duct supports and hangers. See drawings for locations of rigid attachment.

END OF SECTION 23 58 51

SECTION 23 58 70

POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters
B. Carbon monoxide exhaust fan
C. In line exhaust fans
D. HVLS Propeller Fans
E. Wall prop fans

1.2 RELATED SECTIONS

A. Section 23 5890 - Ductwork.

B. Section 23 5910 - Duct Accessories: Backdraft dampers.

C. Section 26 6180 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 261 - Directory of Products Licensed to Bear the AMCA Certified Ratings Seal.

D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

E. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

F. NEMA MG1 - Motors and Generators.

G. NFPA 70 - National Electrical Code.

H. UL 705 - Power Ventilators.

1.4 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions.

1.5 OPERATION AND MAINTENANCE DATA

A. As part of the Closeout Documents furnish maintenance data. Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

PART 2 - PRODUCTS

2.1 ROOF EXHAUSTERS

A. The only acceptable manufacturers are:
1. Greenheck
2. Penn
3. Cook

B. Product Requirements:
1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
2. Sound Ratings: AMCA 301, tested to AMCA 300
3. Fabrication: Conform to AMCA 99.
4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

C. Fan Unit: V-belt or direct driven as indicated, with spun aluminum, resilient mounted motor; 1/2 inch mesh, 16 gage aluminum birdscreen; square base to suit roof curb with continuous curb gaskets.

D. Roof Curb: 14" high of galvanized steel with continuously welded seams, and factory installed nailer strip. **FAN CURB CAP CAN NOT BE MORE THAN 1/2" LARGER THAN THE CURB**. This means if the fan cap is 12"x12" the curb will be 11-1/2"x11-1/2". Secure the curb cap to the curb on all four sides, one screw each side, two screws each side where one side larger than 12”.

E. Electrical Characteristics and Components

1. Electrical Characteristics shall be as indicated on the Electrical Drawings.

F. Backdraft Damper: For fans that operate intermittently, gravity actuated, aluminum multiple blade construction, felt edged with nylon bearings. Furnish factory supplied damper tray with electrical knockouts.

G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

2.2 CARBON MONOXIDE EXHAUST FAN

A. FAN HOUSING

1. Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.

2. Fan shall be of airtight PermaLock construction with the scroll panel material formed and embedded into the side panels. All interior and exterior surface steel shall be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be RAL-7023, concrete grey. No uncoated metal fan parts will be allowed.

3. Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.

4. Gravity discharge shutter at fan outlet.

5. Drain port shall be located at lowest part of scroll housing to prevent moisture build-up in the interior of fan.

6. An OSHA compliant weatherhood shall be included to completely cover the motor pulley and belt.

7. **Fan shall be provided with integral curb cap inlet box constructed of same material, with access panel for inspection of fan wheel and duct**. It will be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be RAL-7023, concrete grey. Inlet box shall not increase static pressure resistance to the exhaust fan.

8. Provide with matching vibration isolation minimum 18" roof curb. Roof curb shall be constructed of 14 ga. galvanized steel, include one inch of insulation and be provided with adjustable duct support bar for connecting building duct to roof curb. **Springs on the curb shall have 1 inch of static deflection for the site specific weight of the fan.**

B. FAN WHEEL

1. The fan wheel shall be of the non-overloading single width backward inclined centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19

2. Fan wheel shall be manufactured of single thickness blades securely riveted or welded to a heavy gauge back plate and wheel cone.

3. The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

C. FAN MOTORS AND DRIVE

1. Motors shall meet or exceed EISA (Energy Independence and Security Act) efficiencies. Motors to be NEMA T-frame, 1800 or 3600 RPM, Open Drip Proof (ODP) with a 1.15 service factor.

2. Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.

3. Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.

4. Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type.

5. Air Handling Quality bearings to be designed with low swivel torque to allow the outer race of the bearing to pivot or swivel within the cast pillow block. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration.

6. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed for each pressure class.

7. Bearings shall have Zerk fittings to allow for lubrication.

C, MANUFACTURERS:

1. Greenheck USF Series
2. Penn
3. Cook

2.3 IN LINE EXHAUST FANS

A. In line centrifugal exhaust fan to have the following:

1. Insulated housing
2. Backdraft damper
3. Direct drive with solid state speed control

B. The only acceptable manufacturers are Greenheck, Cook & Penn.

2.4 SUSPENDED PROPELLER FANS (HVLS):

A. Fan shall have ten (10) low speed airfoils of precision extruded 6063-T5 aluminum alloy weighing no more than 1.52 lb per linear foot. The foils shall be connected to the hub section of the fan by means of two (2) locking bolts per foil. The bolts shall be SAE Grade 8 only, 5/16" diameter and rated with a minimum tensile strength of 150, 000psi. Additionally, the airfoils shall be interlocked with retainers to prevent an individual airfoil from becoming accidentally disconnected from the hub. The retainers shall be made from 14Ga ASTM 1008/1010 zinc plated steel. As an option, airfoils may be colored as specified by the Architect/Owner.

B. Winglets (10 each) are injection molded of ‘no break polypropylene’ and shall be attached at the tip of each foil by means of a #10 barrel screw. The standard color shall be safety yellow but may be colored as specified by the Architect or Owner.

C. The fan mounting system shall be designed for quick and secure installation from a structural support beam. The mounting system of the fam shall allow for easy removal and relocation, if required. All components in the mounting system shall be of welded construction using low carbon steel no less than 3/16 inch thick and be powder coated for appearance and resistance to corrosion. All mounting bolts shall be SAE Grade 8 or equivalent and rated with a minimum tensile strength of 150000 psi.

D. An Upper Safety Cable shall provide an additional means of securing the fan assembly to the building structure. It shall be shipped pre-assembled to the Extension Tube in a manner which assures retention and be securable to the building structure with a pin shackle through the loop on each end. All safety cables shall be 3/8 inch diameter and fabricated out of 7x19 stranded galvanized steel. The loops must be secured with a swaged Nicopress fitting, pre-loaded and tested to 3500 lb-force. Field construction of safety cables is not permitted.

E. The Controller for the fan shall be contained within an aluminum enclosure and secured to

the mounting post ‘on board’ the fan assembly. The controller shall be pre-wired to the motor and factory programmed to minimize starting and braking torques. An incoming power cord shall also be pre-wired to the controller. Separate NEMA rated control boxes containing high voltage components will not be permitted in this application.

F. The fan’s power and speed shall b controlled by a remote wall device. The wall control shall be a digital keyboard device and mounted inside the aluminum bezel. The bezel will be capable of mounting to a standard wall box. The wall control shall contain touchpad controls and LCD display for controlling the fan’s direction, operation and speed. Communication with the fan drive and controller must be by a standard commercially available CAT-5 (or higher) Ethernet cable that is field installed and provided by the installer.

G. The fan shall be mounted to an angle iron or I-beam structure. The minimum dimensions of the angle iron must be 2-1/2" x 2-1/2" x 1/4" and cannot be longer than 6 ft. It must be secured to the building structure and must not be mounted to single purling, trusses or bar joists. A Structural Engineer must be consulted for installation methods outside the manufacturer’s recommendation and a certification submitted prior to installation.

H. The manufacturer shall furnish a copy of all operating and maintenance instructions for the fan.

I. The manufacturer shall warrant the fan and components against defects in materials and workmanship pursuant to the following schedule.

- Airfoils Lifetime (parts)
- Hub Lifetime (parts)
- Gearbox 10 years (parts with factory install)
- Motor 10 years (parts with factory install)
- Controller Components 10 years (parts with factory install)
- Full Labor 1 year

J. Manufacturer shall be equal to Big Ass Fans or Macro Air Technologies.

2.5 WALL PROPELLER FANS

A. Manufacturers:
1. Greenheck
2. Penn
3. Cook

B. Impeller: Shaped steel or steel reinforced aluminum blade with heavy hubs, statically and dynamically balanced, locked to shaft, directly connected to motor or provided with V-belt drive.

C. Electrical Characteristics and Components:

1. Motor: Self-aligning pre-lubricated ball or sleeve bearings affixed to mounting plate permitting belt tensioning, neoprene vibration isolation between fan assembly and mounting plate.

2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box

sized to NFPA 70.

D. Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, wall sleeve with baked enamel finish.

E. Backdraft Damper: Multiple blade with offset hinge pin, blades linked.

F. Safety Screens: One inch galvanized wire over inlet, motor, and drive.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible connections specified in Section 15910 between fan inlet and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Provide sheaves required for final air balance.

D. Install backdraft dampers on inlet to exhausters as described above.

E. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION 235870

SECTION 23 58 80

AIR DISTRIBUTION

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Grilles, registers & diffusers

B. Louvers

1.2 SUBMITTALS

A. Shop Drawings: Indicate for manufactured products and assemblies, and include electrical characteristics and connection requirements.

B. Product Data: Provide for manufactured products and assemblies, and include electrical characteristics and connection requirements.

C. Operating and Maintenance Instructions: Include instructions for lubrication, filter replacement, spare parts lists, and wiring diagrams.

PART 2 - PRODUCTS

2.1 BACKDRAFT DAMPERS

A. Shall be furnished by fan manufacturer.

B. Factory gravity backdraft dampers furnished with the fan.

2.2 GRILLES, REGISTERS & DIFFUSERS

A. Manufacturers:
1. Titus
2. Metalaire
3. Price

B. Frame style and mounting shall be coordinated with the ceiling type.

2.2 LOUVERS:

A. Type: 4" deep (fixed) or 6" deep(combination) with drainable blades at 45 degrees, heavy channel frame, bird screen with 1/2" square mesh for exhaust and 3/4" for intake.

B. Fabrication: Fixed louvers shall be extruded aluminum drainable blades in extruded aluminum frame. Combination louvers shall be extruded aluminum drainable blades in aluminum frame. Damper operators shall be within the frame.

C. Furnish clear anodized finish.

D. Mounting: Furnish box frame.

E. Combination louvers to have 120V operator

F. **Submittals shall include site specific pressure drop and net area for the louver size submitted at the scheduled air quantity.**

G. Acceptable manufacturers:
1. Ruskin
2. Greenheck
3. Dowco

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

E. Check location of air outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 9.

END OF SECTION 23 58 80

SECTION 23 58 90

DUCTWORK

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Casing and plenums.

C. Duct cleaning

D. Flue vent pipe

1.2 RELATED SECTIONS

A. Section 23 52 50 - Duct Insulation: External insulation and duct liner.

B. Section 23 59 10 - Ductwork Accessories.

C. Section 23 58 80 - Air Distribution..

D. Section 23 59 90 - Testing, Adjusting and Balancing.

1.3 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. SMACNA - HVAC Air Duct Leakage Test Manual.

C. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

D. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work.

B. Product Data: Provide data for duct liner.

1.6 PROJECT RECORD DOCUMENTS

A. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal

and Flexible.

B. Maintain one copy of document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A Standards.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of in conformance with ASTM A90.

B. Flexible Ducts:

1. Manufacturers: Thermaflex, Clevaflex, Flexmaster.
2. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
3. Pressure Rating: 6 inches WG positive and 1.0 inches WG negative.
4. Maximum Velocity: 4000 fpm
5. Temperature Range: -20 degrees F to 210 degrees F

C. **Exposed rectangular and round duct shall have paint grip finish. Sheet metal to be either mill phosphatized or galvannealed**. **This includes but is not limited to Service, Parts & FQC.**

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. **Where rectangular elbows are used provide double thickness turning vanes in supply, return and exhaust 90 degree elbows.**

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints. Wrap joints with 3" wide duct tape.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

F. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic. Snaplock is also acceptable.

G. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted. Duct constructed using these systems will refer to the manufacturer's guidelines for sheet gauge, intermediate reinforcement sizing, spacing and joint reinforcement.

H. Formed on flanges will be accepted. Formed on flanges will be constructed as a SMACNA T-24 flange, whose limits are defined on Page 1-25 1985 SMACNA Manual First Edition. No other construction pertaining to formed on flanges will be accepted. Formed on flanges shall be accepted for use on ductwork 42" wide or less and subjected to 2" water column static pressure.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

2.4 HANGERS:

A. Hang and support duct as defined by SMACNA standards. Hanger spacing not to exceed eight feet.

B. **No duct shall be supported from the roof deck. All hangers, and duct support shall be suspended from structural roof steel.**

C. All hanger straps shall be turned under the bottom of the duct.

D. Support supply plenums for RTU’s in the service area with unistrut on the bottom of the plenum held up by all thread connected to the roof steel. Duct straps on the sides of the plenum are not acceptable.

2.5 FLUE VENT PIPE

A. Vent pipe for equipment with draft inducer fans shall be double wall equal to Metalbestos BV.

B. Vent terminations be equal to Metalbestos CT chimney round top.

C. Accessories storm collar, tall flashing cone, etc, to be equal to Metalbestos.

D. Installation shall be in accordance with manufacturer’s instructions. Maintain minimum 1" clearance around flue pipe.

PART 3- EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

D. Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

H. Sleeves for duct thru cmu or concrete walls: Galvanized Steel.

3.2 SCHEDULES

A. DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Supply	Galvanized Steel
Return & Relief	Galvanized Steel
General Exhaust	Galvanized Steel

B. GALVANIZED DUCTWORK PRESSURE CLASS SCHEDULE

AIR SYSTEM	PRESSURE CLASS
All rectangular supply & return All supply and return plenums at all RTU's	2.0 inch water column
Round supply & return branch duct to single diffuser or register	1.0 inch water column
General exhaust	1.0 inch negative water column
Carbon monoxide exhaust (rectangular)	4.0 inch negative water column

END OF SECTION 23 58 90

SECTION 23 59 10

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct access doors.

B. Duct test holes.

C. Fire dampers.

D. Flexible duct connections.

E. Volume control dampers.

F. Spin in fittings

1.2 RELATED SECTIONS

A Section 23 58 90 - Ductwork.

1.3 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. NFPA 70 - National Electrical Code.

C. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

D. UL 33 - Heat Responsive Links for Fire-Protection Service.

E. UL 555 - Fire Dampers and Ceiling Dampers.

1.4 SUBMITTALS

A. Shop Drawings: Indicate for shop fabricated assemblies including spin-in fittings.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

SECTION 23 59 51

CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Instruments and control elements.

B. Co-ordination with EMS and Electrical contractor.

1.2 SYSTEM DESCRIPTION

A. Control Systems: Thermostats, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

B. Mechanical contractor shall be responsible for all control devices not part of the EMS control system. This includes, but is not limited to 24V thermostats, 120V thermostats, 120V twist timers, interlock control relays and manual switches. Control devices will be furnished to the electrical contractor for installation and wiring. **Division 26 will be responsible for ALL 120V interlock wiring. This includes motor operated louver and damper operators.**

The mechanical contractor shall be responsible for all 24V control wiring.

C. All 24V control wiring and transformers for HVAC equipment that are not directly controlled by the EMS system will be by Division 23.

D. Include installation and calibration, supervision, adjustments and fine tuning necessary for complete and fully operational system as described in the sequence of operation indicated on the drawings.

1.3 SUBMITTALS

A. Shop Drawings: For review indicate complete operating data, schematic system drawings, and written detailed operational description of sequences.

B. Product Data: For review provide description and engineering data for each control system component.

C. Operation and Maintenance Instructions: For project closeout include:

1. Systems descriptions, set points, and controls settings and adjustments.
2. Inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
3. Interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

PART 2 - PRODUCTS

2.1 EXHAUST FANS

A. Control of exhaust fans shall be as indicated on the drawings. Starters, where required, shall be furnished and installed under Division 26.

B. All thermostats, switches and interlock control relays fans shall be furnished by Division 23.

2.2 SMOKE DETECTORS

A. RTU smoke detectors shall be furnished and wired by the Electrical Contractor. The mechanical contractor shall install all smoke detectors.

B. Detectors shall be located in the return duct prior to dilution by outside air. See HVAC General Notes on drawing M3.0:

1. detector not required in RTU serving the PBX room.
2. detectors not required for RTU's less than 2000 cfm with a hard ducted return

C. On a detection of smoke, the unit shall be shut down and a signal shall be sent to the Fire Alarm Panel. See Division 26 for additional information.

2.3 LOUVERS:

A. Where combination louvers are scheduled with a 24V operator, a 120V/24V transformer shall be provided and shall be interlocked with their respective exhaust fans as indicated on the drawings.

B. Control wiring and all interlocks for 120V combination louvers and roof intake hood damper operators is included in Division 26.

2.4 RTU'S:

A. Temperature and combination temperature/humidity sensors shall be furnished by Lennox and installed and wired under Division 26.

B. Carbon dioxide sensors shall be furnished by Lennox, and installed and wired under Division 26.

B. Service area RTU to have fresh air tempering (FAT). Discharge air temperature sensor is shipped loose in the unit and shall field installed by the mechanical contractor in the supply air duct. See drawings for additional information.

D. Demand ventilation: See section 235990/3.5/K.

E. Humiditrol: For units with Humiditrol option, the humidity setpoint will be 55%. Priority will be given to **COOLING**. If unit operating in dehumidification mode (dehum) while receiving a call for cooling, the unit shall drop out of duhum mode and operate in the cooling mode. If there is still a call for dehumidification after cooling has been satisfied, the unit shall operate in the dehum mode until either the humidistat is satisfied, or there is a call for cooling or heating.

F. Fans ON continuous during occupied and cycle during setback.

G. Outside air dampers closed during fan operation in setback.

H. Units that are 100% outside air shall not be permitted to operate during unoccupied.

SECTION 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Verify that conditioned power supply is available to the panel. Verify that field end

devices, and wiring is installed prior to installation proceeding.

B. Coordinate installation of system components with installation of mechanical systems equipment.

3.2 INSTALLATION

A. Install work in accordance with manufacturer's instructions.

B. Provide conduit and electrical wiring where required. Refer to Section 26 61 70.

C. **The installation and connection of any control wiring harnesses shipped loose with, or partially installed in Lennox RTU's, will be the responsibility of the mechanical contractor. This especially includes ERV interlock, and outside air damper motor wiring for RTU's that are 100% outside air.**

3.3 FUNCTIONAL PERFORMANCE TESTING

A. Contractor to provide representative during the functional performance testing period.

END OF SECTION 23 59 51

SECTION 23 59 90

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 SCOPE

A. Work is included in this section and is part of the Contract Sum/Price.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Field Reports: Submit under provisions of Section 01330.

C. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

D. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.

E. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.

F. Provide reports in pdf format. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

G. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

H. Test Reports: Indicate data on AABC National Standards for Total System Balance forms

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01770.

1.6 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.

B. Perform Work under supervision of AABC or NEBB Certified Test and Balance Technician.

1.8 SEQUENCING

A. Sequence work under the provisions of Division 1.

B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies noted during performance of services, which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. **The Test and Balance contractor shall report the position of outside air damper for minimum outside air for each RTU to Carmax's service provider, Comfort Systems. (Courtney Swain Courtney.Swain@comfortsystemsusa.com)**

K. Demand ventilation: for RTU's with demand ventilation, on a call for ventilation (CO2 level exceeds set point of 1000 ppm) the outside air damper will open to the position that permits the scheduled amount of outside air indicated in the RTU schedule on sheet M3.0 to enter the unit. When no call for ventilation, position of outside air damper will be closed. The outside air damper default position of 30% open on a call for ventilation **MUST BE CHANGED** at the prodigy board. Carbon dioxide sensor shall be furnished by Lennox and installed and wired by the electrical contractor.

L. **Suggested procedure for RTU's with bypass curbs and mixing boxes:**

1. close bypass damper
2. set outside air and supply air at 100% and as scheduled on RTU Schedule on M3.0
3. gradually open bypass damper until outside air and the sum of the supply air registers is equal to the scheduled outside air shown in the RTU Schedule on M3.0.

M. Lennox Enlight with Core Controller: See the links listed below for information, tips and tutorial on test and balance for Enlight units thru the integral Core controller:

hubspotusercontent-na1.net

3.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing

Packaged Roof Top Heating/Cooling Units
Exhaust fans
Air Inlets and Outlets
Energy Recovery Ventilators

B. Report Forms

1. Title Page:
   a. Name of Testing, Adjusting, and Balancing Agency
   b. Address of Testing, Adjusting, and Balancing Agency
   c. Telephone number of Testing, Adjusting, and Balancing Agency
   d. Project name
   e. Project location
   f. Project Architect
   g. Project Engineer
   h. Project Contractor
   i. Project altitude
   j. Report date

2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
   e. Nomenclature used throughout report
   f. Test conditions

3. Instrument List:

   a. Instrument

b. Manufacturer
c. Model number
d. Serial number
e. Range
f. Calibration date

4. Electric Motors:

a. Manufacturer
b. Model/Frame
c. HP/BHP
d. Phase, voltage, amperage; nameplate, actual, no load
e. RPM
f. Service factor
g. Starter size, rating, heater elements
h. Sheave Make/Size/Bore

5. Exhaust Fan Data:

a. Location
b. Manufacturer
c. Model number
d. Serial number
e. Air flow, specified and actual
f. Total static pressure, specified and actual
g. Inlet pressure
h. Discharge pressure
i. Sheave Make/Size/Bore
j. Number of Belts/Make/Size
k. Fan RPM

Note: individual outlets in carbon monoxide exhaust not required to be part of T&B. With all blast gates open, setting air qty at fan will be sufficient.

6. Air Distribution Test Sheet:

a. Room number/location
b. Design velocity
c. Design air flow
d. Test (final) velocity
e. Test (final) air flow

Packaged Air Conditioning Units

a. Similar to exhaust fan, except total and external static pressure.
b. Supply air
c. Return Air
d. Outside Air
e. Bypass air (service area units only)
f. Energy Recovery Ventilators: Outside air and exhaust air

NOTE: T&B CONTRACTOR TO INDICATE IN THE TEST & BALANCE REPORT MINIMUM POSITION OF THE OUTSIDE AIR DAMPER FOR EACH RTU.

END OF SECTION 23 59 90

SECTION 23 67 00

AIR COOLED HEAT PUMP

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Condensing unit package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Refrigerant piping connections.

E. Motor starters.

F. Electrical power connections.

1.2 RELATED SECTIONS

A. Section 23 55 35 - Refrigerant Piping and Specialties.

B. Section 23 58 50 - Direct Expansion Fan Coil Units

C. Electrical Spec Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

C. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

D. ASHRAE 14 - Methods of Testing for Rating Positive Displacement Condensing Units.

E. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

F. UL 207 - Refrigerant-Containing Components and Accessories, Non-Electrical.

G. UL 303 - Refrigeration and Air-Conditioning Condensing, and Air-Source Heat Pump Equipment.

1.4 SUBMITTALS FOR REVIEW

A. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections.

B. Product Data: Provide rated capacities, weights specialties and accessories, electrical nameplate data.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

A. Project Closeout: Operation and Maintenance Data: Warranties Procedures for submittals.

B. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Material and Equipment: Transport, handle, store, and protect products.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

C. Protect units on site from physical damage. Protect coils.

1.8 WARRANTY

A. Project Closeout. Warranties.

B. Provide a five year warranty to include coverage for refrigerant compressors.

SECTION 2 - PRODUCTS

2.1 MANUFACTURERS

A. Condensing units shall be furnished by Carmax thru National Account with Lennox. Lennox is the only acceptable manufacturer.

2.2 MANUFACTURED UNITS

A. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens.

B. Construction and Ratings: In accordance with ARI 210/240 ARI 365 and UL 207 and UL 303. Testing shall be in accordance with ASHRAE 14.

C. Performance Ratings: Seasonal Energy Efficiency Rating (SEER) not less than prescribed by current adopted energy code.

2.3 CASING

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors.

C. Provide removable access doors or panels with quick fasteners and piano hinges.

2.4 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of refrigerant.

B. Coil Guard: Smart Hinge louvered coil protection.

2.5 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge.

B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor with permanent lubricated ball bearings and built in current and thermal overload protection.

2.6 COMPRESSORS

A. Compressor: Hermetic scroll type, variable speed with reversing valve, defrost cycle and crankcase heater.

B. Mounting: Statically and dynamically balance rotating parts and mount on rubber-in-shear vibration isolators.

C. Lubrication System: Reversible, positive displacement or Centrifugal oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.

D. Motor: Constant speed 1800 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Furnish with starter.

2.7 REFRIGERANT CIRCUIT

A. Provide each unit with two independent refrigerant circuits, for units over ten tons, factory supplied and piped.

B. For each refrigerant circuit, provide:
1. High capacity liquid line dryer
2. Liquid line sight glass and moisture indicator.
3. Thermal expansion valve
4. Insulated suction line.
5. Suction and liquid line service valves and gage ports.
6. Charging valve.
8. Compressor discharge service valve.
9. Four way reversing valve for heat pump operation

2.8 CONTROLS

A. On unit, mount weatherproof steel control panel, NEMA 250, containing power and control wiring, factory wired with single point power connection.

B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. For each condenser fan, provide across-the-line starter with starter relay.

C. Provide safety controls arranged so any one will shut down machine:
1. High discharge pressure switch with auto reset for each compressor.

2. Low suction pressure switch auto reset for each compressor.
3. Oil Pressure switch manual reset.

D. Provide low ambient head pressure control where indicated on the drawings.

2.9 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Motor: See Electrical Drawings.

SECTION 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

C. Provide for connection to electrical service.

D. Where on grade, install units on minimum 3" concrete pad. Where on the roof, install on flashed 14" equipment rails equal to Pate. Secure the condensing unit to the support rails.

E. Comply with ASHRAE 15.

3.2 DEMONSTRATION AND INSTRUCTIONS

A. Project Closeout:

1. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.

2. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

END OF SECTION 23 67 00

SECTION 260000

ELECTRICAL GENERAL

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide all materials, tools, and labor for a complete electrical installation as shown on the contract documents and indicated in the specifications.
2. Procure all permits and licences.
3. Coordinate the electrical installation with the following:

a. Architect
b. Contractors of other trades.
c. Local Electrical and Building Inspectors, or the authority having jurisdiction.
d. Local Utility companies serving the project.

B. Related Documents:

1. Electrical, "E-" , drawings
2. All working drawings included in the contract documents.
3. Specifications of the following divisions/sections:

a. Division 1: General Requirements
b. Division 3: Concrete
c. Division 11: Equipment
d. Division 15: Mechanical

1.02 ABBREVIATIONS:

A. The following abbreviations are used throughout Division 16 specifications:

1. AFF: Above Finished Floor
2. ANSI: American National Standards Institute
3. ASTM: American Society for Testing and Materials
4. HVAC: Heating, Ventilating and Air Conditioning
5. IEEE: Institute of Electrical and Electronic Engineers
6. IES: Illuminating Engineering Society
7. ITL: Independent Testing Laboratories
8. NEC: National Electrical Code
9. NECA: National Electrical Contractor Association
10. NEMA: National Electrical Manufacturers Association
11. NFPA: National Fire Protection Association
12. NIC: Not in contract
13. UL: Underwriters Laboratories, Inc.

1.03 DEFINITIONS:

A. "Provide" means to furnish and install.

1.04 CODES AND STANDARDS:

A. Comply with codes and published standards which are applicable to the electrical installation of this project (Contractor shall verify all codes and standards with the authority having jurisdiction and comply as required).

1.05 STANDARDS FOR MATERIALS AND WORKMANSHIP:

A. Use materials that are new and, where UL or ITL has established standards, listed and/or labeled.

B. Organize and execute work so that finished appearance is neat; mechanical, plumb when vertical and level when horizontal. Any installation that does not meet this requirement shall be replaced or reinstalled at no additional cost to the Owner.

C. Provide sufficient qualified journeyman electricians who are thoroughly experienced with the materials and methods specified and familiar with the design requirements.

D. At least one qualified journeyman shall be present at all times during the execution of the work.

E. In acceptance or rejection in any portion of the electrical work, no allowance will be made for lack of skill on the part of the workmen.

1.06 INTENT OF DRAWINGS AND SPECIFICATIONS:

A. General:

1. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable electrical and mechanical systems in every respect.

2. The drawings are diagrammatic only, intending to show general arrangement and location of system components. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown, but shall be provided at no change in contract price.

3. All work shall be accurately laid out and coordinated with other trades to avoid conflicts and to provide maximum accessibility for operation and maintenance.

B. Wiring and Elementary Diagrams:

1. Wiring and elementary diagrams for equipment as shown on the drawings are based on the product of the specified equipment manufacturer and are shown for convenience to aid in estimating the extent of the work involved. The equipment actually installed shall be wired and connected in accordance with the equipment manufacturer's recommendations and shall conform to details in approved wiring diagrams to be furnished by the equipment manufacturer. All equipment so connected shall be made to operate in a safe, proper and efficient manner. Note that control circuitry is not necessarily shown on the drawings but shall be installed in conduit between the points and devices indicated on the diagrams.

C. Branch Circuiting:

1. The branch circuit wiring has been designed to utilize the advantages of multi-wire distribution and shall be installed substantially as indicated on the drawings. No major changes in the grouping or general routing of the branch circuits shall be made without the approval of the Engineer in writing. Circuits shall not be combined in a common raceway where the overcurrent protection would exceed the ampacity of the conductors as derated per NEC.

2. The number of conductors in each home run of conduit is indicated on the drawings and where there is a conflict between the number of wires indicated and the actual number required as determined by the functional design requirements, the number of wires determined by the functional design requirements shall govern.

3. In general, there is a number associated with each branch circuit outlet which identifies the particular branch circuit to which the device served by the outlet is to be connected. The circuit number indicated has been assigned only for reference and guidance, and is not intended to limit panelboard circuitry. All branch circuits shall be connected to breakers in accordance with circuit requirements and good industry practice. The balancing of all loads shall be included in the work of this Division.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide equipment, products and materials shown on the drawings, as specified in the specifications or added by addendum.

2.02 SUBSTITUTION OF MATERIALS:

A. Refer to Contract Conditions.

2.03 CONCRETE:

A. Refer to Division 3 specifications.

2.04 PLYWOOD BACKBOARDS:

A. 3/4"x size indicated on the drawings, A/D grade.

PART 3 - EXECUTION

3.01 VISIT TO SITE:

A. All persons proposing to submit quotations for work in accordance with these plans and specifications are expected to visit the site of the work covered by the plans and specifications and are to familiarize themselves with existing conditions as they affect the work of this section of the specifications. Claims resulting from a failure to visit the site or inspect the existing conditions will not be considered.

3.02 EXISTING FACILITIES:

A. Coordinate the interface between the existing systems and the respective extensions and/or new systems.

3.03 PROTECTION OF MATERIALS:

A. Cover fixtures, equipment and apparatus for protection against dirt, water, chemical or mechanical damage before and during construction.

B. Keep all conduit and other openings protected against entry of foreign matter.

C. Restore the original finish, including shop coat, of fixtures, apparatus or equipment that has been damaged prior to substantial completion.

3.04 COORDINATION:

A. Prior to rough-in of any materials, coordinate with subcontractors the physical clearances for and sequencing of Division 16 work as it interfaces with and relates to architectural, structural, plumbing and HVAC systems.

3.05 EXCAVATION AND BACKFILL:

A. This contractor shall provide all excavation and backfill required for the work covered under this Division.

B. Verify the location of all underground piping, foundations and any other underground utilities before commencing work. All existing underground utilities shall be protected from damage.

C. Excavation shall be made to the proper depths. If excavation is carried below that required, the bottom shall be brought to the required elevation with sand fill, thoroughly compacted.

D. Fill shall be clean sand or clay, free of trash, rock, or other debris. Excavated materials may be used, provided it can be readily compacted. All fill shall be mechanically tamped, shall be uniform throughout, and shall be sufficient at all locations to obtain a modified Proctor 95 rating.

E. Where conduits pass below footings, install steel pipe sleeves with at least 2" clearance all around conduit and fill excavation to the bottom of the footing with concrete. Where conduits pass through walls below grade, install steel pipe sleeves with at least 2" clearance all around conduit. Fill annular space around conduit with inorganic compressible filler to provide a watertight seal.

3.06 PAINTING:

A. All steel surfaces not galvanized, factory-finished or of weathering type steel shall be cleaned free of all rust, primed and provided one finish coat of semi-gloss enamel of color and manufacturer approved by the Engineers.

B. All factory-finished steel surfaces; boxes, enclosures, etc., shall be cleaned and retouched or repainted as necessary to provide a rust-resistant coating. Where painting or is not specifically specified, ferrous devices, bolts, nuts, inserts, etc., shall be galvanized.

C. All nameplates shall be left unpainted and in a clean condition.

3.07 SETTING OF EQUIPMENT:

A. The setting of equipment shall be carefully coordinated with the work and requirements of the other trades involved to ensure compatibility and to avoid conflicts.

B. Equipment, base mounted on concrete or masonry slabs, pads and piers, or mounted on stands, gratings, platforms, or other, shall not be set in any manner, except on the finished and permanent support.

C. Support of equipment on studs or by other means, and the placing or building of the supporting slab, pad, pier, stand, grading, or other, "to the equipment", is prohibited.

3.08 TEMPORARY POWER:

A. The Contractor, at his own expense, shall make arrangements for the purchase of power or portable power and provide for the extension of utility power to the point of usage. The cost of power shall be included in the appropriate bid items to which it is appurtenant and shall include full compensation for furnishing all labor, materials, tools and equipment which may require power.

3.09 PERMITS:

A. The Contractor shall pay for permits, low voltage permits, inspections and other costs incidental to providing electrical installations.

3.10 INSPECTIONS:

A. Owner will perform two (2) inspections at substantial completion. Electrical contractor must provide two (2) full days of journeymen to attend and assist in inspection effort.

B. The installation shall be inspected on at least three (3) widely spaced occasions by a local inspection authority. Application shall be made to the local authority for such inspections and this Contractor shall pay all costs for this inspection service.

C. Inspections shall be made for compliance with the power company requirements, the National Electrical Code and any local codes.

D. A copy of inspection reports shall be promptly sent to the Contractor, to the Owner and to the Engineers, including a Certificate of Compliance on completion of the work.

3.11 SHOP DRAWINGS AND PRODUCT DATA SUBMITTALS:

A. Submit as prescribed in Divison 1 shop drawings and/or product data for the electrical equipment and materials listed below. Check for compliance with contract documents and certify compliance by affixing Electrical Contractor's "Approved" stamp and signature.

1. Shop drawings and product data:

a. Life Safety System (fire alarm)

2. Product data only:

a. Conduits, Couplings, Connectors, and Fittings
b. Wiring Devices and Coverplates (receptacles, switches, wallbox dimmers)
c. Fuses and Circuit Breakers
d. Junction Boxes, Outlet Boxes, and Floor Boxes
e. Lighting Fixtures and Lamps

f. Disconnect Switches, Motor Starters, and Motor Switches
g. Wire and Cable
h. Time Clocks, Relays, Contactors, and Photocells
i. Transient Voltage Surge Suppression (TVSS) Equipment

B. Refer to respective sections for submittal instructions where instructions have been prescribed.

C. Obtain shop drawing review by engineer before purchase of any equipment requiring shop drawing submittals.

D. Include with the electrical distribution equipment submittal a plan view of each electrical room or area designated for electrical distribution equipment. Use 1/2" = 1' scale and show the submitted equipment laid out in each room/area. Label each piece of equipment and indicate the required maintenance clearance by a dashed line.

3.12 CERTIFICATION AND TEST REPORTS:

A. Submit the following certifications and test reports to the Architect in the format and at the time prescribed in Division 1:

1. Certifications:

   a. Life Safety System

2. Test Reports:

   a. Megger test for all feeders and Service Entrance conductors.

3.13 MAINTENANCE MANUALS AND OPERATING INSTRUCTIONS:

A. Submit the following maintenance manuals and operating instructions to the Architect as prescribed in Division 1:

1. Life Safety System
2. Other systems as directed by Owner

B. Use a separate three ring binder for each maintenance manual and include wiring diagrams, maintenance instructions, parts list, maintenance tools list, manufacturer's and nearest dealer's name, addresses and telephone numbers. Organize into sections.with index thumb-tab markers.

C. Use a three ring binder for operating instructions with a separate thumb-tab in each section for each system or major item. Include in the instructions start-up, operation sequence, control, shut-down, safety features and seasonal adjustments.

D. Preparation of data (in form of an instructional manual for use by Owner's personnel) shall be done by personnel who are:

1. Trained and experienced in maintenance and operation of desired products.
2. Familiar with requirements of this Section.
3. Skilled as technical writers to the extent required to communicate essentail information.
4. Skilled as draftsperson competent to prepare required drawings.

3.14 OPERATIONAL TEST

A. At the time of the substantial completion job observation, perform a test of all light fixtures, electrical systems, equipment, machinery and appliances, in the presence of the Architect or his representative, which demonstrates that all of Division 16 systems are operational.

B. The following tests shall be included:

1. Control and Distribution Equipment:

a. Check the wire terminals, clean connections.
b. Check all control switches, alarm devices, indicating instruments for proper operation under normal and simulated abnormal conditions.

2. Three phase equipment:

a. Check all equipment for correct phase rotation.

3. Circuit Breakers:

a. Inspect each circuit breaker.
b. Check for loose connections.
c. Operate each circuit breaker manually

3.15 JOB OBSERVATION ASSISTANCE:

A. During all job observations, provide an electrician with tools and volt/ammeter to accompany Architect and/or his representative.

B. Remove any covers, trims or wiring devices and open all cabinets, disconnect switches or other equipment served electrically and designated by the Architect or his representative.

C. Restore removed or opened equipment to its installed or closed position after the job observation.

3.16 OWNER INSTRUCTION AND ASSISTANCE:

A. At substantial job completion job observation, instruct the Owner's operating personnel in the operation, sequencing, maintenance and safety/emergency provisions of the electrical systems.

3.17 AS-BUILT DRAWINGS:

A. Record on one set of electrical drawings all changes, deviations and underground conduits. Transfer same to a reproducible plan and deliver same to architect as per Division 1.

3.18 WARRANTIES:

A. All equipment installed under this Division of the work shall be warranted for a minimum of one year after the specified performance has been demonstrated and accepted by the Owner. Refer to Article 12 of General Conditions to Standard Agreement for warranty requirements.

B. During this warranty period, replace any and all defective equipment and parts at no cost to the Owner.

3.19 STRUCTURAL MEMBERS:

A. No penetrations or any such alteration to structural members, joists, columns, etc. shall be performed during the course of work covered by this Division unless prior approval in writing is obtained from the structural engineer.

3.20 GRAND OPENING DAY ASSISTANCE:

A. On the date established by the Owner, the electrical subcontractor shall have on-site, for an eight-hour day, a qualified journeyman who is experienced with the materials and design requirements of the project as well as a service vehicle. The cost of this time and equipment shall be included in the Base Bid. Upon completion of this work, the journeyman shall prepare a “No Cost” service call invoice and have the invoice signed by the CARMax Operations Manager. This signed invoice shall be submitted to the General Contractor for processing to the Owner.

END OF SECTION 16050

SECTION 261100

RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide continuous conduit systems - beginning at the service point, to all distribution equipment and to every outlet and piece of electrical equipment with conduits, couplers, supports, hangers, fittings, bushings and accessories.

B. Related Sections:

1. Section 16050: Electrical General

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.01 RIGID STEEL AND INTERMEDIATE METALLIC CONDUIT:

A. Conduit:

1. Rigid ferrous steel pipe, hot-dipped galvanized or sherardized with smooth interior.

2. Acceptable Manufacturers:

a. Allied
b. Triangle
c. Wheatland

B. Couplings and Connectors:

1. Couplings:

a. Hot-dipped galvanized or sherardized ferrous steel, threaded

2. Connectors:

a. Steel or malleable iron, threaded with throat bushing, lock nuts and, where prescribed, grounding lugs.

3. Erickson:

a. Malleable iron, concrete tight

4. Acceptable Manufacturers:

a. Appleton

b. Crouse Hinds
c. Steel City
d. Thomas & Betts

C: Joint Compound:

1. Anti-seize lubricant with rust and corrosion inhibitors and colloidal copper
2. Acceptable Manufacturers:

a. Thomas & Betts

D. Expansion Fittings:

1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper.

2. Acceptable Products:

a. Crouse Hinds "XJ"
b. O.Z. Gedney "AX" or "DX"
c. Appleton "XJ"

2.02 ELECTRICAL METALLIC TUBING:

A. Conduit:

1. Thin wall ferrous steel tubing, hot-dipped galvanized, smooth interior, square and reamed ends

2. Acceptable Manufacturers:

a. Allied
b. Wheatland
c. Triangle

B. Couplings and Connectors:

1. Couplings:

a. Steel, compression type, installed where exposed to moisture
b. Steel, setscrew type, when installed indoors

2. Connectors:

a. Steel, compression type with nylon insulated bushings, locknuts, and where prescribed, grounding lugs, installed where exposed to moisture.
b. Steel, setscrew type with nylon insulated bushings, locknuts, and where prescribed, grounding lugs, installed indoors.

C. Expansion Fittings:
1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper.

2. Acceptable Products:

a. Crouse Hinds "XJ"
b. O.Z. Gedney "AX" or "DX"
c. Appleton "XJ"

2.03 RIGID NONMETALLIC CONDUIT:

A. Conduit:

1. Schedule 40 Polyvinyl chloride (PVC), normal duty, resistant to crushing, moisture, low temprature, and corrosive agents in standard trade sizes.

2. Schedule 80 Polyvinyl chloride (PVC), heavy duty, resistant to crushing, moisture, low temprature, and corrosive agents in standard trade sizes.

B. Couplings and Connectors:

1. Couplings: Schedule 40 PVC (or Schedule 80)
2. Connectors: Schedule 40 PVC (or Schedule 80) with lock nuts

C. Expansion Fittings:

1. Schedule 40 PVC (or Schedule 80) with grommeted inner cylinder and outer sleeve

D. Joint Cement:

1. PVC solvent

E. Acceptable Manufacturers:

1. Carlon
2. Cantex
3. Wheatland

2.04 LIQUIDTIGHT FLEXIBLE CONDUIT:

A. Conduit:

1. Galvanized steel single strip, interlocked, smooth inside and out, with liquid-tight flexible polyvinyl chloride outer jacket.

2. Acceptable Manufacturers:

a. Carlon
b. Wheatland
c. Allied

B. Fittings:

1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing, liquid tight, locknuts and external ground lugs.

2. Acceptable Manufacturers:

a. Appleton
b. O.Z. Gedney
c. Thomas & Betts

2.05 FLEXIBLE METAL CONDUIT:

A. Conduit:

1. Galvanized steel single strip, interlocked, smooth inside and out.
2. Acceptable Manufacturers:

a. AFC
b. Alflex
c. General Cable

B. Fittings:

1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing and lock nuts.
2. Acceptable Manufacturers:

a. Appleton
b. O.Z. Gedney
c. Thomas & Betts

PART 3 - EXECUTION

3.01 APPLICATIONS:

A. Provide Rigid Metal Conduit or Intermediate Metallic Conduit for main service entrance, feeders, areas where exposed to moisture and when permitted in plans or approved in writing by the Architect, exposed on exterior surfaces and exposed interior from floor to 10'-0" or where exposed to physical abuse.

B. Provide Electrical Metallic Tubing (EMT) for interior power circuits, branch circuits and system circuits in walls, plenums, attics or when permitted in plans or approved in writing by the Architect, exposed above 10'-0" where not exposed to moisture.

C. Provide Rigid Nonmetallic Conduit (Schedule 40 PVC) for main service ground, main telephone service, in slab on grade, in direct contact with earth, exposed in corrosive environments above 10'-0" above floor, or service entrance when encased in concrete.

D. Provide Liquid-tight Flexible Metal Conduit for final connecting link (minimum of 12", maximum of 72") to the following:

1. Plumbing equipment
2. Exterior Mechanical equipment
3. Equipment in wet areas or areas likely to be exposed to moisture.

E. Provide Flexible Metal Conduit for:

1. Final connection link (minimum of 12", maximum of 72") to:

a. Motors
b. Transformers

c. Mechanical equipment

2. Connections between junction boxes and accessible recessed lighting fixtures.

F. Provide explosion-proof (suitable for use in Class I, Division 2, Group D locations) watertight flexible conduit in hazardous areas.

G. Metal clad (MC) cable shall be allowed for branch circuit work concealed in walls only where allowed and as limited by local code or the authority having jurisdiction. MC cable shall not be used for exposed branch circuit work or concealed above ceilings except for final connections from junction box to light fixture as prescribed in Section 16500. MC cable shall contain a separate insulated equipment grounding conductor. Under no circumstances will AC cable be allowed. All circuit homeruns from the area served to the panel where circuit originates shall be installed in conduit as prescribed elsewhere in specifications.

H. Any proposed changes to the above specified applications must be submitted to the Engineer for approval.

3.02 CONDUIT SUPPORT:

A. Intervals: Maximum 10 feet on center and within 3 feet of each outlet box, junction box, cabinet or fitting.

B. Conduits 3/4" and smaller:

1. Method

a. When single conduit: Attach directly to building structure or suspend with 1/4" rod.

b. When multiple parallel and adjacent conduits and:

1) When horizontal at structure: Attach directly to structure or to support framing attached to structure.
2) When horizontally suspended: Attach to support framing, suspended from building structure.
3) When vertical: Attach to support framing attached to building structure, wall structure or suspended from building structure.

2. Conduit attachment:

a. When direct to structure or single conduit suspended: Spring steel friction, spring steel latching or clamped with bolts or screws.
b. When on support framing: Two section bolted conduit clamp.

3. Structural steel attachment
a. When single conduit: Spring steel friction, clamp with bolt or bolted
b. When hanger rod: Clamp with bolt or bolted

4. Concrete attachment: Steel preformed conduit clamp. Attach clamp with expansion anchor installed in drilled hole or with power fastening anchor designed to meet concrete specification. In either case, maintain design support of 300% or greater of load.

5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load.

C. For 1" or larger:

1. Method:

a. When single conduit: Attach directly to building structure or suspend with threaded rod.
b. When multiple parallel and adjacent conduits: Attach to support framing attached to building structure, wall structure or suspended from building structure.

2. Conduit attachment:

a. When single conduit: Bolted clamp
b. When on support framing: Two section bolted conduit clamp

3. Structural steel attachment: Beam clamps with bolts or bolted directly to steel.

4. Concrete attachment: Provide preset insert prior to concrete pour or coordinate drill locations with Architect. When drilling provide expansion anchors. In either case, maintain design support of 300% or greater of load.

5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load.

D. Framing:

1. Attachment, suspension and bearing members capable of supporting 300% of load.

3.03 INSTALLATION:

A. For conduit layout follow, generally, the diagrammatic layout shown on plans. Provide offsets and routing changes to avoid structural, architectural or equipment elements.

B. Provide 1/2" minimum size conduit. For in-slab or underground installation provide 3/4" minimum size conduit.

C. Conceal all conduit except where explicitly shown or described to be exposed. Install conduit concealed above a lay-in ceiling with clearance to allow easy removal of ceiling panels.

D. Install exposed conduit parallel with or perpendicular to building walls at greatest height possible. Paint exposed conduit two coats of color directed by Architect.

E. Extend homeruns from outlets shown to panel designated. Do not combine more than three (single phase) circuits per homerun.

F. Use benders designed for the size and type of conduit. Limit each bend to 90 degrees or less with a radius 10 times conduit diameter or greater for telephone system and 6 times conduit diameter or greater for all other systems.

G. Provide insulated bushings at each end of every conduit run.

H. Provide joint compound on rigid steel conduit and intermediate metallic conduit joints.

I. Provide an Erickson type coupling where two segments of a conduit run must be joined and neither can be rotated.

J. Close all conduit ends during construction with plastic conduit plugs.

K. Install all underground conduits beneath concrete slabs.

L. Install conduit above water and steam piping where possible. Conduits shall be installed at least 6" from hot flues, steam pipes, hot water pipes, and other hot surfaces.

M. Provide a green insulated grounding conductor (sized per NEC) in each conduit.

N. Provide ground lugs on all conduit connectors to service equipment enclosures.

O. Provide grounding wedge lugs or locknuts designed to bite metal on conduit connectors to panel cabinet or pullboxes.

P. Seal all conduits which extend from the interior to the exterior of the building to prevent the circulation of air.

Q. Provide a thruwall waterproof seal on each conduit that penetrates a wall at a below grade level.

R. Provide an expansion fitting in each conduit crossing a building expansion joint and locate the fitting at the joint. Also provide expansion fittings in building conduits exceeding 100 feet at intervals of 100 feet.

S. Where liquids are present, form drip loops in liquid-tight flexible conduit to prevent liquid from running into connections.

T. Blow out and swab all conduit clear of trash and water prior to pulling wire.

U. Provide a nylon pullcord in all empty conduits.

V. In mechanical equipment rooms where a piece of equipment is located more than 2 feet away from walls or columns, serve equipment from underfloor or provide a vertical conduit, minimum 1", attached to floor and ceiling with conductors entering and exiting conduit through conduit bodies.

W. Coordinate conduit supports in precast or cast-in-place concrete prior to pour.

X. Provide a fire rated seal on each conduit that penetrates any floor or fire rated partition. Match seal rating to floor or partition rating.

Y. Provide an explosion-proof seal in each conduit run where it enters and leaves a hazardous location per NEC requirements.

Z. Provide at least three spare 3/4" empty conduits up from flush mounted panelboards and turn out above ceiling (for future expansion).

AA. Conduits shall not be routed through the area located up to 30” AFF in automobile service areas per NEC Class 1 Division 2 requirements. If required and written approval is obtained from Engineer, any conduits passing through this area shall be rigid galvanlized conduit with no joints or fittings and shall extend a minimum of 24” below slab before transitioning to nonmetallic conduit per NEC 511.4. Any conduits not meeting this requirement shall be removed or be provided with seal-offs as required at no additional cost to Owner.

BB. All raceways supports shall comply with local seismic zone requirements. Contractor shall verify requirements with authority having jurisdiction.

3.04 UNDERGROUND INSTALLATION:

A. Where exterior of building, bury conduit a minimum of 24" below finished grade and a maximum of 30" below finished grade. Where depths of more than 30" are required due to soil conditions, contractor shall notify engineer in writing for direction and possible increase in feeder and/or conduit sizes per NEC Appendix B.

B. When under interior slab on grade, seal vapor barrier around conduit penetration.

3.05 SERVICE ENTRANCE CONDUITS

A. Refer to Section 16420 for service entrance requirements.

END OF SECTION OF 16110

SECTION 261200

CONDUCTORS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide continuous color coded conductors beginning at service point to distribution equipment and to each outlet and each piece of electrical energy consuming equipment.
2. Provide continuous splice-free conductors within conduits. Conductors shall be continuous from outlet to outlet with splices made only in outlet or junction boxes.

B. Related Sections:

1. Section 16050: Electrical General

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 CONDUCTORS:

A. All conductors shall be copper, unless specifically noted on the drawings to be aluminum.

B. Copper Conductors:

1. Soft drawn annealed copper, 98% conductivity, without weld, splice or joint throughout its length; uniform in cross section without flaws, scales, or other imperfections with THHN/THWN or XHHW insulation.
2. Acceptable Manufacturers:
   a. Anaconda
   b. Phelps Dodge
   c. Pirelli Cable
   d. Senator
   e. Southwire
   f. Triangle

C. Configuration:

1. No. 14 and smaller. Solid
2. No. 10 and smaller: Stranded-Solid where installed under wrapped screw type connection.
3. No. 8 and larger: Stranded

D. Insulation - 600 Volts:

1. No. 6 and smaller: THHN, THWN
2. No. 4 and larger: XHHW

E. Jacket Color:

1. No. 8 and smaller: Uniform colored jacket
2. No. 6 and larger: Black

F. Jacket Markings:
1. Voltage
2. Insulation type
3. Conductor Size
4. Conductor type

2.02 COLOR CODING TAPE:

A. Vinyl 3/4" wide with uniform color and adhesive backing.

B. Acceptable Manufacturers:
1. Brady
2. 3M
3. Plymouth
4. Thomas & Betts

2.03 SPLICE AND TAP MATERIALS:

A. No. 10 and smaller:
1. Crimp type: Cylindrically shaped conductor sleeve for crimping copper conductors. Insulated with nylon or plastic cover.
2. Twist on: Inner spiral spring or threads for holding and making electrical contact between copper conductors and with outer long skirted insulated cover of nylon or plastic.

B. No. 8 and Larger:
1. Set-screw or bolted type: Metal connectors for joining copper to copper, with bolts or set-screws to apply pressure to conductors. Insulate with nylon or plastic cover or with electrical tape.
2. Pressure type: Metal connectors for joining copper to copper, copper to aluminum, or aluminum to aluminum with power operated crimping tool. Insulate with nylon or plastic cover or with electrical tape.

C. Acceptable Manufacturers:
1. AMP
2. Burndy
3. Ideal
4. Ilsco
5. Panduit
6. 3M
7. Thomas & Betts

2.04 CONDUCTOR TERMINALS:

A. Copper conductors: High conductivity copper terminal designed to hold conductor and make electrical contact by bolt, setscrew or power crimp and with spade to match equipment receiving conductor.

B. Acceptable Manufacturers:
1. Burndy
2. Ideal
3. Ilsco

4. Panduit
5. Thomas & Betts

2.05 CONDUCTOR HARNESS:

A. Plastic or nylon self-locking straps (commonly refered to as zip-ties or tie-wraps).

B. Acceptable Manufacturers:
1. Panduit
2. Thomas & Betts

2.06 WIRE PULLING LUBRICANT:

A. Lubricating, insulating and chemically neutral to conductors, conductor insulation and conduits.

B. Acceptable Manufacturers:
1. Greenlee
2. Ideal
3. Polywater

2.07 ELECTRICAL TAPE:

A. Vinyl plastic; moisture tight, resistant to ultraviolet radiation, alkalies, acids and corrosion; chemically neutral to conductors and conductor insulation; fire retardant; and single thickness dielectric strength equal to or greater than 10,000V.

B. Acceptable Manufacturers:
1. Scotch/3M
2. Plymouth

2.08 FLEXIBLE CABLE:

A. Heavy duty cord type S, SO, ST, or STO

B. Equipment ground conductor included

C. Connectors:
1. Straight blade devices: General Electric series GED (15 to 60 amps)
2. Locking devices: General Electric series GLD (15 to 30 amps)
3. Pin-and-sleeve devices: General Electric series GE (20 to 100 amps)

D. Connections shall be complete with locknuts, strain relief fittings, sealing gaskets, gland nuts, and bushings as required for a complete installation.

E. Acceptable Manufacturers:
1. Hubbell
2. Crouse-Hinds
3. Levition
4. Appleton

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install the number of conductors indicated with a minimum of three (3) conductors (including ground) being installed in each conduit not prescribed to be empty.

B. Minimum Conductor Size: No. 12

C. Complete installation of raceway run prior to pulling conductors.

D. Install insulated bushings in conduit fittings prior to pulling conductors.

E. Use wire pulling lubricants to reduce stress on conductors. Pull all conductors of a run together. Use pulling methods which do not damage the raceway or conductors. Leave 8" minimum length of conductor at junction boxes for connections.

F. Color Coding:

1. No. 8 and smaller: Uniform colored jacket with respective color below.
2. No. 6 and larger: Two wraps of tape applied within 6" of each conductor end with respective color below.
3. Conductor Color Code:

Voltage	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White with colored stripe matching phase conductor	Gray with colored stripe matching phase conductor
Ground	Green	
Isolated Ground	Green w/ White Stripe	

4. For Different Voltages in Same Enclosure: Use a colored stripe (not green) on one neutral to differentiate between systems. Keep stripe color consistent throughout project.

G. At outlets leave a minimum of 12" of conductor ends at each fixture outlet, device outlet and equipment outlet box.

H. Conductor Terminals:

1. Single: Use terminals on conductors no. 8 and larger where equipment receiving conductors do not have conductor lugs with set-screw(s)
2. Multiple: Install terminals on conductors where more than one conductor is connected to a single lug.

I. Route conductors in all switchboards, panelboards, motor control centers and terminal cabinets parallel to or at right angle to the enclosure's sides and tops. Group and harness conductors in those enclosures using conductor harness straps.

J. Prior to energizing conductor, megger test conductors for continuity and shorts. Correct deficiencies prior to energizing.

K. Apply aluminum oxide inhibiting compound to the ends of all conductors prior to installing terminals or installing in mechanical lugs.

L. Tighten all bolted connections in and to mechanical lugs to torque rating specified per manufacturers recommendations.

M. Tighten all conductors with mechanical connections, torqued in accordance with the conductor and/or connector manufacturers markings as well as the values referenced in the following publications:
1. Underwriters Laboratories Electrical Construction Directory (Green Book).
2. Underwriters Laboratories Electrical General Information (White Book).

N. Type THHN conductors shall not be used in wet or damp locations.

O. Conduit sizes are based upon type THWN/THHN insulation conductors. Where other type insulated conductors are necessary, conduit sizes shall be increased as required by the NEC.

P. Control wiring may be #14 AWG, except where length of runs would not permit proper operation of the controls or where larger sizes are required by code.
1. Class 1 remote control and signal circuit conductors shall not be smaller than #14 AWG.
2. Class 2 low energy remote control and signal circuit conductors shall not be smaller than #16 AWG, unless noted otherwise on the drawings or recommended by the equipment manufacturer incorporating such wiring.
3. Conductor insulations shall be as specified herein before except that #16 AWG conductors for remote control or signal circuits may be commercial grade fixture wire, Types RF-2, TF, or other types recognized by the NEC as applicable

Q. Types NM and NMC cables are prohibited.

R. Heat resistant insulated conductors shall be used for wiring in hot locations and for recessed fixtures.

S. All branch circuit homeruns shall have the following sized conductors as a minimum (whether shown on the drawings or not) to prevent excessive voltage drop (increase conduit size as required per NEC):
1. #10 AWG for 120 and 208 volt circuits with homeruns over 100' long
2. #8 AWG for 120 and 208 volt circuits with homeruns over 200' long
3. #10 AWG for 277 and 480 volt circuits with homeruns over 200' long

T. For branch circuits rated 20 and 30 amperes, if branch circuit wiring is upsized for voltage drop, the neutral and ground wires shall be the same size as the “hot” conductor per NEC 250.122 (B).

END OF SECTION 16120

SECTION 261300

BOXES

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide electrical boxes or, where prescribed, conduit bodies for devices, outlets, splice connection points, raceway junction and conductor pulling points complete with supports, covers and accessories.

B. Related Sections:
   1. Section 16050: Electrical General.

C. Standards:
   1. Underwriters Labratories labeled and listed for application specified.

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 INTERIOR OUTLET BOXES AND EXTENSIONS:

A. Galvanized steel, UL listed for application with conduit knockouts and threaded holes for mounting devices and/or coverplates.

B. Minimum Sizes:
   1. Single Device: 3"H x 2"W x 2"D
   2. Gang Device: 3"H x 2"W (per gang) x 2"D
   3. Octagonal: 4"W x 1-1/2"D
   4. Square: 4" Square x 1-1/2"D

C. Acceptable Manufacturers:
   1. Appleton
   2. Raco
   3. Steel City
   4. American Electric

2.02 CONCRETE BOXES:

A. Galvanized steel for encasing in concrete with conduit knockouts and threaded holes for mounding devices and/or coverplates.

B. Acceptable Manufacturers:
   1. Appleton
   2. Crouse Hinds
   3. Raco
4. Steel City

2.03 MASONRY BOXES:

A. Galvanized steel for mounting in masonry walls with conduit knockouts and threaded holes for mounding devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Raco
3. Steel City
4. Crouse Hinds

2.04 CAST BOXES:

A. Cast malleable iron, cadmium/zinc plated finish, NEMA 3R, threaded conduit entries, neoprene coverplates gasket and threaded holes for mounting devices and/or coverplates.

B. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Raco
4. Steel City

2.05 JUNCTION AND PULL BOXES:

A. Dry Locations: Galvanized sheet steel, NEMA 1, welded seams and cover held by stainless steel screws or bolts.

B. Damp or Wet Locations: Cast malleable iron with corrosion-resistant finish, NEMA 3R, threaded conduit entries, neoprene coverplate gasket, and coverplate held by stainless steel bolts.

C. Acceptable Manufacturers:
1. Appleton
2. Crouse Hinds
3. Hoffman
4. Killark

2.06 FLOOR BOXES:

A. As specified on the drawings for particular application.

2.07 PLASTIC BOXES

A. Schedule 40 Polyvinyl cloride

B. Acceptable Manufacturers:
1. Carlon
2. Queen City
3. Raco

PART 3 - EXECUTION

3.01 DEVICE APPLICATIONS:

A. Boxes for switches, receptacles, dimmers (designed for device box mounting) and future devices:

1. For dry Locations:
a. When recessed:
1) For construction other than concrete or masonry, use interior outlet box.
2) For concrete: Concrete box
3) For masonry: Masonry box or square interior outlet box with masonry extension.
b. When surface: Cast box
2. For Damp or Wet Locations:
a. When recessed:
1) For concrete: Concrete box
2) For masonry: Masonry box or square interior outlet box with masonry extension.
b. When surface: Cast box
3. For hazardous Areas: Hazardous area boxes

3.02 GENERAL APPLICATIONS:

A. For lighting fixtures, equipment connections, pullboxes for conduit 1" and smaller, and junction boxes for conduits 1" and smaller.

1. Recessed Interior Box:
a. For construction other than concrete or masonry, use octagonal or square interior outlet box.
b. For concrete: Concrete box
c. For masonry: Concrete box or square interior box with masonry extension.
2. Box Above an Accessible Ceiling: Octagonal or square interior outlet box.
3. Exposed Interior Box:
a. Above 7'-0": Octagonal or square interior outlet box or conduit body.
b. 7'-0" and below: Cast box or conduit body
4. Exterior Box:
a. When recessed in vertical element or ceiling:
1) For concrete: Concrete box
2) For masonry: Concrete box or square interior box with masonry extension.
3) For construction other than concrete or masonry, provide square interior box.
b. Flush mounted in ground: Cast junction box
c. Exposed: Cast box or conduit body.

B. Hazardous Locations: Hazardous area box

C. Integrally Mounted Boxes: Boxes which are an integral part of an equipment assembly from the manufacturer and are UL listed for the application may be used in lieu of the boxes prescribed above.

3.03 JUNCTION BOXES AND PULL BOXES (conduits larger than 1"):

A. Junction boxes or conduit bodies where junction is exposed

3.04 SUPPORT:

A. General: Support each box from the building structure independently of conduit as follows, utilizing a support system capable of carrying 300% of load.

1. Surface:

a. Structural Steel: Bolted directly to steel member or bolted to spring clip which is clipped to steel member.
b. Concrete: Power driven fastener or bolt to expansion anchor set in drilled hole.
c. Wood: Screw or bolt to wood.
2. Suspended: Bolted to engineered spring clip which is clipped to suspended ceiling system.
3. Recessed:
a. Concrete: Set in concrete prior to pour.
b. Masonry: Set or cut into masonry during masonry errection. Grout in around box.
c. Drywall: Attach directly to stud or joist by screw or bolt; or directly to a galvanized steel support which is attached directly at each end to stud or joist by screw or bolt.
d. Earth: Compact earth around box

3.05 INSTALLATION:

A. Outlet locations indicated on the plans are approximate. Coordinate and determine the exact location at the building. The architect reserves the right to shift the exact location of any outlet 10 feet before it is permanently installed without any additional cost to the Owner.

B. Install boxes plumb when vertical, level when horizontal and flush adjacent surface when recessed.

C. Where an outlet occurs in an architectural feature, center the outlet in same.

D. Where the mounting height of a wall outlet is not shown, mount at height directed by Architect. Mounting heights are from finished floor to box centerline unless noted otherwise.

E. The contractor may, with Architect's approval, slightly vary an outlet's mounting height so that the box's top or bottom occurs at a masonry joint.

F. Where outlets at different levels are shown adjacent, install them on the same vertical line.

G. Space wall switch outlets with first gang box 4" from door trim on the installed strike side. Verify all door swings prior to installing wall switch outlet boxes.

H. Locate boxes and conduit bodies so that covers are accessible and removable.

I. Limit masonry cuts from outlet boxes so that coverplate covers the cut.

J. Provide plaster rings for all boxes set in plaster walls or ceilings.

K. Match configuration to application.

L. Utilize box size (capacity) based upon NEC.

M. For devices, utilize boxes designed to support the device independently of coverplate and so install.

N. Cover unused conduit openings with plastic covers for sheet steel boxes and threaded plugs for cast boxes.

O. Prior to pulling conductors or installing devices, clean boxes of dirt, debris and water.

P. Cover all boxes and secure with screws or bolts.

Q. Install pullboxes to limit pulling distance and/or pulling bends.

END OF SECTION 16130

SECTION 261350

UNDERGROUND ENCLOSURES/PULLBOXES

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide underground enclosures and pullboxes as shown and as specified. Enclosures shall be manufactured with closed bottoms, removable covers, and concrete gray finish.

B. Related Sections:
1. Section 16050: Electrical General.

C. Standards:
1. Underwriters Labratories labeled and listed for application specified.

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 UNDERGROUND ENCLOSURES:

A. Underground enclosures shall designed to be installed flush to grade with the cover fitting flush to the box.

B. The enclosures shall be suitable for installation in either direct or buried native soil, embedded in concrete.

C. The enclosures shall be capable of withstanding normal shipping and installation practices without chipping, cracking, or structural damage.

D. The enclosures shall be of a stackable design for greater installation flexibility.

E. All covers are to be equipped with a minimum of two lockdown mechanisms. All covers shall have a logo recessed into the cover and it shall read "COMMUNICATION" (or as specified on the plans).

F. All enclosure covers will have some type of recessed access point to allow removal of the cover with a hook. The access points will be placed in such a location to allow for the greatest amount of leverage and safety possible.

G. Enclosures shall be designed and suitable for installations and use through a temperature range of -40ºC (-40ºF) to 60ºC (140ºF).

H. Material Safety Data Sheets (MSDA) must be attached in a weather tight vessel on each pallet.

I. All enclosures and covers are to be rated for a static vertical design load of 15,000 lbs. and must pass a minimum static vertical test load of 22,568 lbs. A physical description of the testing

methods shall be included with the test reports. Load versus deflection curves shall also be provided. Deflection under design load shall not exceed ½" for the cover and ¼" per foot of length of enclosure. When the enclosure dimensions are not uniform, an average of the minimum and maximum dimensions shall be used to determine the length used to calculate the allowable deflection.

J. Permanent deflection of any surface shall not exceed 10 percent of the maximum allowable static design load deflection. None of the cyclic loadings shall exceed the maximum allowable deflection. In no case shall any permanent deflection of the cover, enclosure or extension be great enough to interfere with the placement or removal of the cover on the enclosure.

K. The covers shall be skid resistant and have a minimum coefficient of friction of 0.50 on the top surface of the cover. Coatings will not be approved.

L. Any point on the covers must be able to withstand a 70 foot-pound impact administered with a 12 pound weight having a "C" tup (ASTM D-2444) without puncturing or splitting.

M. The material specimen samples shall have the following characteristics:

Material Designation	Compressive Strength	Tensile Strength	Flexural Strength
Standard Weight	11,000 psi	1,700 psi	7,500 psi

N. The material is tested according to the requirements of ASTM D543, Section 7, Procedure 1, for chemical resistance, using the following chemicals in the concentrations noted:

Chemical	Concentration
Sodium Chloride	5%
Sulfuric Acid	0.1 N
Sodium Carbonate	0.1 N
Sodium Sulfate	0.1 N
Hydrochloric Acid	0.2 N
Sodium Hydroxide	0.1 N
Acetic Acid	5%
Kerosene	Per ASTM D543
Transformer Oil	Per ASTM D543

O. Other required acceptance standards are:

1. ASTM D756, Procedure E: Accelerated Service Exposure.
2. ASTM G53: Recommended Practice for Operating Light and Water Exposure on Non-metallic Materials (with a UVA 340 bulb)
3. ASTM D570, Section 5, 6.1, 6.5: Water Absorption.
4. ASTM D790: Flexural Properties.
5. ASTM D635: Flammability Test.

P. The manufacturer is responsible for proof of compliance with the latest version of the ASTM standards.

Q. Except for the flammability test, the minimum acceptance criteria for material retention is 75% of the control specimen values for load and deflections no more than 2% change in weight or any dimension, no visual cracking, crazing, checking, blistering, or surface pitting. For the flammability test the burning rate must be less than 0.3 inches in length for each 0.1 inches of thickness.

R. Acceptable manufacturers:
1. Quazite by Hubbell (PG series or equal)
2. Equals shall be submitted to the Engineer for prior approval

PART 3 - EXECUTION:

3.01 INSTALLATION

A. Mount enclosure flush with finish grade as indicated on plans per manufacturers recommendations

B. Installations shall be in commercial sidewalks and behind curbs where no delibrate traffic is planned. All locations shall be approved by Carmax prior to starting work.

END OF SECTION 16135

SECTION 261400

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
   1. Provide switches, receptacles, dimmers and other strap mounted wiring devices as shown on the drawings.

B. Related Sections:
   1. Section 16050: Electrical General
   2. Section 16130: Boxes

C. Standards:
   1. Underwriters Laboratories listed and labeled.
   2. NEMA (configurations as listed)

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Acceptable Manufacturers of Switches, Receptacles, and Coverplates:
   1. Products specified as standard of quality are manufactured by Hubbell Incorporated, Wiring Device Division; referred to as Hubbell.
   2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
      a. Arrow-Hart
      b. Bryant
      c. Leviton
      d. Pass and Seymor/Legrand
      e. Slater
   3. Manufacturers product numbers listed below do not include color selection. Refer to Section 16140, 2.06 for device colors

2.02 RECEPTACLES:

A. Duplex - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with ground screw, NEMA 5-20R.
   1. Hubbell # 5362.

B. Single - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with ground screw, NEMA 5-20R.
   1. Hubbell # 5361.

C. Duplex Isolated Ground - 20A: 2-pole, 3-wire, 125 Volts, side/back wiring with insulated/ isolated ground screw, NEMA 5-20R.
   1. Hubbell # IG5362.

D. Duplex Ground Fault Circuit Interrupter - 20A: 2-pole, 3-wire, 125 Volts, pigtail wiring, thru wiring to protect 4 receptacles downstream, test and reset buttons, NEMA 5-20R.
   1. Hubbell # GF20.

E. Plugstrips - 20A: 2-pole, 3-wire, 125 Volts, receptacles at every 6" on center.
   1. Wiremold Plugmold #2100 with #2127GT receptacles
   2. Provide all fittings and accessories for a complete installation

F. Special Purpose - as noted on the drawings.

G. Floor outlets - as noted on the drawings.

2.03 SWITCHES:

A. Single Pole Single Throw Toggle: 20 Ampere, 120/277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
   1. Hubbell # 1221.

B. Double Pole Single Throw Toggle: 20 Ampere, 120/277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
   1. Hubbell # 1222.

C. Three Way Single Throw Toggle: 20 Ampere, 120/277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
   1. Hubbell # 1223.

D. Four Way Single Throw Toggle: 20 Ampere, 120/277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
   1. Hubbell # 1224.

E. 120 Volt Pilot Light Switch: 20 Ampere, 120 Volt, maintained contacts, single pole single throw, side/back wiring, red handle illuminated when circuit is energized.
   1. Hubbell # HBL1221PL

F. 277 Volt Pilot Light Switch: 20 Ampere, 277 Volt, maintained contacts, single pole single throw, side/back wiring, red handle illuminated when circuit is energized.
   1. Hubbell # HBL1221PL7.

2.04 LIGHTING CONTACTORS:

A. Enclosed contactors:
   1. Number and arrangement of poles as per plans
   2. Operation for 120/208V or 277/480V loads as per plans
   3. Continous duty amperage as per plans
   4. Asco series #920 or equals by:
      a. Square D
      b. General Electric
      c. Siemens/ITE
      d. Cutler-Hammer

2.05 COVERPLATES:

A. Stainless Steel Coverplates:
   1. Smooth stainless steel, satin finish, 0.040 inch thick, accurately die cut, protected with release paper, oversize (3-1/8" x 4-7/8" , single gang), in configurations up to six (6) gang as indicated on the drawings, screws to match finish, and openings to match device.

B. Surface Mounted (only where specifically allowed on plans or approved in writing by Architect):
   1. Corrosion-resistant steel, rounded corners and edges, stainless steel screws, single or multiple gang as indicated on the drawings. Openings to match device(s) and construction to match box.

D. Weatherproof:
   1. Gasketed, hinged with spring loaded closers, secured with corrosion-resistant screws and UL listed for wet location.

2.06 DEVICE AND COVERPLATE COLOR/FINISH:

A. Sales Building, Break and Training Rooms

1. Wiring devices shall be LIGHT ALMOND with LIGHT ALMOND coverplates.

2. Isolated ground devices shall be ORANGE with LIGHT ALMOND coverplates.

3. Devices installed in floor boxes, surface mounted boxes, and wiremolds shall be GREY (ORANGE for isolated ground devices).

B. Service, FQC and Carwash:

1. Wiring devices shall be GREY with SATIN FINISH STAINLESS STEEL coverplates.

2. Isolated ground devices shall be ORANGE with SATIN FINISH STAINLESS STEEL coverplates.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install the type device indicated by symbol or legend at the location shown on the plans.

B. Install devices after conductors are pulled and painting is completed.

C. Install devices vertically, unless otherwise noted, with SPST switches having up as "ON" and receptacles having ground pin at bottom.

D. Where more than one device is indicated at a location, the devices shall be mounted adjacent to each other with not more than 6” horizontal separation between outlets.

E. Coordinate location of devices with other trades and architectural features. Do not locate devices on two different finishes such as half on wall tile and half on painted surface.

F. Ampere ratings of receptacles served with dedicated circuits shall match the ampere rating of the overcurrent device, whether indicated on the plans or not.

END OF SECTION 16140

SECTION 261700

MOTOR AND EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide power wiring to each motor, all mechanical equipment, all service equipment,and all miscellaneous equipment included in the contract documents. Power wiring is the system of conductors from the energy source to the equipment that conducts the electrical energy which does work or provides heat.
2. Provide a disconnect switch, fused where prescribed, for each motor or piece of equipment.

B. Related Sections:

1. Section 16440: Disconnect Switches
2. Section 16475: Overcurrent Protection
3. Section 16050: Electrical General
4. Section 16480: Motor Starters
5. Section 16710: Energy Management System

PART 2 - PRODUCTS

2.01 STARTERS:

A. Refer to Section 16480 for motor starter requirements.

2.02 MOTORS AND EQUIPMENT:

A. Motors, mechanical equipment, service equipment, etc., provided under other divisions.

2.03 CONTROL AND INTERLOCK WIRING:

A. All 120V control wiring or low voltage control wiring relating to NOVAR system controls is provided by Division 16, except where specifically prescribed on the plans. All other low voltage HVAC control wiring is provided by Division 15 unless noted otherwise on the plans.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Coordinate all rough-in and final power wiring and equipment connection with other subcontractors.

B. Install and connect individually mounted starters provided by other subcontractors.

C. Label each disconnect switch and starter with name of equipment it serves.

D. Coordinate overcurrent device rating with nameplate of motor or equipment which it protects.

E. Verify nameplate voltage of equipment prior to connection of power supply conductors. Equipment damage due to connection of incompatible supply voltage, whether indicated on plans or not, shall be the responsibility of this contractor.

F. Coordinate with Division 15 the locations for any and all Mechanical or Fire Protection control devices requiring 120 volt power prior to any work. All wiring and conduit for 120 volt controls shall be by Division 16.

END OF SECTION 16170

SECTION 261950

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Identify the following electrical equipment with a nameplate or directory indicating load served or equipment name:
   a. Switchboard, Main and all Branches
   b. Transformer
   c. Panelboards, Main and Branch Breakers
   d. Disconnect Switches and Motor Starters
   e. Contactors, Time Switches, and Relays

1.02 SUBMITTALS:

A. Sample of Nameplate

PART 2 - PRODUCTS

2.01 NAMEPLATES:

A. 277 Volt and 480 Volt equipment - Bakelite Label, red face, white core.

B. 120 Volt, 208 Volt, and 240 Volt - Bakelite Label, black face, white core.

C. Lettering:
   1. Main Service Disconnect - 1/2" high letters.
   2. All others - 1/4" high letters.

2.02 PANELBOARD DIRECTORY:

A. Panelboard Manufacturers Directory in plastic sleeve on inside of panel cover door.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Securely mount each nameplate to its respective equipment with screws or epoxy type cement. Double sided foam core type tape is not acceptable.

B. Type in the branch breaker load information onto the manufacturers panel directory. Mark all spares in pencil. Install in plastic sleeve on inside of panel cover door.

C. Label all junction box covers with the circuit number installed in the box with a permanent marker.

D. Each service disconnecting means shall be permanently marked to identify it as a service disconnect per NEC 230-70(b).

E. Where building is served by more than one service per plans, provide permanent plaques to identify locations of all other service disconnects per NEC 230-2(e). Coordinate format of identification with local authority having jurisdiction.

END OF SECTION 16195

SECTION 264200

SERVICE ENTRANCE

PART 1 - GENERAL

1.01 SUMMARY:

A. Description

1. Provide electrical service entrance as shown on the drawings and specifications.
2. Provide transient voltage source suppression for the service entrance.
3. Electrical service shall be 480Y/277 volts, 3 phase, 4 wire wye connected.

B. Related Sections

1. Section 16050: Electrical General
2. Section 16110: Raceways
3. Section 16120: Wire and Cables
4. Section 16630: Transient Voltage Surge Suppression (TVSS) System

PART 2 - PRODUCTS

2.01 TRANSIENT VOLTAGE SURGE SUPPRESSOR:

Refer to Section 16630 for Transient Voltage Surge Suppressor specifications.

3.0 PART 3 - EXECUTION

3.01 SERVICE ENTRANCE INSTALLATION:

A. Provide service entrance conductors as indicated on the drawings.

B. Encase service entrance conduits in 3" concrete envelope.

C. Where service entrance conduits pass through the interior of any building or structure without first terminating immediately at a service disconnect, conduits shall be encased in concrete at least than 2" thick per NEC art. 230-6 if approved by the local authority having jurisdiction.

3.02 UTILITY COMPANY COORDINATION:

A. Provide metering as indicated on the drawings. Obtain and comply with utility company metering requirements.

B. Obtain requirements for installation of utility company's transformers and primary cabling. Provide conduits, concrete pads, elbows, etc. as required by utility company.

C. Coordinate connection requirements of service entrance conductors to utility company transformer.

END OF SECTION 16420

SECTION 264230

CPI MODULAR SWITCHGEAR

Part 1 - General:

1.1 Overview

A. The ***Control & Power Integration System*** is a U.L. Listed method of integrating all building electrical switchgear, electrical controls and, when applicable, energy management systems into a unitized package. For the remainder of this section, this unitized package may also be referred to as the CPI System or Unitized Switchgear.

1.2 Summary

A. CarMax Auto Superstore, Inc. maintains a national account with CPI. Unitized Switchgear are provided by owner, furnished through the CPI package. Deliveries are to be coordinated by Contractor. Contractor is responsible for scheduling delivery dates with CPI, off loading, storage, and protecting equipment for installation. Contractor shall obtain bill of materials & installation requirements from CPI prior to bid. Contractors bid shall include all items reflected on drawings that are not indicated on CPI's bill of materiasl.

B. As part of the base bid as described on plans, contractor shall receive delivery of and install the unitized electrical switchgear as manufactured by Carolina Products, INC.

C. The Unitized Switchgear shall incorporate:

1) All applicable switchgear consisting of Distribution Panelboard(s), Sub-Panelboard(s), neutral bars and ground bars.

2) All applicable electrical controls components and associated wiring.

3) All applicable sub-panel feeders, control wiring and branch circuit wiring. All wiring shall be copper conductors with a minimum insulation rating of 75^{o}C.

D. Unitized Switchgear will include the various component's specification sheets and operation manuals. Carolina Products will supply two (2) copies of as built drawings to be shipped with the equipment. The above mentioned materials shall constitute a CPI System Manual. If additional manuals are required, they may be purchased through Carolina Products at (800) 736-4455.

E. The CPI System shall meet U.L. 508 and U.L. 891 and listed as a complete assembly.

1.3 Enclosure Construction

A. Enclosures shall be constructed of 1/8" thick aluminum and shall have a natural brushed finish.

B. Each enclosure shall be 84" tall by 10" deep by a maximum of 47" wide.

C. Each enclosure bottom shall have a minimum of 1 1/8" flange on all sides for stability. Remaining area shall be open for conduit entry.

D. Each enclosure shall have a 1/8" thick hinged aluminum door with a raised 1" flange on all sides. This will make the enclosure with its door a total of 11" deep.

E. Each enclosure door shall be hinged so that it can be easily removed when necessary, such as during installation. (Exception: If components mounted on the door require wiring interface, this door shall be mounted so that it can not be removed to prevent accidental damage of components and wiring.) The removal of the enclosure door shall not require the hinge system to be disassembled

F. Each enclosure door shall be held closed by 1 of 2 methods.

1) Bolted along the edge opposite of the hinge.

2) A three-point locking handle which consists of extension rods with rollers. This assembly shall be of high quality and ensure the ease of door operation. All locking handles shall be keyed alike.

G. Each enclosure shall have all applicable cut-outs to expose all circuit breakers.

H. Upon request, a hinged panelboard outer door will be supplied. This door shall be constructed of 1/8" thick aluminum and be non-removable. This door will be held closed by a non-locking "T" style handle. Upon request, this panelboard outer door may also have a locking handle. These handles shall be keyed alike.

I. An enclosure and the enclosure door shall constitute a cabinet section.

J. These cabinet sections shall be bolted together as needed to form a U.L. Listed complete assembly.

K. Each cabinet section shall be labeled as a Type 1 Enclosure.

L. Each cabinet section shall bear the appropriate U.L. Label on the outside of the enclosure door in plain sight.

M. Each cabinet section will have a metal plate mounted on the outside of the cabinet door and have the following information stamped onto the metal plate.

1) Carolina Products Project Number for project tracking
2) Section number X of X total sections
3) Section Voltage & type of system (ex. 120/208V 3 phase 4 wire)
4) Section FLA (Full Load Amps)
5) Section Neutral FLA
6) Section Fault Current Rating (ex. 10K AIC)

1.4 Switchgear

A. All switchgear supplied by Carolina Products shall be industrial grade manufactured by Square "D", Westinghouse or General Electric.

B. Unless specified in writing to Carolina Products from bodies having authority, Carolina Products reserves the right to choose one of the switchgear manufacturers listed above.

C. For the remainder of this section, the terms switchgear, service panelboard(s) or panelboard(s) shall include and apply to all manufacturers.

1.5 Service Panelboard(s) shall meet the following criteria:

A. U.L. Listed equipment
B. Rated for a maximum 600 VAC.
C. Rated and labeled for use as Service Entrance Equipment.
D. Copper Bus rated for 1000A PSI (per square inch).
E. Meet all requirements as specified on drawings unless otherwise approved.
F. Rated equal to or greater than the maximum available Fault Current.
G. Include all branch circuit breakers as specified on drawings unless otherwise approved
H. All lugs, including branch circuit breakers, shall be rated for a minimum of 75°C.
I. When surge suppression is required, a Liebert AccuVar Surge Suppression System shall be factory installed and wired by Carolina Products.

1.6 Panelboard(s) rated at 480 VAC shall meet the following criteria:

A. U.L. Listed equipment
B. Copper Bus
C. Meet all requirements as specified on drawings unless otherwise approved.
D. AIC Rating per drawings
E. Include all branch circuit breakers as specified on drawings unless otherwise approved
F. All branch breakers shall be bolt-on type circuit breakers.
G. All lugs, including branch circuit breakers, shall be rated for a minimum of 75°C.
H. A United Power Surge Suppression System shall be factory installed and wired by Carolina Products.

1.7 Panelboard(s) rated at 240 VAC or less shall meet the following criteria:

A. U.L. Listed equipment
B. Copper Bus
C. Meet all requirements as specified on drawings unless otherwise approved.
D. AIC ratings per drawings
E. Include all branch circuit breakers as specified on drawings unless otherwise approved
F. All branch breakers shall be bolt-on type circuit breakers.
G. All lugs, including branch circuit breakers, shall be rated for a minimum of 75°C.
H. A United Power Surge Suppression System shall be factory installed and wired by Carolina Products.

1.8 Factory Assembled Specifications

A. Switchgear
1) Service panelboard(s) and sub-panelboard(s) shall be mounted so that their deadfronts are flush with the enclosure doors. Also, branch circuit breakers shall be accessible without opening the enclosure door.
2) All panelboard(s) provided by Carolina Products that are specified as remote mounted will be shipped as loose items including panelboard, breakers, can and cover.
3) All panelboard(s) shall be clearly labeled with a red plastic label with white engraved lettering. These labels shall be pop riveted in place.
4) Panelboard(s) shall be provided with a computer generated circuit directory card that will be placed in a metal frame with a plexi-glass cover and pop riveted in place.
5) All ground bars and neutral bars shall be provided and mounted by Carolina Products.
6) All feeder and branch circuit wiring shall be copper conductors with a minimum insulation rating of 75°C.

B. Electric Controls
1) Typical control components may consist of but not limited to relays, transformers, contactors, pilot lights, switches, terminal strips, CPI System 1000 or other owner specified building management system.
2) Components will vary depending upon application and additional components other than those mentioned above may be required.
3) All components shall be factory mounted and wired by Carolina Products unless otherwise specified.
4) All component wiring shall be copper conductors with a minimum insulation rating of 75°C.

C. Testing & Quality Control
1) Complete System shall pass a dielectric test per U.L. 508 standards.
2) Complete System shall be reviewed for proper assembly.
3) All components and associated wiring shall be tested for defects and proper operation.

1.9 Installation

A. When the unitized switchgear is required to ship in multiple sections, the electrical contractor shall assemble these sections according to the accompanying drawings.
B. Contractor shall install all bolts, which are provided by Carolina Products, required to join the cabinet sections.
C. When necessary, the electrical contractor shall reconnect all wiring plugs or terminate all wires between cabinets as marked by Carolina Products.
D. Electrical contractor shall terminate all field wiring, such as non-controlled branch circuit wiring, as specified on the drawings provided with the CPI system.

E. Electrical contractor shall conduct all work associated with the CPI system in a neat and professional manner.
F. Contractor shall install 3” high concrete housekeeping pads for all floor-mounted CPI gear.

1.10 Delivery, Scheduling & Technical Information

Carolina Products, Inc.
1132 Pro Am Drive
Charlotte, NC 28211
(800) 736-4455

END OF SECTION 16423

SECTION 264250

SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide a sectional, totally free-standing, indoor, steel enclosed, dead front switchboard as specified herein and scheduled on the drawings.

B. Related Sections:
   1. Section 16050: Electrical General
   2. Section 16420: Service Entrance
   2. Section 16475: Overcurrent Protection

C. Standards:
   1. Underwriters Laboratories #891
   2. Nema #PB2
   3. NFPA 70 (National Electrical Code)

1.02 SUBMITTALS:

A. Manufacturers Products Data Sheets

B. Shop Drawings:
   1. Dimensional Data
      a. Top View
      b. Floor plan w/conduit openings
      c. Side view
      d. Front elevation
   2. Power/distribution Schematic
   3. Ground Fault Protection Schematic
   4. Lightning Arrestor/Surge capacitor Schematic
   5. Meter Panel Layout

PART 2 – PRODUCTS

2.1 MANUFACTURER:

A. CPI is the only acceptable supplier.

B. CarMax Auto Superstore, Inc. maintains a national account with CPI. Switchboards are provided by owner, furnished through the CPI package. Deliveries are to be coordinated by Contractor. Contractor is responsible for scheduling delivery dates with CPI, off loading, storage, and protecting equipment for installation.

2.02 SWITCHBOARD:

A. The switchboard shall be deadfront with front accessibility required. The switchboard frame shall be 90 inch. high of formed code gauge steel rigidly welded and bolted together to support all cover plates, bussing and component devices during shipment and installation. Steel

base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit. The switchboard enclosure shall be painted on all exterior and interior surfaces. The paint finish shall be a medium light gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. All front covers shall be screwed on and removable and all doors shall be hinged with removable hinge pins. Top and bottom conduit areas shall be clearlyindicated on shop drawings.

B. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 for temperature rise. Through bus shall be extruded aluminum plated by the ALSTAN 70 or 80 process. The through bus shall have an ampacity as shown in plans and shall be rated to withstand a short circuit current rating of the RMS symmetrical amperes value as shown in the plans. The through bus supports, connections and joints are to be bolted together with hex-head bolts and Belleville washers to minimize maintenance requirements.

C. Each switchboard, as a complete unit, shall be given a single short circuit current rating by the manufacturer. Such ratings shall be established by the actual tests by the manufacturer, in accordance with UL specifications, on equipment constructed similarly to the subject switchboard.

D. The switchboard shall be rated for 480/277 volts, 3 phase, 4 wire service, and UL listed for service entrance.

E. Provide a 25% ground bus full length, securely bolted to each frame with sectionalizing links at shipping section boundaries.

F. In each service entrance section, provide a removable disconnecting link in the neutral (ground) bus, and a removable links shall be front accessible where rear accessibility is not maintained. Coordinate location of ground and neutral links with all applicable ground fault sensor requirements.

G. When one switchboard has more than one group of service entrance conductors (busway or cable), provide a 12 gauge steel barrier full height and full depth of the switchboard to separate and isolate each group of service entrance conductors.

H. Arrangement of phases, phase A - B - C, left to right, top to bottom, and front to rear.

I. The switchboard shall contain any necessary provisions for customer metering as required by ASHRAE 1989-90.1.

2.04 BRANCH MOLDED CASE CIRCUIT BREAKERS:

A. Group mounted molded case circuit breakers are to be totally front accessible. The circuit breakers are to be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. The circuit breakers are to be removable by the disconnection of only the load side cable terminations and all line and load side connections are to be individual to each circuit breaker. No common mounting brackets or electrical bus connectors will be acceptable.

B. Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.

2.05 METERING COMPARTMENT:

A. When indicated on the drawings or required by the local utility company, provide a current transformer compartment, located in the service entrance section of the switchboard for metering.

B. The compartment shall be barriered and covered with a hinged door with sealing provisions. A voltmeter, ammeter, power factor meter and watthour meter shall be mounted in the door and supplied with current and potential transformers and instrument transfer switches where required. All front plated used for mounting meters, instrument transfer switches or other front mounted devices shall be hinged with all wiring installed.

2.06 GROUND FAULT PROTECTION:

A. A ground fault protection system shall be included when indicated in the switchboard schedule or where otherwise indicated on the plans. It shall consist of a current sensor, relaying device, test with and without tripping device, and an appropriately sized molded case circuit breaker or fusible bolted pressure contact switch. Components shall be designed to operate in conjunction with each other, and the system shall be UL listed. Installation of the equipment shall in all respects be in accordance with the manufacturer's recommendations.

B. A current sensor shall be provided which is of sufficient size to properly encircle all phase and neutral (when used) conductors of the circuit to be monitored. The current sensor shall be coordinated with the input required by the ground fault relay. The current sensor shall include a test winding which allows the complete system , including the current sensor, ground fault relay, and circuit interrupting device, to be tested under simulated ground fault conditions. The frame of the current sensor shall be constructed so that one leg can be removed to prevent disturbing cables or bussing during installation or removal of the sensor.

C. The ground fault relay shall be designed to provide instantaneous (0.03 seconds) operation when a ground fault of sufficient magnitude occurs within the relay's zone of protection, and by zone selective interlocking to provide a restrained time delay operation when the fault occurs downstream but outside the relay's zone of protection.
The relay shall be solid state construction for maximum reliability and shall require 120 volt power for operation of the relay as well as the associated circuit interrupting device. Current settings for the ground fault pickup point shall be field adjustable continuously from 100 thru 1200 amperes. A calibrated dial shall be provided for setting the ground fault pickup point. Settings for individual relays shall be as indicated on the plans. The restrained time delay for each zone shall be field adjusted to be 0.2 seconds.

D. A testing/monitoring system which uses the test winding of the current sensor to simulate a ground fault condition shall be supplied. This test system shall be UL listed to comply with the National Electrical Code requirements for performance testing.
1. Components shall be supplied which allow testing of the ground fault system with or without tripping the circuit interrupting device. System operation as a result of a ground fault shall be confirmed by lighting a red indicating lamp.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install switchboard on 3" high concrete housekeeping pad. Secure switchboard to floor and/or walls with anchors approved for the material in which they are installed.

B. Make provisions to obtain current transformers from the local utility company and deliver same to switchboard manufacturer for factory installation in the switchboard.

C. Tighten all bolted connections in and to switchboard to torque rating specified per manufacturers recommendations.

D. Tighten all conductors with mechanical connections, torqued in accordance with the conductor and/or connector manufacturers markings as well as the values referenced in the following publications:
1. Underwriters Laboratories Electrical Construction Directory (Green Book).
2. Underwriters Laboratories Electrical General Information (White Book).

E. Securely strap all conductors in switchboard allowing for sufficient bending radius as specified in NFPA 70.

END OF SECTION 16425

SECTION 264300

DISTRIBUTION PANELS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide an indoor, steel enclosed, dead front, main distribution panelboard with circuit breakers as specified herein and scheduled on the drawings.

B. Related Sections:
   1. Section 16050: Electrical General
   2. Section 16475: Overcurrent Protection

C. Standards:
   1. Underwriters Laboratories #891
   2. Nema #PB2
   3. NFPA 70 (National Electrical Code)
   4. Underwriters Laboratories #67

1.02 SUBMITTALS:

A. Manufacturers Products Data Sheets

B. Shop Drawings:
   1. Dimensional Data
      a. Top View
      b. Floor plan w/conduit openings
      c. Side view
      d. Front elevation
   2. Power/distribution Schematic

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. CPI is the only acceptable supplier.

B. CarMax Auto Superstore, Inc. maintains a national account with CPI. Distribution Panels are provided by owner, furnished through the CPI package. Deliveries are to be coordinated by Contractor. Contractor is responsible for scheduling delivery dates with CPI, off loading, storage, and protecting equipment for installation

2.02 DISTRIBUTION PANELS:

A. The distribution panel shall be deadfront with front accessibility required. The main distribution panel shall be constructed of code gauge steel rigidly welded and bolted together to support all cover plates, bussing and component devices during shipment and installation. The enclosure shall be painted on all exterior and interior surfaces. The paint finish shall be a medium light gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. All front covers shall be screwed on and removable and all doors shall be hinged

with removable hinge pins. Top and bottom conduit areas shall be clearly indicated on shop drawings.

B. The bussing shall be of sufficient cross-sectional area to meet UL Standard 891 for temperature rise. The bus shall be extruded aluminum plated by the ALSTAN 70 or 80 process.

C. Each distribution panel, as a complete unit, shall be given a single short circuit current rating by the manufacturer. Such ratings shall be established by the actual tests by the manufacturer, in accordance with UL specifications, on equipment constructed similarly to the subject panel.

D. The distribution panel shall be rated for 240 volts or 480 volts (as indicated on the drawings), 3 phase, 4 wire service, and UL listed for service entrance where utilized as a main distribution panel.

2.03 MOLDED CASE CIRCUIT BREAKERS - MAINS AND BRANCHES:

A. Common Characteristics
1. Circuit breakers shall be constructed using glass reinforced polyester insulating material providing superior dielectric strength. Current carry components shall be completely isolated from the handle and the accessory mounting area.
2. Circuit breakers shall have an overcenter, trip-free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
3. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
4. Circuit breaker escutcheon shall have International I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the "ON" or "OFF" position.
5. Breaker faceplate shall indicate rated ampacity. Breaker faceplate shall indicate UL and IEC certification standards with applicable voltage systems and corresponding AIC ratings.
6. Circuit breakers shall be UL listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Auxiliary Switch, Alarm Switch, Ground Fault Shunt Trip, Electrical Operators, Cylinder Locks, Mechanical Lugs Kits, Compression Lugs Kits, and Handle Accessories.

B. Thermal Magnetic
1. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Thermal elements shall be factory calibrated to operate in a 40øC ambient environment. Thermal elements shall be ambient compensating above 40øC.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install panel on 4 inch high concrete housekeeping pad. Secure panelboard to floor and/or walls with anchors approved for the material in which they are installed.

B. Tighten all bolted connections in and to panelboard to torque rating specified per manufacturers recommendations.

C. Tighten all conductors with mechanical connections, torqued in accordance with the conductor and/or connector manufacturers markings as well as the values referenced in the following publications:

1. Underwriters Laboratories Electrical Construction Directory (Green Book).
2. Underwriters Laboratories Electrical General Information (White Book).

D. Securely strap all conductors, allowing for sufficient bending radius as specified in NFPA 70.

END OF SECTION 16430

SECTION 264400

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SUMMARY:

A. Description

1. Provide disconnect switches in configurations as indicated on the drawings complete with enclosures and accessories.

B. Related Sections

1. Section 16050: Electrical General
2. Division 1: Submittals
3. Section 16170: Motor and Equipment Connections
4. Section 16475: Overcurrent Protection

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Acceptable Manufacturers as Follows:

1. Square D

2.02 DISCONNECT SWITCHES:

A. Disconnect switches shall be heavy duty (NEMA Type HD) and Underwriters Laboratories Listed.

B. All switches shall have blades which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60 degrees C or 75 degrees C, aluminum or copper wires.

C. Switches shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position with at least three locks shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF".

D. Switches shall be furnished in NEMA 1 general purpose enclosures unless specified as NEMA 3R on the plans. Covers on NEMA 1 enclosures shall be attached with pin type hinges, NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured

fromgalvanized steel. Enclosures shall have a gray baked enamel finish, electrodeposited on cleaned, phosphatized steel.

E. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600 volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL listed short circuit rating of the switch, when equipped with Class H fuses, shall be 10,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amperes.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install disconnect switch adjacent to equipment it serves or as located on the plans.

B. Anchor enclosures firmly to walls and/or structural surfaces. Coordinate mounting of disconnects to roof top mechanical equipment with supplier/installer.

C. Coordinate with Division 15 for any factory provided disconnect switches on mechanical equipment.

D. Furnish fuses for fusible switches. Fuse sizes indicated on the drawings are provided for bidding purposes and are based on the equipment specified in other divisions of these specifications. Fuse sizes shall be based on the nameplate data of the equipment actually installed.

E. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance.

END OF SECTION 16440

SECTION 264500

GROUNDING

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide a grounding system for the main building service and each separately derived system originating at the respective grounding electrode(s) and radiating to every electrical power controlling and consuming device in the system.
2. If available, existing grounding system may be reused; verify condition of existing system and compliance with this section

B. Related Sections:

1. Section 16050: Electrical General
2. Section 16110: Raceways
3. Section 16120: Conductors

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.01 DRIVEN GROUND RODS:

A. Provide ten (10) feet long, 5/8 inch diameter copperclad steel ground rods.

2.02 EXOTHERMIC WELDS:

A. Provide exothermic copper welds with materials and configuration to match application.

B. Acceptable Manufacturers:

1. Cadweld

2.03 GROUND CLAMPS:

A. Bronze, U.L. listed, with configuration to match application.

B. Acceptable Manufacturers:

1. Burndy
2. Ilsco
3. Thomas & Betts
4. O.Z. Gedney

PART 3 - EXECUTION

3.01 SERVICE ENTRANCE GROUNDING ELECTRODES:

A. Driven Ground Rods: Install two driven ground rods minimum 10 feet apart, located outside of building, and as close as possible to the service switchboard but a minimum of 36" from the building foundation. Locate in non-paved area where feasible. Install so as to maintain accessibility to top of rod. Provide each with box with removable cover for inspecting ground rod connection. Install box so that top is flush with finished grade. In sandy or dry areas where the moisture content of soil is not adequate to maintain a suitable ground path, a UFER ground system shall be utilized.

B. Building Steel: Select a connection point on the building steel as close as possible to the domestic water service entrance that will also remain exposed.

C. Domestic Water Pipe: Select a connection point on the domestic water pipe as close as possible to the point it enters the building and that will also remain exposed.

D. Sprinkler Water Pipe: Select a connection point on the sprinkler water pipe as close as possible to the point it enters the building and that will also remain exposed.

3.02 MAIN SERVICE GROUNDING ELECTRODES BONDING CONDUCTORS:

A. Install a #3/0 bare stranded copper conductor between each grounding electrode and its closest grounding electrode neighbor so that all electrodes are bonded together.

B. Exothermic weld each bonding connection both cable to cable and cable to grounding electrode.

3.03 MAIN SERVICE GROUNDING ELECTRODE CONDUCTOR:

A. Install a bare stranded copper conductor (size as indicated on plans or #3/0 if not specified) from the closest driven ground rod to the service entrance device ground bus.

B. Exothermic weld the connection to the ground rod and ground bus.

3.04 SEPARATELY DERIVED SYSTEM GROUNDING ELECTRODE:

A. Select a local grounding electrode described by the National Electrical Code and make connection to a point permanently visible.

3.05 SEPARATELY DERIVED SYSTEM GROUNDING ELECTRODE CONDUCTOR:

A. Install a stranded bare copper conductor sized according to NEC between the local grounding electrode and the separately derived system grounded conductor.

B. Exothermic weld the grounding electrode conductor to the grounding electrode.

3.06 ADDITIONAL BONDS:

A. Gas Service Pipe: Bond gas service pipe at the first accessible point nearest its entry to the building to the nearest main service grounding electrode with a 3/0 bare stranded copper conductor. Exothermic weld the connection at grounding electrode and to a ground clamp at the gas pipe.

B. Roof Structure: Bond roof structure steel at its nearest accessible point to the building steel connection point with a 3/0 bare stranded copper conductor. Exothermic weld both connections.

C. Domestic Water Meter: Install bond across water meter with 3/0 stranded bare copper conductors of sufficient length to accommodate removal of meter. Exothermic weld both connections to water pipe.

D. Non-metallic Domestic Water Insulated Coupling: Install bond across insulated coupling with 3/0 stranded bare copper of sufficient length to accommodate removal of coupling. Exothermic weld both connections to water pipe.

E. Gas Meter: Install bond across gas meter with a 3/0 stranded bare copper conductor of sufficient length to accommodate removal of meter. Use ground clamps on pipes and exothermic weld cable to clamps.

F. Telephone Service: Provide a No. 6 bare stranded copper conductor bonded to the nearest exposed point on the grounding electrode system or the grounding electrode conductor to the telephone service backboard and leave six(6) feet slack at the backboard.

G. Where a building is supplied by more than one service, provide a #3/0 bare copper conductor in 1" conduit between each main grounding electrode system of each service. Exothermic weld the connection at both ends.

H. Irrigation controller

3.07 EQUIPMENT GROUNDING CONDUCTOR:

A. General: Install a separate insulated copper conductor, color coded green, from respective panelboard ground bus to device and/or controller. Provide in all conduits (metallic or nonmetallic). Do not use conduit as only method of grounding.

B. All steel conduits entering the main switch shall have a threaded conduit insulated type "BLG" grounding busing bonded together and to the ground bus with a #4 bare stranded copper conductor.

3.08 ADDITIONAL EQUIPMENT GROUNDING CONDUCTORS:

A. Roof Top HVAC Units: Install an equipment grounding conductor from the respective switchboard or panelboard ground bus to the unit disconnect switch and from disconnect switch to equipment ground lug or to housing in absence of ground lug.

B. Install a separate copper equipment grounding conductor between the respective ground buses of the following:

1. Main Distribution Panel and each Panelboard
2. Main Distribution Panel and each Transformer
3. Transformer and each Panelboard
4. Panelboard and each Sub-panelboard

C. Isolated Ground Receptacles: Install a separate grounding conductor for each circuit from panelboard ground bus to isolated ground receptacles on that circuit.

D. Wiring Devices: At both switches and receptacles, provide a grounding jumper from the device to a screw on the device box.

E. Provide a separate insulated grounding conductor from the separate insulated ground bus of panelboards serving isolated ground receptacles back to the main service grounding point or the separately derived system grounding point where a transformer is used.

3.09 EQUIPMENT GROUNDING CONDUCTOR ROUTING:

A. Route equipment grounding conductor with respective feeder, power wiring and branch circuit conductors.

3.10 CONDUITS:

A. All grounding electrode conductors, equipment grounding conductors and bonds where not internal to equipment enclosures shall be installed in conduit to within 6" of terminating clamp or exothermic weld.

END OF SECTION 16450

SECTION 264600

TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide dry type transformers complete with enclosures, primary lugs, secondary lugs, and taps.

B. Related Sections:
   1. Section 16050: Electrical General.
   2. Section 16450: Grounding.

C. Standards:
   1. Underwriters Labratories labeled and listed.
   2. NEMA ST20.
   3. NFPA 70 (NEC)

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. CPI is the only acceptable supplier.

B. CarMax Auto Superstore, Inc. maintains a national account with CPI. Transformers are provided by owner, furnished through the CPI package unless noted otherwise on drawings. Deliveries are to be coordinated by Contractor. Contractor is responsible for scheduling delivery dates with CPI, off loading, storage, and protecting equipment for installation

2.02 DESCRIPTION:

A. Dead front construction, U.L. listed and labeled and conforming to NEMA and ANSI standards. Dry type, ventilated construction.

B. Steel enclosure with a gray enamel finish, removeable front and rear panels.

C. Insulation system U.L. rated 220 degrees Celsius having an average rise by resistance of 150 degrees Celsius per NEMA ST20.

D. Provide 6 - 2 1/2 taps, 4 below and 2 above.

E. Voltage: 480V delta to 208Y/120V.

F. Lugs to match conductors.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Set taps to yield a secondary voltage of 120V to 125V.

B. Provide lugs to match primary and secondary conductors prescribed.

C. Provide a nameplate on each transformer.

D. Provide grounding per NEC 250.

E. Provide a 3" housekeeping pad for exterior transformers weighing 500 pounds or more.

F. Transformer secondary conductors shall not exceed 10'-0" in length to main overcurrent protection device in equipment served per NEC 240-21(c)(2). If installation of conductors meeting this requirement is not possible due to location and/or orientation of equipment, provide an additional fused disconnect switch (whether shown on plans or not) located to satisfy the ten foot rule noted above.

G. Transformers indicated to be suspended shall be supported from structure utilizing 1/2" threaded rods and unistrut.

H. Transformers serving panels that contain mostly computer and/or related loads shall be K-4 rated (whether indicated on plans or not).

END OF SECTION 16460

SECTION 264700

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide panelboards complete with enclosure, circuit breakers, spaces, trims, covers, locks and accessories in configurations as indicated on the drawings.

B. Related Sections:
   1. Section 16050: Electrical General

C. Standards:
   1. Underwriters Laboratories #67
   2. Underwriters Laboratories #489
   3. Underwriters Laboratories #50
   4. NFPA 70 (National Electrical Code)

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets

B. Shop Drawings
   1. Dimensional Data
      a. Enclosure Size
      b. Gutter Space
      c. Cover and Trim
   2. Bussing Size
   3. Lug Configuration and Ratings
   4. Branch Breakers
   5. Main Breakers

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. CPI is the only acceptable supplier.

B. CarMax Auto Superstore, Inc. maintains a national account with CPI. Panelboards are provided by owner, furnished through the CPI package. Deliveries are to be coordinated by Contractor. Contractor is responsible for scheduling delivery dates with CPI, off loading, storage, and protecting equipment for installation

2.02 GENERAL:

A. Panelboards shall be of dead front construction, equipped with thermal magnetic molded case circuit breakers of frame size and trip ratings as shown on the schedule.

2.03 208Y/120 VOLT PANELBOARDS:

A. Circuit Breakers:

1. Circuit breakers shall be Square D or NOOB (bolt-on) thermal-magentic, molder case circuit breakers. Breakers shall be 1, 2, or 3-pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Bolt-on (NOOB) circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware.

2. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 240 volts ac maximum with continuous current ratings as noted on the plans. Interrupting ratings shall be as schedule with a maximum of 65,000 rms symmetrical amperes at 240 volts ac. Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

B. Bussing Assembly and Temperature Rise

1. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or phase sequence type and shall accept bolt-on (NOOB) circuit breakers. All current carrying parts of the bus structure shall be plated.

2. Panelboard bussing shall be copper or tin plated aluminim.

2.04 480Y/277 VOLT PANELBOARDS:

A. Circuit Breakers

1. Circuit breakers shall be (bolt- on) thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Breakers shall have an overcurrent, trip-free, toggle-type operating mechanism with quick-make, quick break action and position handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Bolt-on circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware.

2. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 277 volts ac (single pole, 15-30 amperes) or 480Y/277 volts ac (2 and 3 pole, 15-100 amperes) with continuous current ratings as noted on the plans. Interrupting ratings shall be as scheduled at 277 volts ac (single pole) or 480Y/277 volts ac (2 and 3 pole). Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

B. Bussing Assembly and Temperature Rise:

1. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or phase sequence type and shall accept bolt-on circuit breakers.

2. Panelboard bussing shall be copper or tin plated aluminum.

2.05 CABINETS AND FRONTS:

A. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Each front shall include a door and have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. 600A panelboard fronts shall have exposed trim clamps. Column width fronts shall have exposed hinges and be screw cover type. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door.

2.06 INTEGRATED EQUIPMENT SHORT CIRCUIT RATING:

A. Each panelboard, as a complete unit, shall have a short current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

B. Use of series rated systems shall be allowed with acceptable UL documenation submitted with equipment shop drawings with the exception of panelboards containing motor loads exceeding limit specified in NEC 240.86. Series rated systems shall be so marked per NEC 110-22.

2.07 UL LISTING:

A. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When used as service entrance device, panelboards shall be listed for use as service equipment.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Mount panelboard flush or surface as prescribed with top 6'-6" at a.f.f. Panelboards located in automobile service areas shall be mounted with bottom minimum of 30” a.f.f. per Class 1 Division 2 requirements.

B. Key all locks alike and give owner two key per panelboard.

C. For flush mounted panelboards, provide a minimum of three spare 3/4" conduits stubbed out into ceiling space.

D. Anchor enclosures firmly to walls and/or structural surfaces.

E. Where panelboards exceed 42 poles, provide multiple sections with equal size enclosures with 4" diameter openings with bushings between abutting enclosures.

F. Panelboards serving isolated ground receptacles shall be provided with a separate insulated ground bus (whether indicated on plans or not) for termination of isolated ground conductors.

G. Panelboards serving computer and/or related circuits shall be provided with a 200% neutral bus (whether indicated on plans or not) and feeders serving panel shall be provided with equivalent double-sized neutral.

END OF SECTION 16470

SECTION 264750

OVERCURRENT PROTECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. Provide fuses and circuit breakers of ampere rating and U.L. Classification as indicated on the drawings.

B. Related Sections:
1. Section 16050: Electrical General
2. Section 16430: Main Distribution Panel
3. Section 16440: Disconnect Switches
4. Section 16170: Motors and Equipment Connections
5. Section 16470: Panelboards

1.02 SUBMITTALS:

A. Product Data
1. Manufacturers: Product Data Sheets
2. Time - Current Characteristic Curves (Average Melt)
3. Current Limitation Curves

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Acceptable Manufacturers - Fuses:

1. Products specified as standard of quality are manufactured by Cooper Industries, Bussmann Division, referred to as Bussmann.

2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
a. Gould Shawmut

3. All fuses shall be of the same manufacturer.

B. Acceptable Manufacturers - Circuit Breakers

1. Products specified as standard of quality are manufactured by Square D Company, referred to as Square D.

2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
a. Square D

3. Circuit breakers shall be of the same manufacturer as the panelboard or enclosure in which they are installed.

2.02 FUSES:

A. Mains, Feeders and Branch Circuits:

1. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN LOW-PEAK time-delay fuses KRP-C(amp)SP. Fuses shall employ "0" rings as positive seals between the end bells and the glass melamine fuse barrel. Fuse links shall be pure silver (99.9% pure) to limit the short circuit current let-throughvalues to low levels and comply with NEC Sections requiring component protection. The terminals shall be peened. Fuses shall be time-delay and shall
hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories Inc. with an interrupting rating of 300,000 amperes RMS symmetrical. The fuses shall be UL Class L. Fuses shall be "LOW-PEAK YELLOW" in color.

2. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK dual-element fuses LPN-RK, LPS-RK, or LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuses shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting
point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds (30A, 250V Class RK1 case size shall be a minimum of 8 seconds at 500% of rated current) and be listed by Underwriters Laboratories, Inc with an interrupting rating of 300,000
amperes RMS symmetrical. The fuses shall be Time-Delay UL Class RK1 or J to maintain the engineered protection of the system components. Fuses shall be "LOW-PEAK YELLOW" in color.

B. Spares:

1. Upon completion of the building, the electrical contractor shall provide the Owner with spare fuses as shown below: 10% (minimum of 3) of each type and rating installed fuses shall be supplied as spares.

2. BUSSMANN spare fuse cabinet - Catalog No. SFC shall be provided to store the above spares. The spare fuse cabinet (SFC) shall include a supply of "LOW-PEAK YELLOW" NOTICE labels.

2.03 MOLDED CASE CIRCUIT BREAKERS:

A. Description:

1. Circuit breakers shall be Square D FA, KA, LA, NH, PA and/or PC one, two or three pole molded case circuit breakers rated 15 through 3000 amperes, 120 VAC, 240 VAC, 277 VAC, 480 VAC, as specified on the drawings. Breakers shall have an interrupting rating to match the panel in which they are installed or as indicated on the drawings. All circuit breakers shall be UL and CSA listed, IEC 157-1 rated, meet NEMA Standard AB1-1975 and Federal Specification W-C-375B/GEN, when applicable. Breakers covered under this specification may be installed in panelboards, switchboards, individual enclosures, motor control centers, combination motor starters or 1-LINE busway plug-in units.

B. Construction:

1. Molded case circuit breakers shall have overcenter toggle-type mechanisms, providing quick-make, quick-break action. Breakers shall be calibrated for operation in an ambient temperature of 40 degrees C. Each circuit breaker shall have trip indication by handle position and shall be trip-free. Two and three pole breakers shall be common trip. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
Circuit breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to assure uniform tripping characteristics in each pole). A push-to-trip button shall be provided on the cover for mechanically tripping the

circuit breaker. The circuit breaker shall have reverse connection capability and be suitable for mounting and operating in any position.

C. Terminations:

1. Circuit breakers shall have removable lugs. Lugs shall be UL listed for copper and aluminum conductors. Breakers shall be UL listed for installation of mechanical type or compression type lugs.

2.04 CURRENT LIMITING CIRCUIT BREAKERS:

A. Description:

1. Current limiting circuit breakers from Square D shall be I-LIMITER IF (20-100 amperes), IK (110-250 amperes) and shall be rated at (240 VAC) (480 VAC) with an interrupting rating of 100,000 rms symmetrical amperes. IL current limiting circuit breakers (300-400 amperes) shall be rated (240 VAC) (480 VAC) with an interrupting rating of 200,000 rms symmetrical amperes. All I-LIMITER circuit breakers shall meet UL requirements as current limiting circuit breakers, be CSA listed, IEC 157-1 rated,meet NEMA Standard AB1-1975 and Federal Specification W-C-375B/GEN.

B. Construction:

1. Current limiting circuit breakers shall be supplied in molded case construction. The circuit breaker section shall have an overcenter, trip-free toggle-type mechanism with quick-make, quick-break action. A push-to-trip button shall be provided on the cover for mechanically tripping the circuit breaker. The circuit breaker shall have permanent trip units containing individual thermal and magnetic trip elements in each pole. The thermal trip element shall be calibrated for 40 degrees C. ambient temperature. The breaker shall have reverse connection capability and be suitable for mounting and operating in any position.

C. Terminals:

1. The current limiting circuit breakers shall have removable lugs. Lugs shall be UL listed for copper and aluminum conductors. Breakers shall be UL listed for installation of mechanical type or compression type lugs.

D. Current and Energy Limitation:

1. On high level fault currents, the I-LIMITER circuit breaker shall peak current and let thru energy and provide a voltage transient-free interruption at near unity power factor. On fault currents below the threshold of limitation, the I-LIMITER circuit breaker shall provide conventional overload and short circuit protection.

E. Series Connected Ratings:

1. Combinations for series connected interrupting ratings shall be recognized by Underwriters Laboratories and shall appear in the Recognized Component Directory under the "Circuit Breakers -Series Connected" product category DKSY2. Current limiting circuit breakers shall allow the use of branch circuit breakers with lower interrupting capacities on systems capable of delivering fault currents up to 200,000 rms symmetrical amperes at 480 VAC and 100,000 rms

symmetrical amperes at 600 VAC.

PART 3 - EXECUTION

3.01 INSTALLATION - FUSES:

A. Install fuses in all switches shown on the plans which require fuses.

B. Fuses shall not be installed in the switch until equipment is ready to be energized.

C. Install "LOW-PEAK YELLOW" NOTICE labels to alert the end user of the engineered level of protection of the electrical equipment. They shall be marked with the proper fuse rating, per the drawings, and placed in a conspicuous location on the enclosure. These labels are available with the spare fuse cabinet (SFC) and are also available upon request from Bussmann.

3.02 INSTALLATION - CIRCUIT BREAKERS:

A. Install circuit breakers in panelboards, switchboards, distribution panelboards, and enclosures as shown on the drawings.

B. Terminate wiring into circuit breaker lug. Tighten lug to torque level as marked on the lug.

END OF SECTION 16475

SECTION 264800

MOTOR STARTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION:

A. Magnetic motor starters for motor operated equipment will be furnished by the supplier of the equipment unless otherwise indicated. The electrical contractor shall mount and connect all such starters not provided in control panels factory-mounted on the equipment.

B. This contractor shall be responsible for the proper selection of thermal overload elements for all motor starters. Overloads shall not exceed 115% of the normal full load running current of the motor protected.

1.3 STANDARDS:

A. NEMA Pub. No. ICS

B. Starters and associated devices, unless otherwise indicated, shall have NEMA 1 enclosures where mounted indoors and NEMA 3R enclosures with space heaters where mounted outdoors.

C. When motors are supplied with horsepower ratings different from those indicated on the drawings, starters, feeders, overloads, disconnects, and associated devices of the correct size and rating shall be provided.

PART 2 - PRODUCTS

2.1 PRODUCTS:

A. All starters installed under this Contract for 3 phase fans shall be provided with motor controllers and, except as otherwise shown or specified, shall be furnished and installed under DIVISION 16. The motor capacities, controller sizes, wire and conduit sizes, etc., indicated or specified, shall be the minimum required, and the work covered in this section includes the furnishing and installing of controllers, wire, conduit, etc., of the required capacities and sizes above the minimum requirements for proper coordination and field application. Other trades shall furnish all necessary information, including wiring diagrams where necessary for the proper installation of their equipment. All controllers shall conform to the latest applicable NEMA standards for type, size and duty as specifically applied. Refer to the drawings and specifications of other Divisions to assist in determining the extent of work involved.

B. Magnetic across-the-line type controllers shall provide thermal overload protection for all phases and be sized for the motor being controlled and with manual reset device on the outside of the controller housing. Start-stop push button stations, selector switches, extra auxiliary contacts, etc., shall be furnished with the controllers as shown on the drawings, scheduled or as elsewhere specified herein. Thermal overload elements shall be as standard with the manufacturer. All controllers shall be provided with red and green pilot lights, mounted in the cover with

indicating-the-run status. NEMA Size 00 magnetic controller shall be the minimum size furnished under this Division. Provide extra auxiliary contacts for starters to be remotely controlled via automatic temperature control systems see drawings or interlocked with equipment provided under other divisions of these specifications.

C. All 460 volt motor controllers shall be furnished with the individual control circuit transformers integrally mounted with the controller and providing a secondary voltage of 110 to 120 volts. Fuses shall be provided for protection of the control circuit conductors. The non-fused side of the transformer secondary winding shall be grounded.

D. Manual starters, where indicated, shall be provided complete with thermal overload protection in all phases. Each shall be equipped with a quick-break operating mechanism and silver contacts. Terminals shall be pressure type. Overload devices shall be of the bimetallic type and be of such design as to cause the switch handle to assume a mid-position on overload. The mechanism shall be trip-free so that the contacts cannot be reclosed until the bimetallic strip cools.

E. The work of this Division shall include the proper selection and installation of all motor controllers furnished hereunder and shall also include the proper installation of motor controllers furnished under other DIVISIONS. A schedule of all motor controllers furnished under this DIVISION shall be submitted for review by the Engineer.

F. NEMA Size 00 controllers shall be the minimum size furnished under this DIVISION, and controllers shall be the standard product of a single manufacturer. Controllers shall be I-T-E, Furnas, General Electric, Square D, Cutler-Hammer or Westinghouse, complete with NEMA Type-1 enclosure, except where otherwise indicated on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide full-voltage, magnetic type starters unless otherwise indicated.

B. Starters shall disconnect all circuit conductors.

C. Each ungrounded phase or motor lead shall have overload protection in its starter.

D. Magnetic starters for motors without automatic control shall have built-in momentary "stop-start" or multiple speed pushbuttons and pilot lights for each speed.

E. Magnetic starters for motors with automatic control shall have built-in "hand-off-auto" selector switches and associated pilot lights.

F. Control voltage shall be 120 volts obtained from within starter. Control transformers shall be part of starter. Ungrounded control wiring, including the primary to the control transformers shall be fused.

G. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance.

END OF SECTION 16480

SECTION 265000

LIGHTING

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide lighting fixtures as prescribed in the lighting fixture schedule complete with housing, junction boxes, ballasts, lamp sockets, lamps, lenses, baffles and trims installed with support from building structure. Verbal description of fixture in schedule will take precedence over manufacturer number.

B. Related Sections:
   1. Section 16050: Electrical General.

C. Standards:
   1. Underwriters Laboratories labeled and listed.
   2. CBM Approved
   3. ANSI C82.2
   4. 1992 National Energy Conservation Act.

1.02 APPROVED SUPPLIERS

A. All lighting shall be furnished by the Owner. General Contractor or his subcontractor shall be responsible for receiving, inventory and storage, and installation. Contractor shall coordinate shipping and other requirements with the following approved lighting supplier:

LSI Lighting
Joanna Ducker
1 (800) 436-7800 Ext 3110

1.3 SHIPPING AND STORAGE INFO

A. The Contractor shall coordinate with lighting supplier all requirements for storage and shipping of light fixture package including lamps. Contractor shall confirm anticipated ship date and schedule all work as required. It is the Contractor's responsibility to manage delivery process which shall include receipt of material, handling, storage, protection and insurance.

B. The Contractor shall be advised that the light fixture package and lamps may be shipped from several different factories at different times.

PART 2 - PRODUCTS

2.01 LIGHT FIXTURES: As prescribed in lighting fixture schedule.

2.02 FLUORESCENT BALLAST:

A. Electronic: Solid state electronic, Class A sound rating, CBM certified ,90 degree Celsius, capable of operating one to four lamps, modulated high frequency (above 20K hz), internally protected from line transients, class "P", and shall have five (5) year warranty.
1. Acceptable manufacturers as follows:
a. Advance
b. Motorola
c. Magnatec

B. Exterior fluorescent fixtures installed outdoors or in unheated spaces shall be provided with 0 degree cold weather ballasts.

2.03 HIGH INTENSITY DISCHARGE BALLAST:

A High Pressure Sodium: Core and coil or constant power autotransformer, high power factor (92% minimum) starting current less than operating, 5% lamp power variation on 10% line potential variation, 180 degree Celsius Class H insulation, -20 degree Fahrenheit starting temperature.

B. Metal Halide Lamp: Core and coil or constant autotransformer lead-peaked, high power factor (90% minimum), starting current less than operating, 10% lamp power variation on 10% line potential variation, 180 degree Celsius Class H insulation, -20 degree Fahrenheit starting temperature.

C. Manufacturers:
1. Acceptable manufacturers are as follows:
a. Advance
b. General Electric
c. Universal
d. Jefferson

D. Exterior fluorescent fixtures installed outdoors or in unheated spaces shall be provided with 0 degree cold weather ballasts.

2.4 LAMPS:

A. Furnish and install lamps in all fixtures. Fluorescent lamps shall be rapid start, T8, energy saving type, or as scheduled on the drawings. Incandescent lamps shall be 2500 hours, 130 volt unless otherwise indicated on the schedule. HID lamps shall be as specified in the lighting fixture schedule or as recommended by the manufacturer. Acceptable lamp manufacturers are General Electric, Westinghouse and Sylvania.

B. Contractor is to remove any leftover lamps at project close (Lamp supplier typically includes extra lamps with fixtures for damages). Owner will not store spare lamps on site.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Support:

1. Support each fixture from the building structure.
2. Support in a manner that ensures the fixture weight being equally distributed from each support and the fixture remaining in a level position.
3. Provide support systems capable of carrying 300% of load imposed.

B. For pendant or suspended fixtures mounted to suspended ceilings provide 1/4" steel rods above the suspended ceiling from building structure to fixture. Provide a minimum of two supports for each chassis and spaced a maximum of 4 feet on center.

C. For recessed H.I.D. and fluorescent fixtures recessed in a suspended ceiling, provide 2 #10 awg. wire supports from building structure to fixture. Provide a minimum of two supports for each chassis spaced a maximum of 4 feet on center and located on diagional corners of the fixture. Provide tie down clips to secure fixture to the ceiling grid.
All surface or pendant mounted H.I.D. fixtures shall be provided with safety chains. Provide additional supports and/or clips as required to comply with local seismic zone requirements.

D. For recessed single incandescent, provide #10 AWG steel hanging wire from building structure to fixture; minimum of 2 separate supports per fixture.

E. For each recessed fixture, provide a trim to match the type ceiling (plaster, grid, exposed panel, etc.) in which it is being installed.

F. Aim and adjust all fixtures with lamp position, tilt, shutters, rotation or other types of adjustment during installation. The Architect or his representative will determine the final aiming and adjustment of such fixtures during the substantial completion job visit. Fixtures serving areas where daylighting dominates will be adjusted after sunset.

G. Provide electrician with equipment and tools to execute aiming and adjustment instruction.

H. Confirm compatibility and interface of other material with luminaire and ceiling system. Report discrepancies to the Engineer, and defer ordering until clarified.

I. Coordinate with Division 15 to avoid conflicts between luminaires, supports, fittings, and mechanical equipment.

J. Provide wiring channel for mounting fluorescent luminaires and wiring between luminaires; suspended below mechanical piping and duct work. Nominal size of channels 2-7/8 x 2-3/4 inches, 16 gage steel, white baked enamel finish, complete with channel connectors, end closure pieces, cover pieces, mounting hickeys, luminaire connectors, and joiner pieces 12 inches long to form a rigid assembly.

K. Except where specifically shown on the drawings, the use of chain hangers or tie wire for support of fixtures is prohibited. Suspended fixtures shall be fitted with swivel hangers and canopies.

L. Mounting heights of fixtures are, in most cases, indicated on the drawings or scheduled. Where job conditions require mounting heights different from those shown or specified to avoid equipment, structural features, etc., such changes in mounting height shall be as directed without additional cost to the Owner.

M. All fixtures are shipped less fuse and fuse holder. If fuses are required by the local authority, Contractor shall furnish and install these items in this base bid.

N. All fixtures are shipped less prewired whips. Contractor shall furnish and install, at his option, flexible whips to connect to the branch circuit as shown on the drawings. Maximum length of whip shall be 6 feet.

O. The work of this Section shall include the careful examination of the Architectural and Mechanical drawings as to become acquainted with the structural features of the building, and the location of pipe and ductwork which would alter the location and spacing of outlets for fixtures. Where conflicts develop, same shall be referred to the Engineer for a decision as to the proper location. The work of this Section shall also include responsibility for the proper reinforcement of any ductwork necessary to carry the added weight of lighting fixtures where same must be supported by such ductwork.

P. Attention is directed to the possible close fit requirements of some lighting fixtures within bar joist areas. All fixtures for these areas shall be closely coordinated with bar joist locations for proper fit and alignment.

END OF SECTION 16500

SECTION 265100

BATTERY POWERED EMERGENCY LIGHTING

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide emergency lighting fixtures as prescribed in the lighting fixture schedule complete with housing, junction boxes, ballasts, lamp sockets, lamps, lenses, baffles and trims installed with support from building structure. Verbal description of fixture in schedule will take precedence over manufacturer number.

B. Related Sections:
   1. Section 16050: Electrical General.

C. Standards:
   1. Underwriters Laboratories labeled and listed.
   2. CBM Approved
   3. ANSI C82.2
   4. 1992 National Energy Conservation Act.
   5. Americans with Disabilities Act

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets.

B. Shop Drawings for Custom Fixtures.

1.03 APPROVED SUPPLIERS:

A. All lighting shall be furnished by the Owner. General Contractor or his subcontractor shall be responsible for receiving, inventory and storage, and installation. Contractor shall coordinate shipping and other requirements with the following approved lighting supplier:

LSI Lighting
Joanna Ducker
1 (800) 436-7800 Ext 3110

PART 2 - PRODUCTS

2.01 LIGHT FIXTURES: As prescribed in lighting fixture schedule.

2.02 FLUORESCENT EMERGENCY LIGHTING MODULE:

A. As shown on plans, provide an emergency lighting module. The module shall be a single case assembly with high temperature nickel cadmium battery, charger and electronic circuitry.

B. Under normal mode, the emergency lighting module shall provide sufficient energy to the battery to maintain a constant state of full charge.

C. When AC power drops to approximately 75%, the emergency lighting module shall automatically switch to the emergency mode, keeping one (or two) lamps operating at a reduced output of 1400 lumens (minimum) for a minimum of 90 minutes.

D. Upon restoration of AC power, the emergency module shall automatically return to the charging mode.

E. The transfer from AC power to emergency mode shall be accomplished with solid state circuitry. No moving contacts are permissible.

F. Acceptable manufacturers are as follows: Bodine or equal.

2.03 BATTERY POWERED EXIT SIGNS:

A. Exit signs indicated on plans shall have an emergency power pack complete with a high temperature nickel cadmium battery, charger, electronic circuitry, test switch and charging indicator light.

B. Under normal mode, the emergency power pack shall provide sufficient energy to the battery to maintain a constant state of full charge. When AC power fails, the power pack shall automatically switch to the emergency mode and provide battery power to the lamps. Upon restoration of AC power, the power pack shall automatically return to charging mode.

C. Manufacturers shall be as scheduled on plans.

D. Provide two spare universal mount battery powered exit signs (in addition to those located on plans) for location as directed by local authority having jurisdiction (if required).

2.04 SELF-CONTAINED EMERGENCY LIGHTING UNIT:

A. Where indicated on plans, provide a self contained, maintenance free, emergency lighting unit.

B. Units shall be constructed to conform to Underwriters Laboratories, Inc. standard #924 and be installed to conform to Article 700 of the National Electric Code.

C. Units shall operate as desciberd in sections B and C of 2.03.

D. Provide two spare universal mount emergency lighting units (in addition to those located on plans) for location as directed by local authority having jurisdiction (if required).

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide additional unswitched (bypasses all local switches and lighting contactors/relays) hot conductor to all emergency lighting modules, battery powered exit signs, or self-contained emergency lighting units whether explicitly shown on plans or not.

B. Aim heads as required for maximum illumination of the paths of egress, or as directed by local authority having jurisdiction.

END OF SECTION 16510

SECTION 266300

TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) SYSTEM

PART 1 - PROVISIONS

1.1 PROVISIONS REQUIREMENTS:

A. TVSS system is included in the CPI base system to be supplied by the owner, installed by the contractor per the plans.

B. CarMax has entered into an agreement with GreyGate, Inc. for all TVSS equipment for this store. For the base bid, the TVSS package will be supplied to CPI directly by GreyGate and will be included in the modular switchgear price as purchased by the Contractor from CPI. For the add alternate, The TVSS Package will be purchased by the General Contractor or his subcontractor directly from GreyGate, Inc., Attn: Russ Johnson 4915 Fitzhugh Avenue, Richmond, VA 23230 804-359-3221.

PART 2 - GENERAL

2.01 GENERAL REQUIREMENTS:

A. Refer to the Electrical Riser Diagram on the drawings for TVSS locations.

B. CPI shall verify all quantities and voltages before ordering and TVSS equipment.

C. Upon installation completion, the contractor shall contact Russ Johnson at GreyGate to schedule testing of all TVSS devices.

2.02 RELATED DOCUMENTS:

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

2.03 EXECUTION:

A. A Transient Voltage Surge Suppression system (TVSS) shall be installed to provide effective high energy surge current diversion. The system shall be connected in parallel with the protected system at the service entrance; no series-connected elements shall be used.

B. The TVSS shall be manufactured and installed in compliance with ANSI/IEEE Standards C62.1, C62.41 and C62.45 Category C. In addition, system shall be UL listed as a complete system under UL 1449 Standard for Transient Voltage Surge Suppressors. The TVSS shall be UL1283 listed.

C. The system nominal operating voltage shall be 277/480 volts, three phase, 4 wire. The maximum continuous operating voltage shall be greater than 115% of the nominal operating voltage to ensure the ability of the system to withstand temporary overvoltage conditions. The operating frequency range of the system shall be at least 47 to 63 hertz.

D. The manufacturer shall furnish installation manuals with installation, start-up and operating instructions for the specified system.

E. Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, component and connection locations, mounting provisions, connection details, and wiring diagram.

END OF SECTION 16630

SECTION 267100

ENERGY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and revisions of the Contract, including General, Supplementary and Special Conditions, and Division 1 Sections apply to this Section.

1.2 SUMMARY:

A. Energy Management System (EMS) hardware, software and commissioning will be furnished by the Owner. EMS field installation is to be completed by the Contractor. All specified actions are directed to the Electrical Contractor unless specifically addressed to another subcontractor.

B. EMS hardware factory mounted in CPI gear includes the following (Contractor is responsible for final mounting of CTs and field terminations as shown on drawings):

1. Novar Opus front end controller
2 PLCs as indicated
3. Dimmer Controllers
4. Power Monitoring Modules
5. Transducers & C.T.s
6. Control Relays
7. Contactors
8.. EMS Output Override Toggle Switches
9.. Contactors
10. 24 Volt Transformers
11. 480, 120 and 24 Volt Conductors/Cables and Terminations.

C. EMS hardware furnished by Owner, installed and terminated by Contractor includes, but is not limited to (as indicated on drawings):

1. Space Temperature/ Humidity and CO^2Sensors. Sensors for BACnet enabled Lennox Roof Top Package Equipment are provided with equipment by Lennox. Other sensors are provided by EMS contractor, Comfort Systems USA.
2. Interior light sensors
3. EMS field installed control relays
4. Outdoor temperature, humidity, light level sensor assembly
5. Field mounted CTs
6. Field mounted control relays

D. EMS components furnished and installed by contractor includes but is not limited to:
1. Override switches
2. 480, 120, 24, 0-10 volt conductors/cabling and terminations
3. Communications cabling
4. Raceways and junction boxes as required
5. Remote timed override push buttons as indicated on the drawings

E. The Electrical Contractor is responsible for coordinating work for the Energy Management System including installation, final terminations and commissioning with the following parties:

1. Carolina Products, Inc.: (owner furnished electrical gear package) Contractor is to coordinate shipping dates, receiving and perform installation as required.
2. The Mechanical Contractor: Contractor is to coordinate sensor installation and wiring to support unit start up as required.
3. The EMS Contractor: (owner furnished EMS hardware, software and commissioning) Contractor is to coordinate with EMS Contractor for preconstruction, hardware deliveries, programming and final commissioning as required.
4. The Data/Telephone Contractor: Contractor is to confirm data drop and connection to CarMax network equipment in PBX room
5. The Security System Contractor: Contractor is to coordinate and confirm occupancy status connection(s) to EMS.
6. The Electrical Engineer: Contractor will be present for commissioning verification visit with EMS Contractor and Electrical Engineer.

E. The Energy Management System shall be complete and fully operational on or before the substantial completion date, with the exception of the remote connectivity as dependent on CarMax's network completion.

1.3 WARRANTY:

A. Warranty all Energy Management Equipment for a period of one year and twenty days from Grand Opening Date.

B. Provide warranty labor at no charge for a period of 90 days from Grand Opening Date.

1.4 TEAM MEMBERS (other than Electrical Contractor):

A. Carolina Products, Inc. responsibility shall include:

1. Procure all EMS components specified or shown on the EMS drawings
2. Fabricate enclosures for the Opus, MinIO's, relays, transformers, H-O-A switches, contactors, dimmers, meter modules and other related EMS components.
3. Factory connect all components as shown on the EMS drawings.
4. Forward all EMS components to the Electrical Contractor for installation.
5. Coordinate with the Electrical Contractor all field connections necessary to complete the EMS system.
6. Contact: Ron Sherwood 800-736-4455

B. Mechanical Contractor responsibility shall include:

1. Have all HVAC systems functioning prior to scheduled EMS commissioning.
2. Coordinate connection of BacNet, temperature/humidity sensors and CO^2 sensors with Electrical Contractor.
3. Coordinate RTU control module network addresses with EMS contractor.

C. The EMS Contractor responsibility shall include:

1. Review EMS wiring diagrams to confirm programmability and control wiring.
2. Provide EMS Hardware for integration to CPI gear package to CPI
3. Participate in pre construction on site meeting and review requirements with related trades.
4. Confirm all components of the EMS are in place and properly connected.
5. Final Programming
6. Commissioning of all EMS functions, document results including screen shots.
7. Verify the system is properly reporting to the EMS Monitoring Company.

8. On site demonstration to the Electrical Engineer all specified EMS actions are functioning properly.
9. Train the Store Manager as to the functions, controls and overrides of the EMS system.
10. Contact: Cedric Wilson, Comfort Systems USA, 317-246-4278

D. The Data/Telephone Contractor responsibility shall include;

1. Provide LAN connection to the Opus.

E. The Security Contractor responsibility shall include;

1. Provide occupancy notification to the EMS, via contact closure termination to 4" square box for each occupancy input as indicated on drawings

F. The EMS Monitoring Company responsibility shall include;

1. Confirm they are receiving EMS data and it matches data at the site.
2. Contact: Bryan Stauch, Comfort Systems USA, 317-246-4649

G. The Electrical Engineer responsibility shall include;

1. Respond to any RFI related to the EMS.
2. Inspect the EMS system for completeness, proper installation and connection.
3. Observe the EMS Contractor's demonstration that the system is functioning as specified.
4. Report deficiencies.

D. The Carmax Store Manager responsibility shall include;

1. Participate in the training provided by the EMS Contractor.

1.05 MANUALS

A. Provide Operation and Maintenance manuals for the EMS system.

1.06 AS-BUILT DOCUMENTS

A. Provide as-built documents of EMS system wiring. As-built documents shall include but not be limited to the following:

1. Indicate on floor plans all communications cabling routing.
2. Indicate revisions or field modifications to wiring diagrams.

1.07 SUBMITTALS

A. Manufacturers Product Data Sheets, provided by furnishing party:

1. Contractor:
   a. Low voltage cabling
   b. remote timed override push buttons

2. CPI:
   a. control relays
   b. contactors
   c. output override switches

3. EMS Contractor:

a. Novar hardware
b. PLCs
c. field installed control relays
d. field installed sensors
e. dimming control modules

PART 2 – PRODUCTS

2.1 EMS MANUFACTURER

A. Unless specified otherwise, all Energy Management System components shall be manufactured by NOVAR CONTROLS CORPORATION, furnished by Comfort Systems USA.
B. EMS Hardware, Software and Commissioning is furnished by owner through Comfort Systems USA.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify all equipment and devices are installed to Manufacturers installation and hardware mounting procedures, unless otherwise indicated on drawings.
B. Provide continuous conductors between devices and equipment with no splices
C. Make all wiring terminations.
D. Prior to EMS Contractor Commissioning, the Electrical Contractor shall confirm the following components are installed, connected and labeled:
1. Outdoor Temperature Sensor
2. Outdoor Light Sensor
3. Outdoor and Indoor Humidity Sensors
4. Each Valve Room Temperature Sensor
5. Interior Light sensors and output wiring to ballasts for dimming control
6. RTU Space Sensors
7. Occupancy Notification
8. All EMS Communication Network Cabling
9. LAN
10. Override switches
11. Remote timed override push buttons

3.02 EMS CONTRACTOR COMMISSIONING

A. For each of the components listed below:

a. Verify the presence, proper installation and connection.
b. Test for proper operation,
c. Where there is data or monitored state, confirm Monitoring Company's data/state matches field data/state
d. Document findings

Components:
1. Outdoor Temperature Sensor
2. Outdoor Light Sensor

3. Each Valve Room Temperature Sensor
4. Each Dimmer Controller
5. Each Interior Light Sensors
6. RTU Temperature Sensors
7. Occupancy Notification
8. Communication Networks
9. Power Monitoring Modules
10. Phase loss shut down of RTU's, Compressor(s), Motorized doors and Eurovac.
11. IR and Unit heater thermostat disable relays
12. Contactor Relays
13. Contactors
14. 24 Volt Output Transformers
15. LAN
16. Operation of RTU's and HVAC equipment in both first and second stage operation and heat and cool modes.
17. For each RTU, record Zone, Return Air and Outside temperatures plus Humidity, CO2 ppm, Damper Position, Supply Air temperature, Supply Air temperature after 7 minutes and % of Cooling or Heating call on.

B. Confirm the following outputs with respective programming. Refer to drawings for job specific outputs required:

1. Showroom 50%
a. Includes 50% of the overhead showroom lighting fixtures.
b. Scheduled on/off by security system status. When security system is armed, lights are off.
c. Controlled by EMS override button in LGM. Voltage of 5V shall be applied to dimming circuit when button is activated to achieve 50% output. Lowest voltage between override button & photo sensor shall have priority.
2. Showroom Full Lighting
a. Includes remaining overhead showroom lighting fixtures, showroom accent lighting, bathroom exhaust fans as indicated by mechanical engineer & remainder of sales building lighting.
b. On/ off via time of day scheduling
3. Service Area Exhaust Fans
a. Service restroom exhaust fans and others as indicated by mechanical engineer
b. On/ off via time of day scheduling
4. FQC Interior Lighting
a. FQC interior overhead lighting
b. On/off via time of day scheduling
5. Exterior Security Lighting
a. All exterior wall packs, canopy lighting, security pole light fixtures around perimeter, security pole light fixtures interior lot, exterior signage
b. Enabled on/off by schedule
c. On/ off by exterior light sensor
6. Low Level 50% Exterior Lighting
a. 50% of remaining exterior pole light fixtures interior lot (excludes perimeter poles where present)
b. Enabled on/off by schedule
c. On/ off by exterior light sensor
7. Full Level 100% Exterior Lighting
a. remaining exterior pole light fixtures interior lot (excludes perimeter poles where present)
b. Enabled on/off by schedule
c. On/ off by exterior light sensor
8. Low Level 50% Exterior Perimeter Lighting

a. 50% of remaining exterior perimeter pole light fixtures
b. Enabled on/off by schedule
c. On/ off by exterior light sensor
9. Full Level 100% Exterior Perimeter Lighting
a. remaining exterior perimeter pole light fixtures
b. Enabled on/off by schedule
c. On/ off by exterior light sensor
10. Unit Heater enable/ disable
a. Relays to be wired in series with local thermostats for unit heaters being used for climate control, including presentation lanes IRH, carwash unit heaters, and shop.
b. Enable/disable based on outside air temp lockout above 55' F.
11. Service Zone 1
a. overhead lighting – service bays on entrance wall, and adjacent bays for service type work
b. On/off by time of day scheduling
c. Remote override (software adjustable override time period)
12. Service Zone 2
a. overhead lighting – remaining service bays for service type work
b. On/off by time of day scheduling
c. Remote override (software adjustable override time period)
13. Service Zone 3
a. overhead lighting – overhead lighting around paint booths
b. On/off by time of day scheduling
c. Remote override (software adjustable override time period)

14. Service Zone 4
a. overhead lighting – drive lanes between cosmetic areas and paint booths
b. On/off by time of day scheduling
c. Remote override (software adjustable override time period)
15. Phase Loss
a. Used to shunt breakers serving 3 phase equipment or intercept control wiring to 3 phase equipment during phase loss.
16. Shop Equipment
a. Air compressor "load/unload" control.
b. Vacuum system override control.

C. Time Scheduling

1. Confirm the Time Schedule for lights and mechanical equipment is programmed as indicated on drawings.

D. Daylight Harvesting Commissioning

1. Controller shall include the following capabilities:

a. History recording: System shall include historical reporting with the following fields recorded every one (1) hour:

1. Average, high and low ILS reading per zone;
2. Load output (dimming level) average, high and low.
3. A minimum of one (1) week of data must be present, with the ability to routinely export the data so as to maintain a continuous log of system operation.

b. Alarm capability: System shall have the ability to 'alarm out' if conditions exist that indicate improper operation, to include the following at a minimum:

1. ILS out of range reading (software adjustable),
2. ILS shorted sensor or open fault, control output at 100% for more than 12 hours (software adjustable from 1 to 24), Control output at 0% for more than 12 hours (software adjustable from 1 to 24).

c. Scheduling capability: System shall have the ability to operate the dimming routine to zero setting based on a software adjustable time of day schedule.

d. Zone Illumination Levels:

Service Area: Minimum fc requirement is 65fc
Showroom: Minimum fc requirement is 80fc, though levels should average 90fc.
Presentation Lanes: Minimum fc requirement is 65fc
ILS installation: The ILS is to be mounted in the ceiling, with sensor pointed to the floor, not in direct path of artificial and natural lighting sources.
FDCM installation: Ensure load capacities of FDCMs are not exceeded. Set dimming control modules to revert to 100% lighting signal in the event of a control signal loss.

2. Sequence of operation

a. Independent operation: System will operate each zone of dimming independently from one another.

b. Dimming control sequence: When schedule is active (scheduled on time), perform the following:

1. Start lighting at minimum output setting (software adjustable).
2. If ILS reading is below set point (software adjustable), increase light output level.
3. If ILS reading is above set point (software adjustable), decrease light output level.
2. Set loop parameters to provide a smooth transition for variable overcast conditions, dawn and dusk transitions.

3. Commissioning

a. Adjust the following parameters into the Control System:

1. Minimum output setting is zero
2. Showroom set point is 35fc
3. Presentation set point is 20fc
4. Service Area set point is 20fc
5. Adjust the desired zone light levels during dawn, dusk or variable overcast conditions. This is to be done for each zone.
6. Ensure full artificial lighting is not required.
7. Force output level to 100%. Record effective light level in space with fc meter placed at floor level in controlled lighting zone. If lighting level is not in excess of required fc by at least 25%, cease commissioning and continue when conditions provide less natural light into space. If lighting level exceeds required fc for space, continue commissioning.
8. Ensure some level of artificial lighting is required.
9. Force output level to 0%. Record effective light level in space with fc meter placed at floor level in controlled lighting zone. If lighting level is in excess of required fc minus 20%, cease commissioning and continue when conditions provide less natural light into space. If lighting level exceeds required fc for space, continue commissioning.

4. Control routine testing and adjustment:

a. Set scheduled operation to on. Verify control routine starts lighting at lowest level, record result.
b. Verify control routine ramps up lighting output to maintain initial lighting level setpoint, record result.
c. Measure effective light level in space with fc meter placed at floor level in controlled lighting zone. If lighting level is in excess of required fc in space, lower setpoint by 5fc. If lighting level is less than required fc in space, increase setpoint by fc. Allow control routine to make output adjustments until output reading stabilizes.
d. Continue step 3 until required fc reading is achieved. Record setpoint settings and fc readings.
e. Fail safe operation: Remove control signal from control system. Verify the lighting goes to 100% output, record result, reconnect control signal, verify the lighting control reverts to lowest level.
f. Provide as built documentation of all sensor and dimming control module locations.
g. Provide commissioning results to owner.

E. Power Demand Commissioning:

1.Provide documentation Carmax's demand strategy and set points have been programmed.

F. Provide thorough and complete system documentation. The following completed forms shall be filled out and turned over to CarMax with a copy to Architect: Certification forms shall also be included within the Operation and Maintenance manuals.

1. Module Address Verification
2. Load Title Verification
3. Energy Management System Test Report
4. Results of Internet Test
5. Warranty contact personnel, with 24 hour telephone list, and service personnel's cell telephone numbers.

G. EMS Contractor shall, after commissioning the system, schedule with the Electrical Engineer a separate day at the site to demonstrate the EMS system is working according to specifications.

END OF SECTION 16710

SECTION 267200

LIFE SAFETY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section of the specification includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

D. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

E. The fire alarm installation company shall provide the necessary equipment and programming to enable the main fire alarm control panel to be monitored by the end-uses monitoring company of choice.

1.02 SCOPE:

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Fire alarm information provided on the drawings and specifications is intended to establish minimum requirements per Carmax standards and applicable codes. Electrical contractor shall procure services of a fire alarm subcontractor familiar with the requirements in the local area. Fire alarm contractor shall coordinate closely with the local authorities having jurisdiction and design a system including any additional requirements not shown on the contract documents. Fire alarm contractor shall produce and submit plans as required for permit. In no case shall the system design provide less than the requirements shown on the contract documents, even if permitted by code. Any additional work required by the local authority having jurisdiction after bid has been submitted shall be performed by the fire alarm contractor at no additional cost to owner. Fire alarm contractor shall coordinate closely with other contractors for any additional work to be performed under other divisions.

C. Qualifications:

The fire alarm contractor shall be a licensed low voltage contractor authorized by his respective factory to ensure proper specification adherence, final connection, test, certification, warranty compliance, and service. Additionally, he must submit a letter of authorization (on official letterhead of the company he represents), preceding his bid, that he is an authorized distributor of that product. He shall maintain a service organization with adequate spare parts inventory within 75

miles of the installation site. He shall have training certification by the fire alarm control equipment manufacturer he represents that is not more than two (2) years old, to ensure up-to-date product and application knowledge.

D. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on an NFPA Style 6 (Class A) Signaling Line Circuit (SLC).

2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B).

3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y).

4. Digitized electronic signals shall employ check digits or multiple polling.

5. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

E. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED shall flash.

2. A local piezo electric signal in the control panel shall sound.

3. A backlit 80 character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed and the associated system outputs (alarm Notification appliances and/or relays) shall be activated.

1.03 SUBMITTALS

A. General:

1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.

2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment (compatible UL Listed) from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.

3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

3. Show annunciator layout, configurations, and terminations.

C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.

2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.

2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

E. Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.04 GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year and twenty days from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.05 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the submittal, include a quote for a maintenance contract to provide all maintenance, test, and repair described below. Include also a quote of unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor that shall describe the protocol for preventive maintenance. The schedule shall include:

1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.

2. Each circuit in the fire alarm system shall be tested semiannually.

3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 5.

1.06 POST CONTRACT EXPANSIONS:

A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B. As part of the submittal include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable control modules equal (list actual quantity of each type).

C. Quotation shall include installation and test labor and labor to reprogram the system for this 10% expansion. If additional FACP hardware would be required, include the material and labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include cost of conventional peripherals or the cost of initiating devices or Notification appliances connected to the addressable monitor/control modules.

E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.07 APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.

A. National Fire Protection Association (NFPA) - USA:

No. 12	CO2 Extinguishing Systems.
No. 12	A&12B Halon Extinguishing Systems.
No. 15	Water Spray Systems.
No. 16	Foam/Water Deluge and Spray Systems.
No. 72-1993	National Fire Alarm Code.
No. 101	Life Safety Code.

B. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems.
No. 864	Control Units for Fire Protective Signaling Systems.
No. 268A	Smoke Detectors for Duct Applications.
No. 521	Heat Detectors for Fire Protective
No. 464	Audible Signaling Appliances.
No. 38	Manually Actuated Signaling Boxes.
No. 346	Waterflow Indicators for Fire Protective Signaling Systems.
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling systems.
No. 1971	Visual Notification Appliances.

C. Local and State Building Codes.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.08 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc

FM Factory Mutual

B. The fire alarm control panel shall meet UL Standard 864, (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).

C. The system shall be listed by the national agencies as suitable for extinguishing release applications.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL:

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

B. Silent Knight is the fire alarm system manufacturer. Equals by Fire-Lite will be considered.

C. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

D. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.02 CONDUIT AND WIRE:

A. Conduit:

1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.

2. Unless noted on plans, plenum rated wiring shall be allowed to be neatly tiewrapped to joists or secured with approved hangers unless local authority having jurisdiction requires wiring to be installed in conduit or raceway. Where required by local code, conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit. It is the contractor's responsibility to verify local code requirements regarding fire alarm wiring and conduit.

3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.

4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.

6. Conduit shall be 3/4 inch (19.1 mm) minimum.

B. Wire:

1. All fire alarm system wiring shall be new.

2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).

5. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet (254 m). The system shall support up to 1,000 ft. (25.4 m) of untwisted, unshielded wire. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.

6. All field wiring shall be completely supervised.

7. The Fire Alarm Control panel shall be capable of T-Tapping Class B (NFPA Style 4) Signaling Line Circuits (SLC's). Systems which do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.

8. Wiring routed in conduit underground or below slab shall be wet location rated per N.E.C.

C. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.1 General

2.1.1 Control Panel

The fire alarm control panel (FACP) shall be the IntelliKnight 5808 addressable control panel. The FACP must have a 6 amp power supply and be capable of expansion to a maximum of 54 total amps via bus connected expander modules that supervise low battery, loss of AC and loss of communication.

The FACP must be capable of supporting 99 addressable points and 99 addressable modules. The communication protocol on the SLC loop must be digital. The use of shielded cable or twisted pair is not required.

The panel must have a built in 80 character LCD annunciator with the capability of having an additional eight supervised remote annunciators connected in the field.

The FACP must have a built in UL approved digital communicator. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

The FACP must compensate for the accumulation of contaminants that affect detector sensitivity (Drift Compensation). The FACP must have a maintenance alert feature (differentiated from trouble condition). The panel shall indicate a “Maintenance Alert” which means that the detector is

still in an operational condition but should be cleaned before it enters a “Trouble” condition in which it will no longer function properly.

The FACP shall have a Jumpstart feature that can automatically enroll all properly connected and addressed accessories into a functional system without further programming. This is required by UL 864. Panels that do not have this feature will not be acceptable.

The main communication bus (SBUS RS485) shall be capable of Class B configuration with a total Bus length of 6,000 feet. This communications bus must be fully supervised.

2.1.2 System Wiring

The SLC and Data Communication Bus shall be wired with standard NEC 760 compliant wiring, no twisted, shielded or mid capacitance wiring is required for standard installations. All FACP screw terminals shall be capable of accepting 14-18 AWG wire.

2.1.3 Signaling Line Circuits

The SLC shall be capable of a wiring distance of 10,000 feet from the SLC driver module and be capable of supporting 99 devices and 99 detectors. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 3 seconds. The SLC shall be capable of functioning in a Class A or Class B configuration.

2.1.4 SLC Loop Devices

Devices supported must include analog photoelectric, ionization smoke detectors, analog heat detectors, contact monitoring modules and relay output modules. There is to be no limit to the number of any particular device type up to the maximum of 99 detectors and 99 addressable modules, that can be connected to the SLC.

2.1.5 Addressable Detector Functions

The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:

Automatic compliance with NFPA 72 standards for detector sensitivity testing

Drift compensation to assure detector is operating correctly

Maintenance alert when a detector nears the trouble condition

Trouble alert when a detector is out of tolerance

Alert control panel of analog values that indicate fire.

2.1.6 Programmable Notification Circuits

The FACP shall support four programmable notification circuits that are capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, reset able or door holder power. These circuits shall be programmable for Class A or Class B operation.

2.1.7 Annunciators

The main control must have a built in annunciator with an 80 character LCD display and feature LED's for General Alarm, Supervisory, System Trouble, System Silence, and Power. When in the normal condition the LCD shall display time and date based on a 200-year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 in. No membrane style buttons will be permissible. The annunciator must be able to Silence Acknowledge and Reset alarms through the use of a keypad-entered code, or by using a firefighter key. The annunciators must be able to program up to 20 levels of user codes that will allow the limitation of operating system programming to authorized individuals.

2.1.8 Remote Annunciators

The fire system shall be capable of supporting up to eight remote annunciators. LCD remote annunciators shall have the same control and display layout so that they match identically to the built in annunciator. LED Remote annunciators shall have individually mapped LED's and reset and silence inputs. The reset and silence inputs must use the same firefighters key as the LCD annunciators. Remote annunciators shall be capable of operating at a distance of 6,000 feet from the main control panel on unshielded non-twisted cable.

2.1.9 I/O Module

The fire system shall be able to support up to eight I/O modules on the SBUS that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and shall be suitable for alarm and trouble circuits as well as reset and silence switches. The system shall also support up to 40 LED drivers that reside on the two-wire SLC loop. These driver boards shall contain 80 LED outputs that are powered by an external source.

2.1.10 Serial/Parallel interface

The fire system shall be capable of supporting up to two serial / parallel interfaces that are capable of driving standard computer style printers. The interface shall be programmable as to what information is sent to it and shall include the ability to print out Detector Status, Event History and System Programming.

2.1.11 Distributed Power Modules

The contractor shall supply (where required) a power module model 5895XL compatible with the 5808 fire alarm control panel. The power module must have 6 amps of output power, six programmable "Flexput" circuits are rated at 3 amps each, and two form C relay circuits rated at 2.5

amps at 24 volts DC. The six programmable “Flexput” circuits are capable of being programmed as supervised reverse polarity notification circuits, supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power, or input circuits in Class A or B configurations to support dry contact or compatible two wire smoke detectors. The 5895XL shall be capable of being connected via a RS-485 system bus (SBUS) at a maximum distance of 6000 feet from the main control panel. The power module shall contain an additional RS-485 bus that is completely compatible with all 5808 SBUS modules. The power module will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6000ft. from the power module.

The contractor shall supply (where required) a power module model 5496 compatible with the 5700 fire alarm control panel. The power module must have 6 amps of output power with four notification circuits rated at 3 amps each. The four notification circuits shall have the same functionality as the notification circuits on the main panel. The 5496 shall be capable of being connected via a RS-485 system bus (SBUS) at a maximum distance of 6000 feet from the main control panel.

The 5700 shall be capable of supporting up to eight (8) of the Distributed Power Modules in any combination.

The power module’s RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

2.1.12 Digital Communicator

The digital communicator must be an integral part of the control panel and be capable of reporting all zones or points of alarm, supervisory, and trouble conditions as well as all system status information such as loss of AC, low battery, ground fault, and loss of supervision to any remote devices with individual and distinct messages to a receiving point. The communicator must also be capable of up/downloading of all system programming options, Event History and Sensitivity compliance information to a PC on site or at a remote location. The communicator shall have an answering machine bypass feature that will allow the panel to respond to communication even on phone lines that have other communication equipment present. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage.

2.1.13 Dry Contacts

The FACP shall have three form “C” dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for Alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual Pull, Zone Aux. 1, or Zone Aux. 2 conditions. The trouble contact shall be normal in an electrically energized state so that any total power loss (AC and Backup) will cause a trouble condition. In the event that the microprocessor on the FACP fails the trouble contacts shall also indicate a trouble condition.

2.1.14 Ground Fault Detection

A ground fault detection circuit shall be employed which can detect a ground fault on both the positive and negative side of each circuit. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground faults shall not interfere with normal operation, such as alarm, or other trouble conditions.

2.1.15 Over current Protection

All low voltage circuits will be protected by microprocessor controlled power limiting or have self-restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

2.1.16 Test Functions

A “Lamp Test” mode shall be a standard feature of the fire alarm control panel and shall test all LED’s and the LCD display on the main panel and remote annunciators.

A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for six seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested. the zone tripped, the zone restore and the individual points return too normal.

A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.

A “Bypass Mode” shall allow for any zone, point, group, or nac circuit to be bypassed Without effecting the operation of the total fire system.

2.1.17 Remote Input Capabilities

The control panel shall have provisions for supervised switch inputs for the purpose of Alarm reset and Alarm and trouble restore.

2.1.18 Notification Appliance Mapping Structure

All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 125 output groups. Each of these groups shall have the ability to be triggered by any of the panels 125 zones. A group may be triggered from a zone individually, or may contain a global trigger for manual pull stations, fire drills and two different system alarms. Additionally each zone will individually control the cadence pattern of each of the groups that it is “Mapped” to so that sounders can indicate a variety of conditions. The zone shall be capable of issuing a different cadence pattern for each of the groups under its control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices. Zones shall have eight different output categories; Detector alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual pull, Zone auxiliary one and Zone Auxiliary two. Each of the categories shall have the ability to control from 1 to 8 output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California code, Zone 1 coded, Zone 2 coded, Zone 3 coded, Zone 4 coded, Zone 5 coded, Zone 6 coded, Zone 7 coded, Zone 8 coded, Custom output pattern 1, Custom output pattern 2, Custom output pattern 3, Custom output pattern 4 and Constant. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

The main FACP and addressable power supplies shall support built-in synchronization for

Amseco, Faraday, Gentex, System Sensor, and Wheelock devices.

2.1.19 On Board Programmer

The FACP shall have an on board programmer which will allow for all system functions and options to be programmed. Any panel that does not have this capability will not be accepted.

2.1.20 Downloading Software

The fire alarm control panel must support up/downloading of system programming from a PC under Windows 98, Windows XP, Windows N/T, or Windows Vista. The FACP must also be able to upload the detector sensitivity test results and a 1000 event system event buffer to the PC. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or over the phone lines.

2.1.21 Facility Management Software

The FACP must support a facility management capable of providing off site access to FACP data that is necessary to manage fire system operation. A software package capable of uploading the detector sensitivity test results and the 1000 event system event buffer to the PC shall be required as part of the bid package. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator. The facility management package must be separate from the downloader package and must not be capable of affecting programmed system options.

2.1.22 English Language Descriptions

The FACP shall provide the ability to have a text description of each system device input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

2.2 SYSTEM OPERATION

2.2.1 Alarm

When a device indicates an alarm or supervisory condition the control panel must respond within 3 seconds. The General Alarm or Supervisory Alarm LED on the annunciator(s) shall light and the LCD shall prompt the user as to the number of current events. All notification circuits associated with the alarm or supervisory condition shall activate. If the digital dialer is being utilized it shall transmit a signal to the digital alarm receiving unit. The alarm shall also cause the appropriate door holders and air handlers to shut down. If employed all elevators shall return to the main level or an alternate level when required by the elevator specification or building code. The alarm information must be stored in event memory for later review. Event memory shall be available at the main and all remote annunciators. The alarm memory must be capable of storing up to 1000 events.

When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.

Exception: When detectors are utilized in single station or multi-station applications they may be self- restoring.

An alarm shall be silenced by a code or Firefighter key at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal.

2.2.2 Troubles

When a device indicates a trouble condition, the control panel System Trouble LED should light and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.

When the device in trouble is restored to normal, the control panel shall be automatically reset, The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by a code or Firefighter key at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

2.2.3 Supervision methods

The SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

SYSTEM COMPONENTS

3.1 System Cabinet

3.1.1 Mounting

The system cabinet shall be red and can be either surface or flush mounted. The cabinet door shall be easily removable to facilitate installation and service.

3.1.2 Audible System Trouble Sounder

An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.

3.2 Power Supply and Charger:

The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 6 Amps. The FACP must have a battery charging circuit capable of complying with the following requirements:

Sixty (60) hours of battery standby with five (5) minutes of alarm signaling at the end of this sixty (60) hour period (as required per NFPA 72 remote station signaling requirements) using rechargeable batteries with automatic charger to maintain standby gel-cell batteries in a fully charged condition.

OR

Twenty-four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period (as required per NFPA 72 central station signaling requirements) using rechargeable batteries with automatic charger to maintain gel-cell batteries in a fully charged condition.

The power supply shall comply with UL Standard 864 for power limiting.

The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A “Battery Test” will be performed automatically every minute to check the integrity of the batteries. The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.

In the event that it is necessary to provide additional power one or more of the model 5495, 5499 or 5496 Distributed Power Modules shall be used to accomplish this purpose.

3.2.1 Connections and Circuits

Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Electrical Code (NEC) and the local authority having jurisdiction (AHJ).

The circuit and connections shall be mechanically protected.

A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked “FIRE ALARM CIRCUIT CONTROL”.

ACCESSORY COMPONENTS

4.1 The FACP shall support the following devices on the RS-485 data bus:

5824	Printer Interface Module
5860	LCD Remote Annunciator
5865-3	LED Remote Annunciator
5865-4	LED Remote Annunciator with reset and silence switches
5880	LED I/O module
5895XL	Intelligent Remote Power Supply, 6.0 Amp
5496	Intelligent Remote Power Supply, 6.0 Amp

4.2 The FACP shall support the operation of 99 detectors and 99 addressable module total devices per SLC loop without regard to device type. The following devices shall be supported:

	SK-Photo	Addressable Photoelectric Smoke detector
	SK-Photo-T	Addressable Photoelectric Smoke detector with Thermal
SK-Ion	Addressable Ionization Sensor	
	SK-Heat	Addressable Heat Sensor
	SK-Heat-ROR	Addressable Heat with Rate of Rise
	SK-Heat-HT	Addressable Heat High temp 190°
	SK-Acclimate	Addressable Multi Criteria Smoke detector with thermal
B210LP	6" detector base	
SK-Duct	Duct Housing	
	SK-Relay	Addressable Relay Module
	SK-Relay-6	Addressable Multi Relay Module
	SK-Monitor	Addressable Input Module (Class A or B)
	SK-Minimon	Mini Input Module
	SK-Monitor-2	Addressable Dual Input Module
	SK-Monitor-10	Addressable Multi Input Module (10)
	SK-Control	Addressable Notification Module
`	SK-Control-6	Addressable Notification Multi Module (6)
SK-Zone	Two Wire Smoke Detector Module	
	SK-Zone-6	6 Multi Smoke Detector Module
	SK-Iso	Isolation Module
	SK-Beam	Addressable Beam Detector
	SK-Beam-T	Addressable Beam Detector with Test feature
	B224RB	Detector Relay Base
	B501BHT-2	Detector Sounder Base
	B224BI	Detector Isolator Base
SK-Pull-SA	Addressable Single Action Pull Station	
SK-Pull-DA	Addressable Dual Action Pull Station	

The FACP shall support these other Silent Knight devices via addressable input, addressable Notification, or Addressable Output Modules.

PS-SATK	Single Action Manual Pull Station – Key Reset
PS-DATK	Dual Action Manual Pull Station – Key Reset
PS-SA	Single Action Manual Pull Station – Key Reset
PS-DA	Dual Action Manual Pull Station – Key Reset

4.3 Manual Fire Alarm Stations

Manual Fire Alarm Stations shall be non-coded, break glass, single or double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset manual station and open FACP without use of another key. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed of LEXAN® or

die cast metal with clearly visible operating instructions on the front of the stations in raised letters. Stations shall be suitable for surface mounting on matching backbox, or semi-flush mounting on a standard single-gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on manual station accessibility or per local requirements. Manual stations shall be Model SK-Pull-SA or SK-Pull-DA. If using conventional pull stations they must be installed in conjunction with an Addressable Input Module (SK-Monitor) or Mini Input Module (SK-Minimon). Manual stations shall be Silent Knight Model PS-DATK, PS-SATK, PS-DA or PS-SA and Underwriters Laboratories listed when used with addressable modules.

4.4 Remote Power Supplies

The Remote Power Supplies for Notification appliances shall be the Silent Knight Model 5496 and/or 5895XL. The 5496 and 5895XL Intelligent Power Supplies shall hang on the main SBUS and be programmed through the 5700 control. The 5496 will support 6 amps of 24 volt DC power with 4 notification circuits rated at 3 amps each. The 5895XL will support 6amps of 24 volt DC power, with 6 Flexput circuits, rated at 3amps each. The 5895XL power supply will also regenerate the SBUS for an additional 6000'.

The remote power supply model 5495 or 5499 may also be used on the system. These power supplies support 6amps or 9amps of 24VDC power with 4 notification circuits rated at 3amps each. These power boosters may also be activated from another notification circuit from either the fire alarm control or distributed power modules.

4.5 Notification Devices

The visible and audible/visible signaling devices shall be compatible with the 5808, 5495, 5496, 5499, or 5895XL as stated in the installation manuals and be Listed with Underwriters Laboratories Inc. per UL 1971 and/or 1638. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition. The notification appliance (combination audible/visible units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The visible signaling appliance shall maintain a minimum flash rate of 1Hz or greater regardless or power input voltage. The appliance shall also be capable of meeting the candela requirements of the blueprints presented by the Engineer and ADA. The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate. The unit shall have an input voltage range of 20-30 volts with either direct current or full wave rectified power.

4.6 Smoke Detectors

Smoke detectors shall be Silent Knight model SK-Photo ceiling mounted, addressable photoelectric smoke detectors, SK-Ion ceiling mounted, addressable ionization smoke detector, or SK-Acclimate multi-criteria photoelectric smoke detector. The combination detector head and twist lock base shall be U.L. listed compatible with the Silent Knight 5808 fire alarm control panel. The base shall permit direct interchange with Silent Knight's SK-Ion ionization smoke detector, SK-Acclimate multi-criteria smoke detector or the SK-Heat detector. The base shall be the appropriate twist lock base B210LP. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for

external test equipment. The vandal security-locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30 mesh insect screen. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

4.7 Duct Detectors

Duct Detector shall be Silent Knight Model SK-Duct Housing with the Model SK-Photo Smoke detectors.

4.6 Heat Detectors

Furnish and install analog/addressable heat detectors, Silent Knight model SK-Heat. The combination heat detector and twist lock base shall be U.L. listed compatible with the Silent Knight 5808 fire alarm control panel. The base shall permit direct interchange with the Silent Knight SK-Ion smoke detector, SK-Acclimate smoke detector and the SK-Photo photoelectric smoke detector. The base shall be appropriate twist lock base B210LP. The heat detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch.

WIRING

5.1 Installer's Responsibilities

The installer shall coordinate the installation of the fire alarm equipment.

All conductors and wiring shall be installed according to the manufacturer's recommendations.
It shall be the installer's responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

5.2 Installation of System Components

System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, National Electrical Code, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ).

All wire used on the fire alarm system shall be U.L. Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760.

WARRANTY AND FINAL TEST

6.1 General

The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year 18 months from the date of final acceptance.

6.2 Final Test

Before the installation shall be considered completed and acceptable by the awarding authority, a test of the system shall be performed as follows:
The contractor's job foreman, a representative of the owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.

At least one half of all tests shall be performed on battery standby power.

Where application of heat would destroy any detector, it may be manually activated.

The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per circuit to check for the presence of correct supervision circuitry.

When the testing has been completed to the satisfaction of both the contractor's job foreman and owner, a notarized letter cosigned by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.

The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the awarding authority.

Prior to final test the fire department must be notified in accordance with local requirements.

6.3 As Built Drawings, Testing, and Maintenance Instructions

6.3.1 As Built Drawings

A complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system.

6.3.2 Operating and Instruction Manuals

Operating and instruction manuals shall be submitted prior to testing of the system. Three (3) complete sets of operating and instruction manuals shall be delivered to the owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

PART 7.0 - EXECUTION

7.01 INSTALLATION:

1. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

2. All conduit, junction boxes, conduit supports and hangers shall be concealed. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

3. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

4. All mirrors in duct-mounted smoke detectors shall be cleaned following final cleaning of building and prior to Final Completion.

7.02 TEST:

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

3. Verify activation of all flow switches.

4. Open initiating device circuits and verify that the trouble signal actuates.

5. Open and short signaling line circuits and verify that the trouble signal actuates.

6. Open and short Notification Appliance Circuits and verify that trouble signal actuates.

7. Ground all circuits and verify response of trouble signals.

8. Check presence and audibility of tone at all alarm notification devices.

9. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.

10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

7.04 INSTRUCTION:

A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 16720

SECTION 267400

TELEPHONE/DATA RACEWAY SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:

1. Provide a complete telephone/data raceway system including but not limited to conduits, wood backboard, outlet boxes, and pull strings, beginning with the telephone service entrance conduit and terminating at each telephone outlet.

B. Related Sections:

1. Section 16050: Electrical General
2. Section 16110: Raceways
3. Section 16120: Boxes
4. Section 16450: Grounding.

PART 2 - PRODUCTS

Refer to individual related sections for information on products.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Coordinate telephone service entrance with telephone company.

B. Provide 3/4" conduit concealed from each telephone/data outlet to 6” above ceiling or to bar joists in areas without ceiling. Provide conduit above GWB ceilings and other inacessible areas. See plans for additional conduits and cable specifications and locations.

C. Provide a pull-cord in each conduit with 12” coiled at each end.

D. Mount telephone backboard as prescribed on drawings.

E. Mount wall outlets vertical and if adjacent to a receptacle, mount with maximum of 6" separation between coverplates.

F. Provide a separate grounding electrode for telephone service installed in compliance with NEC 800-40(b)(3) and bonded in accordance with NEC 800-40(c). Refer to NEC 800-11(c).

G. Provide bushings at the end of conduits and in all boxes.

H. Provide pullboxes in conduit runs at intervals not exceeding 100ft. Pullboxes shall be provided with removable covers and identified “Communication.”.

I. All conduit bends shall be long radius.

J. Where required by local code or authority having jurisdiction, Contractor shall provide conduit system for entirety of low voltage system wiring or as required. Contractor shall verify requirements prior to bid and include all such work in his price. All work shall be coordinated with Owner and Owner's vendors.

END OF SECTION 16740

SECTION 267550

ARC FLASH HAZARD ANAYLSIS AND LABELLING

PART 1 - GENERAL

1.01 SCOPE:

A. Description:

1. Electrical contractor shall provide an arc flash hazard analysis of each switchboard, panelboard, transformer and disconnect switch. Determine in the analysis the personal hazard category and the associated flash protection boundary.

2. Electrical contractor shall submit all calculations to the Architect for owner's record.

3. Electrical contractor shall provide an Arc Flash and Shock Hazard label on each switchboard, panelboard, transformer and disconnect switch disconnect switch based upon the arc flash hazard analyis with all appropriate information required by NFPA 70E reported on the label.

B. Codes:

1. NFPA 70
2. NFPA 70E

PART 2 - PRODUCTS

2.01 LABELS:

A. Provided non-paper labels with adhesive both which will resist degradation due to sunlight and moisture.

PART 3 - EXECUTION

3.01 ANALYSIS:

A. The arc flash hazard analysis shall be performed by a registered professional engineer registered in the state where the project is located. The submittal to the Architect shall include the seal and signature of the professional engineer who performed the analysis.

B. The analysis shall include selection and coordination of all overcurrent devices as to operation to minimize both the arc fault level and nuisance tripping.

C. Include in the submittal all time-current curves of breakers and fuses, tabulation of adjustable trip settings and tabulation of current limiting fuses selected.

3.02 INSTALLATION:

A. Install each label on the front of the equipment, in a prominent visible location and where possible, centered.

END OF SECTION 16755

SECTION 311000
SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Protecting existing trees and vegetation to remain.
   2. Removing trees and other vegetation.
   3. Clearing and grubbing.
   4. Topsoil stripping.
   5. Removing above-grade site improvements.
   6. Disconnecting, capping or sealing, and abandoning site utilities in place.
   7. Disconnecting, capping or sealing, and removing site utilities.

1.02 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 31 Section "Grading" for soil materials, excavating, backfilling, and site grading.

C. Division 32 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and planting.

1.03 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

1.04 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.05 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings according to Division 1 Section "Contract Closeout."
   1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.07 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Confirm that the Owner has authority for performing work on property adjoining Owner's property prior to proceeding with this Work.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Notify utility locator service for area where Project is located before site clearing.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
   1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TREE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
   2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
   3. Maintain existing drainage pattern in all tree save areas – standing water in these areas is not permitted.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
   3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.
   1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.03 UTILITIES

A. Arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange to shut off indicated utilities with utility companies.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's and Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.04 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer in accordance with requirements for structural fill.

3.05 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within drip line of remaining trees.
   3. Dispose of excess topsoil as specified for waste material disposal.
   4. Stockpile surplus topsoil and allow for respreading topsoil.

3.06 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.07 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

B. Storage or sale of cleared items or materials on-site is not permitted.

END OF SECTION

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SECTION 312200
GRADING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for slabs-on-grade.
   4. Subbase course for concrete walks and pavements.
   5. Base course for asphalt paving.
   6. Subsurface drainage backfill for walls and trenches.
   7. Excavating and backfilling trenches within building lines.
   8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

1.02 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 1 Section "Unit Prices" for a schedule of unit prices.

C. Division 1 Section "Construction Facilities and Temporary Controls."

D. Division 31 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.

E. Division 32 Section "Landscaping" for finish grading, including placing and preparing topsoil for lawns and plantings.

F. Division 3 Section "Cast-in-Place Concrete" for granular course over vapor retarder.

1.03 MASS ROCK

A. Mass rock excavation, including replacement with approved materials is to be included in the General Contractors contract. Rip Rock is to be included in General Contractors contract.

1.04 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill an excavated area to final grade.

B. Base Course: Layer placed between the subbase course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill as approved by geotechnical engineers.

E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations.
   1. Additional Excavation: Excavation below subgrade elevations as recommended by Owner's Testing Agency, and approved by the Owner, to reach specified compaction level. Additional excavation and replacement material costs are to be included in the Base Contract amount.
   2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Owner's Testing Agency. Unauthorized excavation, as

well as remedial work recommended by Owner's Testing Agency, shall be without additional compensation.

G. Fill: Suitable soil materials, as determined by the Owner's Testing Agency, used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator equal to Caterpillar Model No. 215D-LC; equipped with a 42-inch- wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,000 lbf; measured according to SAE J-1179.
   2. Bulk or Open Excavation: Late-model, track-type tractor, equal to Caterpillar Model No. D-8N, rated at not less than 285-hp flywheel and equipped with a single-shank hydraulic ripper, capable of exerting not less than 45,000-lbf breakout force; measured according to SAE J-732.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Each type of plastic warning tape.
   2. Drainage fabric.
   3. Separation fabric.

B. Samples: For the following:
   1. 30-lb samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
   2. 12-by-12-inch sample of drainage fabric.
   3. 12-by-12-inch sample of separation fabric.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
   3. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

D. Blasting plan approved by authorities having jurisdiction, for record purposes.

E. Insurance Certificates and License for blasting shall be provided to the Owner prior to commencement of blasting.

F. Seismic survey agency report, for record purposes.

1.06 QUALITY ASSURANCE

A. Comply with applicable requirements of NFPA 495, "Explosive Materials Code."

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring services during blasting operations.

C. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.07 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.
   3. Contact utility-locator service for area where Project is located before excavating.
   4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

B. Geotechnical Report: A subsurface geotechnical investigation report for the site, prepared by Terracon dated March 24, 2023 is available for information only. The report is not part of the Contract Documents. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. The Owner, nor the Architect, will not be responsible for interpretations or conclusions drawn from this data by the Contractor. The Contractor shall make their own investigation of existing subsurface conditions. The Owner, nor the Architect, will be responsible in any manner for additional compensation for excavation work performed under the Contract due to the Contractor’s assumptions based on soil investigation data prepared by the Owner’s geotechnical investigation.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. CL can be used if approved by geotechnical engineer.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, MH, CH, OL, OH, and PT, or a combination of these group symbols.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Grab Tensile Strength: 110 lbf; ASTM D 4632.
   2. Tear Strength: 40 lbf; ASTM D 4533.
   3. Puncture Resistance: 50 lbf; ASTM D 4833.
   4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
   5. Apparent Opening Size: No. 50; ASTM D 4751.

C. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Grab Tensile Strength: 200 lbf; ASTM D 4632.
   2. Tear Strength: 75 lbf; ASTM D 4533.
   3. Puncture Resistance: 90 lbf; ASTM D 4833.
   4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D 4491.
   5. Apparent Opening Size: No. 30; ASTM D 4751.

D. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

E. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Unsuitable soils as a result of improper dewatering are to be removed and replaced at the General Contractor's expense.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation. Unsuitable soils as a result of improper subgrade protection are to be removed and replaced at the General Contractor's expense.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

A. Explosives: The use of explosives is prohibited.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to, and beyond, subgrade elevations as necessary to reach specified compaction level, regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions. Unclassified excavated material my include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for excavation or removal of material.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials as directed by the Owner's Testing Agency. Replacement of soils shall be included in both the Contract Time and Contract Sum. No adjustments shall be authorized to either component for such occurrences.

3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended for bearing surface.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.07 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths, in accordance with OSHA guidelines, to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. See Plans for trenching details.
   3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.08 APPROVAL OF SUBGRADE

A. Notify Owner's Testing Agency when excavations have reached required subgrade.

B. If Owner's Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
   1. Additional excavation and replacement material is included in the General Contractor's Contract Sum.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Testing Agency.

3.09 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for record documents.
   3. Inspecting and testing underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.

C. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.
   1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final subgrade.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698.
   1. Under structures, building slabs, steps and pavements, the compaction should be a minimum of 95 percent of the optimum density.

D. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.
   2. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1/2 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
   1. Place base course material over subbase.
   2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 90 percent of maximum dry unit weight according to ASTM D 1557.
   3. Shape subbase and base to required crown elevations and cross-slope grades.
   4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
   5. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 8 inches thick or less than 6 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 60 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 90 percent of maximum dry unit weight according to ASTM D 1557.

3.18 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Owner's Testing Agency.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 5000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

D. Protect areas with slopes exceeding 1 vertical : 2 horizontal with erosion-control fiber mesh and with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect areas with slopes not exceeding 1 vertical : 2 horizontal by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
1. Anchor straw mulch by crimping into topsoil with suitable mechanical equipment.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.
1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

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SECTION 321216
ASPHALT PAVING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Hot-mix asphalt paving.
   2. Hot-mix asphalt patching.
   3. Structure adjustments if not shown on drawings
   4. Asphalt Pavement Sealer.
   5. Pavement-marking paint.
   6. Wheel stops.

1.02 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 31 Section "Grading" for aggregate subbase and base courses and aggregate pavement shoulders.

C. Division 32 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.

1.03 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the standard specifications of the state or of authorities having jurisdiction.
   1. Standard Specification: Local Dept. of Transportation
   2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.04 SUBMITTALS

A. Product Data: For each product specified. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: For each job mix proposed for the Work. When standard agency designs are called for on plans, designs should be approved by agency having authority over specifications.

C. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

D. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements may be submitted in lieu of Material Test Reports. Engineer may request supporting Test Reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance.
   1. Firm shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the DOT of the state in which Project is located.

C. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction for asphalt paving work on public property.

D. Asphalt-Paving Publication: Comply with Virginia Department of Transportation Standard Specifications for Roads and Bridges, latest edition, except where more stringent requirements are indicated herein.

E. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to asphalt paving including, but not limited to, the following:
   1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
   2. Review condition of substrate and preparatory work performed by other trades.
   3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
   4. Review and finalize construction schedule for paving and related work. Verify availability of materials, paving Installer's personnel, and equipment required to execute the Work without delays.
   5. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
   6. Review aesthetic expectations for pavement surface.
   7. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
   8. For existing dealership, discuss mitigation of impacts with the operation of the facility during paving and review coordination required to move on site inventory.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
   1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
   2. Seal Coat: Comply with weather limitations of ASTM D 3910 (pavement and air temperature should be greater than 45 deg F and rising. If pavement or air temperature is below 55 deg F and falling, sealer should not be applied.) or manufacturer’s recommendations, whichever are more stringent.
   3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: Sound; angular crushed stone; crushed gravel; or properly cured, crushed blast-furnace slag; complying with ASTM D 692.

C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone; gravel, properly cured blast-furnace slag, or combinations thereof; complying with ASTM D 1073.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.

E. Reclaimed Asphalt Pavement (RAP). Limit RAP to a maximum of 25 percent by weight of total mix for surface/wearing lifts and 30 percent by weight of total mix for binder/base mixes. Where the Agency Specifications referenced in Section 1.5 B 1 D reference binder replacement, the limits shall be a maximum of 25 percent binder replacement for surface/wearing and a maximum of 30 percent binder replacement for binder/base mixes. Lower limits maybe dictated by local agency experience. Mixes with higher limits may be approved by the Engineer when accompanied by performance-test data indicating adequate cracking resistance.

F. Recycled Asphalt Shingles (RAS). RAS shall not be permitted.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M320 (ASTM D 6373) Performance-Graded (PG) Asphalt Binder or AASHTO M332 Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test. Binder grade should be appropriate for the climatic conditions and be compliant with the local State Transportation Department Specifications for the project site.

B. Undersealing Asphalt: ASTM D 3141, pumping consistency.

C. Allow prime coat materials included in Section 1.5 D, Standard Specifications. Acceptable products include:
   1. Prime Coat: ASTM D 2027; medium-curing cutback asphalt; MC-30, MC-70, or MC-250.
   2. Prime Coat: Asphalt emulsion prime conforming to state DOT requirements or approved products list.
   3. Prime Coat: ASTM D 977, emulsified asphalt, grades SS-1 or SS-1h, or ASTM D 2397, cationic emulsified asphalt, grades CSS-1 or CSS-1h, , diluted with water, of suitable grade and consistency for application.

D. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

2.03 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew. Specified by Geotechnical Engineer, if required.

D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 3 minutes.

2.04 MIXES

A. Hot-Mix Asphalt: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to one of the procedures in the Asphalt Institutes' "Asphalt Mix Design Methods"; and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Nominal maximum aggregate size (NMAS) defined as one sieve size larger than the first sieve to cumulatively retain 10 percent.
   3. Base Course: Typically 1/2 –inch (12.5 mm) or ¾-inch (19.0 mm) nominal maximum aggregate size (NMAS) as indicated on drawings.
   4. Binder Course: As indicated on drawings, if used.
   5. Surface Course: 3/8-inch (9.5 mm) nominal maximum aggregate size as indicated on drawings. Regardless of referenced specifications, minimum percent passing the No. 8 (2.36 mm) sieve shall be 37 percent.
      a. Asphalt Seal Coat: ASTM D 8099, consisting of emulsified asphalt, polymer additive, fine aggregate, and mineral fillers. Coal-tar based products will not be permitted. The asphalt seal coat must meet the following additional requirements:

6. Residue (solids) of undiluted concentrate by distillation or evaporation 57% minimum.
7. ASTM D3910-6.4 Wet Track Abrasion Test < 10.0 g/ft2 loss

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, equipment having a minimum loaded weight of 25 tons to locate areas that are unstable or that require further compaction.

C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.02 COLD MILLING

A. Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, including hot-mix asphalt and, as necessary, unbound-aggregate base course, by cold milling to grades and cross sections indicated.
   1. Repair or replace curbs, manholes, and other construction damaged during cold milling.

3.03 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Fill with like in-kind, approved subgrade or subbase material to bottom of proposed asphalt layer, if required. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
   1. Tack coat faces of excavation and allow to cure before paving.
   2. For asphalt base patching prior to asphalt surface installation - Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
   3. For asphalt surface patching - Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Pump hot undersealing asphalt under rocking slabs until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
   2. Remove disintegrated or badly broken pavement. Prepare and patch with hot-mix asphalt.

C. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

D. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

E. Tack Coat: Thoroughly sweep existing asphalt pavement prior to tack application. Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. of surface.
   1. Allow tack coat to cure undisturbed before paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
   3. Protect all concrete and asphalt surfaces, such as drive approaches and roads not being paved, from tracking tack coat onto surface.

3.04 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
   1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: When specified on plans, apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat when formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.40 gal./sq. yd.. Apply enough material to penetrate and seal, but not flood, surface. Allow cutback prime coat to cure for 48 hours minimum; allow emulsion prime coat to cure for 24 hours minimum..
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.
   3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
   4. Protect all concrete and asphalt surfaces, such as drive approaches and roads not being paved, from tracking tack coat onto surface. Clean sand meeting Section 2.3 B may be applied to primed surface after initial curing to help prevent tracking.

D. Tack Coat: Thoroughly sweep existing asphalt pavement prior to tack application. Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. of surface.
   1. Allow tack coat to cure undisturbed before paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
   3. Protect all concrete and asphalt surfaces, such as drive approaches and roads not being paved, from tracking tack coat onto surface.

3.05 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand only in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.
   1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated. Place hot-mix asphalt surface course in single lift.
   2. Spread mix at minimum temperature of 250 deg F. Higher temperature may be required to facilitate acceptable placement and compaction based on lift thicknesses and ambient weather conditions.
   3. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
   4. Place asphalt in direction of traffic flow.

B. Place paving in consecutive strips not less than 10 feet wide, except where infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Avoid over-rolling cold material. Complete asphalt base course for a section before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill any depressions with hot-mix asphalt in a

manner to prevent segregation of mix. Avoid broadcasting material. Use a lute, rake, or other suitable hand tool to remove coarse particles in order to produce uniform texture comparable to paver laid material. Allow sufficient material for roll down.

3.06 JOINTS

A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces, including saw spoils, if applicable, and apply tack coat.
   2. Offset longitudinal joints in successive courses a minimum of 6 inches.
   3. Offset transverse joints in successive courses a minimum of 24 inches.
   4. Construct transverse joints by bulkhead method or sawed vertical face method as described in AI's "The Asphalt Handbook." Care should be taken to prevent/remove sawing spoils on final wearing surface and to remove sawing spoils from vertical face before tacking or paving against.
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density, but not less than 90 percent.

3.07 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F. Finish rolling to remove roller marks may be completed at a lower temperature.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: At least 92.0 percent of reference maximum theoretical density according to ASTM D 2041, with no individual test less than 90.0 percent nor greater than 97.0 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.08 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.

2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.

3.09 SURFACE TREATMENTS

A. Asphalt Seal Coat: Allow new pavement to cure as long as possible prior to installing Seal Coat. Apply number of seal coat(s) indicated on the Drawings and in accordance with ASTM D 3910 and Manufacturer's Instructions. Allow to cure.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint in two separate coats, with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide an overall minimum wet film thickness of 15 mils.

3.11 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than 2 galvanized steel dowels embedded in precast concrete at one-third points. Firmly bond each dowel to wheel stop and to pavement.
   1. Extend upper portion of dowel 5 inches into wheel stop and lower portion a minimum of 5 inches into pavement or as noted on the detail, which ever is greater.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.
   1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.
   1. Reference maximum theoretical density will be determined by averaging results from the day's production of hot-mix asphalt-paving mixture delivered to site, tested according to ASTM D 2041, and the sampled paving mixture will be compacted according to job-mix specifications.
   2. A test strip will be established in general accordance with local DOT practice to assist the contractor in establishing an optimum rolling pattern for compacting the hot mix asphalt. This procedure should include at a minimum:
      a. Selecting multiple fixed test locations where in place density tests are conducted using a nuclear gauge (ASTM D 2950) as the mix is placed and compacted. Density readings will be obtained at the same location after successive passes with the breakdown and finish rollers. Rolling with the breakdown roller should continue until the density count peaks or the asphalt mat begins to show signs of over rolling. Rolling with the finish roller should continue until no further increase in density is indicated. The number of passes with each compactor necessary to achieve these

thresholds should be established as the rolling pattern. Test strips should be performed for each asphalt mix type placed on the project. If the specified minimum density is not achieved, repeat the test strip altering mix placement temperature or rolling pattern until acceptable density is achieved.

b. Cores shall be obtained from the compacted asphalt courses and their density determined in accordance with ASTM D 2726 or D 1188 to correlate the nuclear gauge readings to a direct density measurement. Based on these results, a bias (correction factor) shall be applied to subsequent nuclear density test results as appropriate.

3. In-place density and thickness of compacted pavement will be determined by one of the following methods.
   a. One core sample will be taken for every 2500 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken per defined area (lot or access road). Core density shall be tested in accordance with ASTM D 1188 or D 2726.
   b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726. Tests should be taken and recorded for every 500 sq. yd. or less of installed pavement.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 321313
CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:
   1. Driveways and roadways.
   2. Parking lots.
   3. Curbs and gutters.
   4. Walkways.

1.02 RELATED REQUIREMENTS

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

B. Division 31 Section "Grading" for subgrade preparation, grading, and subbase course.

C. Division 31 Section “Asphalt Paving” for pavement markings

D. Division 32 Section "Pavement Joint Sealants" for joint sealants within concrete pavement and at isolation joints of concrete pavement with adjacent construction.

E. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials and aggregates.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or adhesive.
   8. Joint fillers.

E. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
1. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Concrete subcontractor.

1.06 PROJECT CONDITIONS

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

PART 2 PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves of a radius 100 feet or less.

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

2.02 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

C. Epoxy-Coated Welded Wire Fabric: ASTM A 884/A 884M, Class A, plain steel.

D. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.

E. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, deformed bars.

F. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

G. Plain Steel Wire: ASTM A 82, as drawn.

H. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A coated, plain steel.

I. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

J. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.

K. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

L. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer coated wire bar supports.

M. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.03 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, Type I or II.
   1. Fly Ash: ASTM C 618, Class F or C.
   2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Blended Hydraulic Cement: ASTM C 595M, Type IS, portland blast-furnace slag cement.

D. Blended Hydraulic Cement: ASTM C 595M, Type IP portland pozzolan cement.

E. Blended Hydraulic Cement: ASTM C 595M, Type I (PM) pozzolan-modified portland cement.

F. Blended Hydraulic Cement: ASTM C 595M, Type I (SM) slag-modified portland cement.

G. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
   1. Class: 4S.
   2. Class: 4M.
   3. Class: 1N.
   4. Maximum Aggregate Size: 3/4 inch nominal.
   5. Do not use fine or coarse aggregates containing substances that cause spalling.

H. Water: ASTM C 94.

2.04 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.05 CURING MATERIALS

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

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

C. Water: Potable.

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

E. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

G. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

H. Products: Subject to compliance with requirements, provide one of the following:
   1. Evaporation Retarder:
      a. Finishing Aid Concentrate; Burke Group, LLC (The).
      b. Sure Film; Dayton Superior Corporation.
      c. Eucobar; Euclid Chemical Co.
      d. Confilm; Master Builders, Inc.
   2. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound:
      a. Res-X Cure All Resin; Burke Group, LLC (The).
      b. Day-Chem Rez Cure; Dayton Superior Corporation.
      c. Kurez DR; Euclid Chemical Co.
      d. 3100-Clear; W. R. Meadows, Inc.
   3. Clear Waterborne Membrane-Forming Curing Compound:
      a. Aqua Resin Cure; Burke Group, LLC (The).
      b. Day Chem Rez Cure (J-11-W); Dayton Superior Corporation.
      c. 1100 Clear; W. R. Meadows, Inc.
   4. White Waterborne Membrane-Forming Curing Compound:
      a. Aqua Resin Cure; Burke Group, LLC (The).
      b. 1200-White; W. R. Meadows, Inc.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: Preformed, plastic, void cap designed to be removed after placement of concrete, equal to Plastic Void Cap Strip Expansion Joint (EXPJ-006) by Right Pointe Company.

B. Wheel Stops: Precast, air-entrained concrete; 2500-psi minimum compressive strength; as indicated on plans. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.
   1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length as indicated on the drawings.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
   1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
   2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
   3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.07 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.

1. Do not use Owner's field quality-control testing agency as the independent testing agency.

C. Proportion mixes to provide concrete with the following properties:
1. Compressive Strength (28 Days): 4000 psi.
2. Flexural Strength (28 Days); 650 psi.
3. Maximum Water-Cementitious Materials Ratio: 0.50.
4. Slump Limit: 4 inches.
a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:
1. Air Content: 4.5 percent for 3/4-inch maximum aggregate.

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

B. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

C. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixers of capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

PART 3 EXECUTION

3.01 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
   1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.04 JOINTS

A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
   1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   3. Provide tie bars at sides of pavement strips where indicated.
   4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
   3. Provide plastic void cap strip expansion joint where detailed on the drawings.
   4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

F. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
a. Radius: 1/4 inch.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

G. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: 1/4 inch.

3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by Owner.

I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

K. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

M. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

N. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.07 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.08 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation: 1/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/4 inch.
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
   5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
   6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
   8. Joint Spacing: 3 inches.
   9. Contraction Joint Depth: Plus 1/4 inch, no minus.
   10. Joint Width: Plus 1/8 inch, no minus.

3.09 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops. Firmly bond each dowel to wheel stop and to pavement. Extend upper portion of dowel 5 inches into wheel stop and lower portion as noted on the drawings into pavement.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing shall be performed according to the following requirements:
   1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
8. When total quantity of a given class of concrete is less than 50 cu. yd., Owner may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
10. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

C. Test results shall be reported in writing to Owner, Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner but will not be used as the sole basis for approval or rejection.

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

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Owner when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 321320
PAVEMENT JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within portland cement concrete pavement.
   2. Joints between portland cement concrete and asphalt pavement.

B. Related Sections include the following:
   1. Division 2 Section "Hot-Mix Asphalt Paving" for constructing joints between concrete and asphalt pavement.
   2. Division 2 Section "Cement Concrete Paving" for constructing joints in concrete paving.
   3. Division 7 Section "Joint Sealants" for sealing non-traffic and traffic joints in locations not specified in this Section.

1.03 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Compatibility and Adhesion Test Reports: From joint sealant manufacturer indicating the following:
   1. Materials forming joint substrates and joint-sealant backer materials have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

D. Product Test Reports: From a qualified testing agency indicating joint sealants comply with requirements, based on comprehensive testing of current product formulations.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency, based on testing current sealant formulations within a 36-month period.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturer, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform tests under environmental conditions replicating those that will exist during installation.
2. Submit not fewer than nine pieces of each type of material, including joint substrates, joint-sealant backer materials, secondary seals, and miscellaneous material.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. Testing will not be required if joint sealant manufacturer submits joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.07 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 Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by joint sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.02 COLD-APPLIED JOINT SEALANTS

A. Type SL Sealant for Concrete and Asphalt: Multi-component, urethane, elastomeric joint sealant complying with ASTM C 920 for Type SL.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Type SL Sealant for Concrete and Asphalt:
      a. Masterseal SL2; BASF
      b. Pourthane SL; W. R. Meadows

2.03 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.04 PRIMERS

A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint- sealant-substrate tests and field tests.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 323113
CHAIN-LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. PVC-coated, steel chain-link fabric.
   2. Polymer-coated, galvanized, steel framework.
   3. Privacy slats.

1.02 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 31 Section "Grading" for filling and for grading work.

C. Division 3 Section "Cast-in-Place Concrete" for concrete post footings.

1.03 DEFINITIONS

A. CLFMI: Chain Link Fence Manufacturers Institute.

1.04 SUBMITTALS

A. Product Data: Material descriptions, construction details, dimensions of individual components and profiles, and finishes.

B. Maintenance Data: For the following to include in maintenance manuals specified in Division 1:
   1. Polymer finishes.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Allied Fence Manufacturing Co.
   2. Anchor Fence Div.
   3. Boundary Fence and Railing Co.

2.02 CHAIN-LINK FENCE FABRIC

A. Steel Chain-Link Fence Fabric: As indicated on the Drawings. Provide fabric fabricated in one-piece widths for fencing in height of 12 feet (3.6 m) and less. Comply with CLFMI's "Product Manual" and with requirements indicated below:
   1. Mesh and Wire Size: 2-inch (50-mm) mesh, 0.148-inch (3.76-mm) diameter for PVC-coated wire.
   2. PVC-Coated Fabric: ASTM F 668, Class 2b over metallic-coated steel wire.
   3. Metallic Coating: Aluminum.
   4. Color: Black.
   5. Coat selvage ends of fabric that is metallic coated during the weaving process with manufacturer's standard clear protective coating.

B. Selvage: Knuckled at both selvages.

2.03 INDUSTRIAL FENCE FRAMING

A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F 1083. Comply with ASTM F 1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) zinc; and the following strength and stiffness requirements:
   1. Line, End, Corner, and Pull Posts and Top Rail: Per requirements for Heavy Industrial Fence.

B. Post Brace Rails: Match top rail for coating and strength and stiffness requirements. Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.

C. Top Rails: Fabricate top rail from lengths 21 feet (6.4 m) or longer, with swedged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain-link fabric.

D. Bottom Rails: Match top rail for coating and strength and stiffness requirements.

2.04 INDUSTRIAL SWING GATES

A. General: Comply with ASTM F 900 for the following swing-gate types:
   1. Single gate.
   2. Double gate.

B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

C. Frames and Bracing: Fabricate members from round (double leaves) and square (single leaf) galvanized steel tubing with outside dimension and weight according to ASTM F 900 for the following gate fabric height:
   1. Gate Fabric Height: More than 6 feet (1.83 m).

D. Frame Corner Construction: As follows:
   1. Welded.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900 for the following gate fabric heights and leaf widths:

F. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops and, for each gate leaf more than 5 feet (1.5 m) wide, keepers.
   1. Coordinate locking provisions with details on the Drawings.
   2. Latch (Typical): Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.
   3. Personnel gate shall be fabricated to accommodate housing box for keyed cylinder and deadbolt indicated on the Drawings.

2.05 FITTINGS

A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F 626.

B. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide weathertight closure cap for each post.

C. Rail and Brace Ends: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Hot-dip galvanized pressed steel or round steel tubing. Not less than 6 inches (153 mm) long.
   2. Rail Clamps: Hot-dip galvanized pressed steel. Provide line and corner boulevard clamps for connecting bottom rails in the fence line to line posts.

E. Tension and Brace Bands: Hot-dip galvanized pressed steel.

F. Tension Bars: Hot-dip galvanized steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F 626:
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
   2. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire.
   3. Power-driven fasteners.
   4. Round Wire Clips: Hot-dip galvanized steel or aluminum for attaching chain-link fabric to H-beam posts.

2.06 PRIVACY SLATS

A. Material: PVC, UV-light stabilized, not less than 0.023 inch (0.58 mm) thick, sized to fit mesh specified for direction indicated.

B. Color: Black.

2.07 POLYMER FINISHES

A. Supplemental Color Coating: In addition to specified metallic coatings for steel framing, fittings and accessories, provide fence components with polymer coating.

B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class 2b.

C. Metallic-Coated Steel Framing: Comply with ASTM F 1043 for polymer coating applied to exterior surfaces and, except for tubular shapes, to exposed interior surfaces.
   1. Polymer Coating: Not less than 10-mil- (0.254-mm-) thick PVC or 3-mil- (0.076-mm-) thick polyester finish.

D. Color: Black complying with ASTM F 934.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
   1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

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

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
   1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set posts in concrete footing. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Using mechanical devices to set line posts per ASTM F 567 is permitted. Verify that posts are set plumb, aligned,

and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

1. Dimensions and Profile: As indicated on Drawings.
2. Concealed Concrete Footings: Stop footings a minimum of 2 inches (50 mm) below grade to allow covering with surface material.

3.04 CHAIN-LINK FENCE INSTALLATION

A. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

B. Line Posts: Space line posts uniformly at 10 feet (3.05 m) o.c.

C. Post Bracing Assemblies: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

D. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by fencing manufacturer.

E. Bottom Rails: Install, spanning between posts, using fittings and accessories.

F. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom rail. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

G. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.

H. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts 12 inches (304 mm) o.c. and to braces 24 inches (609 mm) o.c.

I. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

J. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Vertically.

3.05 GATE INSTALLATION

A. General: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION

SECTION 323119
DECORATIVE METAL FENCING AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Ornamental galvanized steel fencing.

1.02 RELATED REQUIREMENTS

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

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data: In the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, and accessories.

C. Shop drawings: Showing location of fence, gates, each post, and details of post installation, extension arms, gate swing, hardware, and accessories.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain chain link fences and gates as complete units, including necessary erection accessories, fittings, and fastenings from a single source or manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to the compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:
1. Master Halco, Inc.
2. Merchants Metals
3. AmeriStar
4. Monumental Iron Works

B. Fencing: AmeriStar “Montage plus ATF” as manufactured by Monumental Iron Works or approved equal. Fencing shall be the height as noted on drawings with ¾” square, 18-gauge hot-rolled structural steel.

C. Finish: Shall be black polyester resin-based powder coating applied by electrostatic spray process; 2.5 mils minimum thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.

3.02 DO NOT BEGIN INSTALLATION BEFORE FINAL GRADING IS COMPLETED, UNLESS OTHERWISE PERMITTED BY ARCHITECT.

A. Proceed with installation only after unsatisfactory conditions have been corrected.
1. INSTALLATION, GENERAL

B. General: Install ornamental fencing in accordance with the manufacturer’s written instructions.

C. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

D. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set posts in concrete footing. Protect portion of posts aboveground from concrete

splatter. Place concrete around posts and vibrate or tamp for consolidation. Using mechanical devices to set line posts per ASTM F 567 is permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.

1. Dimensions and Profile: As indicated on Drawings.
2. Concealed Concrete Footings: Stop footings a minimum of 2 inches (50 mm) below grade to allow covering with surface material.

END OF SECTION

SECTION 328423
UNDERGROUND SPRINKLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes valves, piping, sprinklers, accessories, controls, and wiring for automatic irrigation systems.

1.02 RELATED REQUIREMENTS:

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

1.03 SUMMARY OF WORK:

A. Extent of underground irrigation system is shown on the Drawings and in Schedules.
   1. Provide all labor, materials and equipment required by or inferred from the Drawings and Specifications to complete the Work of this Section.
      a. Provide a complete and operable system for the irrigation of all landscaped areas on the project site, unless indicated otherwise. The Drawings and specifications are intended to include all items obviously necessary and requisite for the proper irrigation of the Project. The Contractor is responsible to furnish any additional labor, materials and equipment required for a proper system.
      b. The Contractor shall be responsible for adjusting head location, head/nozzle type and size, and any other system components so that irrigation system layout is coordinated with actual field conditions. Such adjustments shall be made at no cost to he Owner except, when authorized in writing, such adjustments which will be compensated for at an agreed upon cost.
   2. Provide additional work and materials required by local authorities.
   3. Pre-Installation Meeting:
      a. Conduct a conference/meeting at the Project site. Review methods and procedures related to the site landscape irrigation system including, but not limited to the following:
         1) The General Contractor is to contact the Irrigation Consultant and Owner a minimum of 60 days prior to the scheduled date of commencement of the irrigation installation.
         2) Meet with Owner and Irrigation Consultant to review Contract Documents.
         3) Verify current drawing release date with contractor’s documents.
         4) Review submittal procedure including codes, substitutions, product data, qualifications, and AS-BUILT
         5) Review project conditions including tap & meter size, permits, utility locations and water conditions.
         6) Review methods and procedures related to irrigation installation.
         7) Review and finalize construction schedule and verify availability of materials, contractor’s personnel, equipment, and facilities needed to make progress and avoid delays.
         8) Review warranty guidelines.

1.04 DEFINITIONS:

A. Supply Piping: Piping from water source to connection to irrigation system pressure piping. Piping is under same pressure as water supply.

B. Pressure Piping: Piping downstream from supply piping to and including control valves. Piping is under irrigation system pressure. Piping in this category includes pressure regulators, water meters, and backflow preventers, when used.

C. Circuit Lateral Piping: Piping downstream from control valves to irrigation system sprinklers, emitters, devices and drain valves. Piping is under pressure during flow.

D. Control Valve: Manual or automatic (electrically operated) valve for control water flow to irrigation system zone.

E. Drain Piping: Downstream from circuit piping drain valves. Piping is not under pressure.

F. Drain Valve: Manual or automatic (pressure operated) drain valve for draining of irrigation system circuit piping.

G. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylobitrile - butadiene - styrene plastic.
   2. NP: Nylon plastic.
   3. PE: Polyethylene plastic.
   4. PTFE: Polytetrafluoroethylene plastic.
   5. PVC: Polyvinylchloride plastic.

1.05 SYSTEM PERFORMANCE REQUIREMENTS:

A. The Drawings are diagrammatic and generally indicate the Work to be installed. The Drawings do not indicate all offset fitting, and sleeves. The Contractor shall furnish such items as may be required to complete the work.

B. Location of Sprinklers and Devices: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.

C. Minimum Water Coverage: Not less than:
   1. Turf Areas: 100 percent
   2. Other Planting Areas: 80 percent

D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves and specialties, unless indicated otherwise.
   1. Mainline Piping: 200 psig.
   2. Circuit Piping (lateral lines and risers): 150 psig.
   3. Drain Piping: 100 psig.

1.06 QUALITY ASSURANCE:

A. Industry Reference Standards: Refer to Division 1 References Section.
   1. American Society for Testing and Materials (ASTM):
      a. C 33-99: Specification for Concrete Aggregates.
      b. C 150-99a: Specification for Portland Cement.
      c. D 1785-96b: Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
      d. D 2241-96b: Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
      e. D 2464-96b: Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
      f. D 2466-94a: Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
      g. D 2467-96b: Specification for Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
      h. D 2564-96a: Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
      i. D 2672-94: Specification for Joints for IPS PVC Pipe Using Solvent Cement.
      j. D 2774-94: Practice for Underground Installation of Thermoplastic Pressure Piping.
      k. D 2855-96: Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
      l. D 3139-96a: Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
   2. National Fire Protection Association (NFPA):
      a. National Electrical Code.
   3. National Electrical Manufacturer’s Association (NEMA):

a. Enclosures for Electrical Equipment (1000 Volts Maximum).

4. Qualifications:
   a. Installer Qualifications: Engage a firm or firms specializing in irrigation installation. Installer shall have successfully completed five projects similar in material, size, scope and complexity to that indicated for this Project that have resulted in construction with a record of successful in-service performance.
      1) Firm Experience Period: Five (5) years of experience.
      2) Field Foreman Experience: Five (5) years of experience with installing firm.

B. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. County regulations supersede these specifications. Notify the Architect in writing of all discrepancies immediately.

C. Do Not Make Substitutions: If the Contractor desires to make substitutions of materials, sufficient descriptive literature and material samples must be furnished to establish the material as an equal substitute. In addition, the Contractor must state his reasons for desiring substitute materials. Submit this request and information to the Architect.

D. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the Drawings and Specification is subject to the approval of the Owner and Architect. They have the right to reject any and all materials and any and all Work which, in their opinion, does not meet the requirements of the Contract Documents at any stage of the operations. Remove rejected Work and or materials from project site and replace promptly.

E. Workmanship: Install materials and equipment in a neat and professional manner following manufacturer's recommendations.

1.07 SUBMITTALS:

A. Section Cross Reference: Refer to Division 1 Submittals Section for general requirements.

B. As-Built Drawings: Any changes in the layout and/or arrangements of the proposed irrigation system, or any other differences between the proposed system and actual installed conditions are to be recorded by the Irrigation Contractor in the form of an "As-Built" Drawing. Provide the Owner and the Architect with a copy of the As-Built Drawings before Work under this Contract will be considered for Acceptance. All automatic and manual valves, hose bibs or quick couplers, and wire splice locations shall be shown with actual dimensions to reference points so they may be located easily in the field.

C. Product Data: Submit, for information only, manufacturer's specifications, product data, installation instructions and general recommendations for ALL components of the irrigation system. Individual copies of product data shall be submitted with the specific product name and model number visibly identified with specific product and model number being identified using a highlighter, asterisk or underlining.

D. Installer Certification: Submit written documentation certifying that Installer complies with requirements of "Installer Qualifications" above.

E. Five sets of a site map showing the individual zones using numbers and color code of the installed irrigation system. One of the site maps is to be laminated and placed in the door of the irrigation control clock for on site reference.

1.08 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials and equipment in such a manner as to not damage the parts or decrease the useful life of equipment.

B. Store materials away from detrimental elements. Coordinate with Owner or General Contractor to secure a safe staging area. Security of stored materials shall be provided by the contractor at all times.

C. Handle, load, unload, stack and transport materials for irrigation system carefully to avoid damage. Handle pipe in accordance with manufacturer's recommendations.

1.09 PROJECT CONDITIONS:

A. The site irrigation system is comprised of two major components, an irrigation distribution and sprinkler system. The Contractor shall connect the distribution network to the domestic water meter.

B. The irrigation system is designed to operate under the following conditions: A minimum of 70 psi water pressure downstream of irrigation water meter, and at least _____ gpm available water supply.

C. Obtain all required permits and pay all required fees, at no additional cost to the Owner. Any penalties imposed due to failure to obtain permits or pay fees are the responsibility of the Contractor.

D. Provide and maintain all passageways, guard fences, warning lights and other protection devices required by the local authorities.

E. Existing Grades: Existing grades will be within .2 feet of grades shown on the Civil Engineering Drawings at time of irrigation work. Determine condition of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Determine location of existing drainage patterns and maintain patterns in completed Work. Perform Work in a manner which will avoid damage to finished grading and drainage patterns. All damage to finished grading and drainage resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.

F. Existing Utilities: Determine location of underground utilities. Perform Work in a manner which will avoid possible damage. Excavate as required. Maintain grade stakes set by others unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from Work covered in these Contract Documents shall be repaired at the Contractor’s expense.

G. Existing Conditions: Perform irrigation Work in the Tree Protection zones and in existing or previously completed landscape areas to avoid damage and disturbance to these areas. Limit work in these areas to only that necessary to perform work specified herein and shown on the Drawings. Return and repair and areas damaged or disturbed while performing the Work to the existing conditions encountered prior to the Work.

H. Existing Site Improvements: Perform Work in a manner which will avoid possible damage to other work. The Contractor is responsible for any damage of mechanical nature as well as damage resulting from leaks in the irrigation system whether due to negligence or otherwise.
   1. Protect improvements on adjoining properties and on Owner’s property.
   2. Restore damaged improvements to their original condition at the Contractor’s expense.

I. Test Water Conditions: The Contractor shall check the pressure downstream of the irrigation meter and/or the pump station discharge and confirm minimum operating pressure noted in this Specification. If minimum operating pressure cannot be obtained, notify the Architect.
   1. In the event the water pressure does not meet minimum operating pressure at the meter as noted in this Specification, notify the Architect, state conditions and submit a proposal for installing a booster pump system capable of increasing the pressure to the minimum noted in this Specification
   2. In the event the water pressure significantly exceeds the operating pressure noted in this Specification, provide a pressure regulator down stream of the backflow preventer.

J. Damages resulting from irrigation installation to work of other trades must be repaired at the expense of the Irrigation Contractor in a timely fashion.

K. Make minor adjustments to system layout as may be required and requested at no additional cost to the Owner.

L. Keep project site clean and orderly at all times during construction.

1.10 WARRANTY:

A. Warranty all Work for a period of one year and 20 days, starting on the Date of Final Completion, against defects in materials, equipment, workmanship and any repairs required resulting from leaks or other defects of workmanship, material or equipment.

B. Emergency repairs may be made by the Owner without relieving the Contractor of his warranty obligations.

C. Repair settling of backfilled trenches occurring during the warranty period, including restoration of damaged plantings, paving or improvements resulting from settling of trenches or repair operations.

D. Respond to Owner's request for repair work within ten (10) days. If not, Owner may proceed with such necessary repairs at the Contractor's expense.

PART 2 - PRODUCTS

2.01 PIPES AND FITTINGS:

A. Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 2241; PVC 1120 compound, SDR 21 of the following size and class:
   1. 3 inches and larger; Class 200.
   2. 2-1/2 inches to 3/4 inches; Class 200.
   3. ½ inch; Class 315.

B. Polyvinyl Chloride (PVC) Plastic Pipe: Exposed pipe; ASTM D 1785, PVC 1120 compound, Schedule 80, 250 psig (1725 kPa) minimum pressure rating for eight (8) inch and smaller sizes, with plain and threaded ends.

C. Pipe three (3) inch and larger shall be PVC pipe with bell and rubber ring gasket, unless otherwise indicated.

D. Pipe smaller than three (3) inch shall be solvent weld PVC pipe.

E. Fittings for integral bell rubber ring gasketed pipe (three (3) inch and larger) shall have the gasket type ductile iron fittings with joint restraints.

F. All pipe fittings size three (3) inches and greater shall be ductile iron in construction. All fitting two and one half (2-1/2) inches and under shall be Schedule 40 solvent weld fittings rated for 200 psi (ASTM D 3139).

G. Solvent weld PVC pipe shall be rigid PVC pipe and shall be assembled using appropriate PVC pipe cleaner/primer and solvent cement in accordance with the manufacturer’s recommendations. Solvent cement shall be No. 717 NSF approved.

H. All solvent weld firings shall conform to Schedule 40 or Schedule 80 PVC dimensions and specifications for solvent weld fittings.

I. Expansion Joints: Shall consist of integral bell and rubber gasket coupling, install every three hundred (300) feet of solvent weld piping.

J. Runs of pipe over twenty (20) feet length must be installed with standard twenty (20) feet length sections.

K. PVC Pipe Couplings located Within Sleeves: Four (4) inches and smaller shall be solve weld. Six (6) inches and larger shall be mechanical joints. Upon exiting sleeves, pipe solvent weld or integral bell and rubber gasket, as specified.

L. Polyvinyl Chloride (PVC) Plastic Pipe Fittings: ASTM D 2466, Schedule 40, socket-type.

M. Exposed Pipe: Polyvinyl Chloride (PVC) Plastic Pipe Fittings: ASTM D 2467, Schedule 80, socket-type.

2.02 RISERS:

A. Provide Threaded Schedule 80 PVC Risers. All risers above grade to be either dark gray or black PVC pipe.

2.03 JOINING MATERIALS:

A. Solvent Cement: ASTM F 656 primer and ASTM D 2564 solvent cement in color other than orange.

B. Gaskets for Plastic Flanged Joints: Materials recommended by plastic pipeand fittings manufacturer.

2.04 ELECTRIC WIRING:

A. 120 Volt AC Wiring: 120 volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service to be provided by Contractor.

B. Splices in the field control wiring shall be waterproof UL listed for 600 volts.
   1. Acceptable Manufacturers and Products:
      a. Manufacturer: 3M
         1) DBY-6
      b. Manufacturer: Paige
         1) DBY-6

C. Control wiring shall be 600 volt solid single conductor wire U.L. approved for direct burial in ground. Minimum wire size: 14 gauge. Control wiring and wiring connections from the controller to the valves is included in this Contract.
   1. Acceptable Manufacturers and Products:
      a. Manufacturer: Paige Electric Co.
      b. Manufacturer: King Wire and Cable
      c. Manufacturer: Regency Wire Corporation

2.05 BACKFLOW PREVENTERS:

A. The Contractor shall provide a backflow device downstream of the domestic water meter. The backflow preventer shall be an approved assembly type as per local code, capable of a having a flow rate of _____ gallons per minute (GPM) with a pressure loss not to exceed eight (8) pounds per square inch (PSI) and shall be suitable for supply pressure up to 150 psi. The backflow preventer body to be bronze, internal parts stainless steel, and the check valve assemblies tight seating rubber. The backflow preventer assembly must include two gate valves for isolating unit, and two ball valve test cocks for testing unit to insure proper operations. All backflow devices should conform to all local codes and regulations.

B. Acceptable Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:
   1. Manufacturer: Watts Regulator Co.
   2. Manufacturer: Febco
   3. Manufacturer: Hershey Products, Inc., Grinnell Corp.

C. If required by local code and the backflow device has to be located above finished grade the contractor is to provide and install an enclosure to protect the device from vandalism and/or the possibility of freeze in geographical areas of the country that experience freezing temperatures.

2.06 PRESSURE REGULATORS:

A. Description: ASSE 1003, single-seated, direct-operated-type, water pressure regulators, rated for initial working pressure of 150 psig minimum, with size, flow rate, and inlet and outlet pressures indicated. Included integral factory-installed or separate field-installed Y-pattern strainer that is compatible with unit for size and capacity.
   1. 2-Inches and Smaller: Bronze body with threaded ends.
   2. 2-1/2 Inches and Larger: Bronze or cast-iron body with flanged ends.
      a. Interior Components: Corrosion-resistant materials.

B. Acceptable Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:
   1. Manufacturer: Watts Industries, Inc
   2. Manufacturer: Cla-Val Co.

3. Manufacturer: Bermad

2.07 ISOLATION VALVES:

A. Valves for isolation purposes shall be bronze manually operated gate valves, allowing full diameter opening when in the full open position of the same size as line.

B. Valves three (3) inches or smaller: Bronze construction, threaded and rated for 200 psi WOG.
   1. Acceptable Manufacturers:
      a. Pegler
      b. Nibco, Inc.
      c. Hammond Valve

2.08 CONTROL VALVES:

A. Description: Manufacturer's standard control valves for irrigation zones, of type and size indicated, and as follows: Valves are to be constructed of a glass filled nylon material with a self cleaning stainless steel screen. The control valve shall be considered to be a "contamination resistant style valve" with flow/low pressure operating capabilities. Flow .25 to 200 GPM; Pressure: 20 to 200 PSI. Valves to conform to Manufacturer's Specifications concerning performance and at pressure provided. Operation will occur through a 24-volt pulse to the AC solenoid.

B. Acceptable Manufacturers:
   1. Manufacturer: Rain Bird Corp.
      a. Product: PESB Series
   2. Manufacturer: The Toro Co.
      a. Product: 252 Series
   3. Manufacturer: Hunter Industries, Inc.
      a. Product: ICV-FS Series

2.09 QUICK COUPLING VALVES:

A. Factory-fabricated, bronze or brass two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5 NH threads for garden hose on outlet; and operating key.

B. Quick coupling valves shall be used as a source to the pressurized main line so that a hose can be attached for manual hand watering. The quick coupling valve will be constructed of brass with a spring loaded seal that will keep the valve in a closed position until the key is inserted into the valve. The valve will also have a hinged locking purple rubber cover to prevent any debris getting into the internal mechanism of the valve. The cover shall be marked with "Do Not Drink" in English and Spanish. All quick coupling valves will be installed on a triple elbow pre-fabricated swing joint. Provide size as indicated on drawings.

C. Quick coupling keys shall be of the single lug variety. Attached to the key will be a hoseswivel adapter sized to the commonly used hose on the project. The key and swivel will both be constructed of brass.

D. Acceptable Manufacturers:
   1. Rainbird Sprinkler Mfg. Corp.
   2. Toro Co.
   3. Hunder Industries, Inc.

2.10 HOSE BIBS:

A. All cast brass or bronze hose bib installed below grade in a twelve (12) by eighteen (18) inch valve box.

2.11 VALVE BOXES:

A. Plastic Valve Boxes: Box and cover, with open bottom and opening for piping; designed for installing flush with grade.

1. Control Valves: Shall be in a twelve (12) by eighteen (18) inch standard valve box with non-hinged cover.
2. Backflow Preventer & 1 ½", 2" Drip Valve Assemblies: Shall be in a twenty (20) by thirty four (34) inch valve box with non-hinged cover.
3. Isolation Valves, Wire Splices and Quick Coupling Valves: Shall be in a ten (10) inch round valve box with cover.

B. All valve boxes are to be BLACK in color with BLACK colored covers.

C. Acceptable Manufacturers:
1. Carson Industries, Inc.
2. Armor Access Boxes, Plymouth Products Co.
3. Rain Bird

2.12 SPRINKLERS:

A. Rotary Sprinkler Heads: The sprinkler shall be capable of covering a 25-40 foot radius at 30-70 psi with a distribution rate of 1.5-8.0 gpm, four (4) inch or twelve (12) inch pop-up trajectory of 13-25 degrees, matched precipitation rate nozzles, filter screen, reducible water radius. The body of the sprinkler shall have a three-quarter (3/4) inch female inlet and a factory installed check valve.

B. Rotary Sprinklers for short radius: The sprinkler shall be capable of covering 20-35 foot radius at 30-55 psi at a rate of .75-4.60 gpm, four (4) inch pop-up and a 25 degree trajectory. The nozzles shall be matched precipitation rate, filter screen, reducible watering radius. The body of the sprinkler shall have a half (1/2) inch female inlet and a factory installed check valve.

C. Full or Part Circle Pop-Up Spray Sprinkler: The sprinkler body. Stem, nozzle and screen shall be constructed of heavy-duty, ultra-violet resistant plastic. It shall have a heavy-duty stainless steel retract spring for positive pop-up and a ratcheting system for easy alignment of the pattern.
1. The sprinkler shall have soft elastomer pressure activated co-molded wiper seal for cleaning debris from the pop-up stem as it retracts into the case to prevent the sprinkler.
2. Spray Sprinklers shall also include a check valve and an internal pressure-regulating device. These units shall identifiable from the top with markings on the cap.
3. Spray sprinklers using a MP Rotator will not require an internal pressure regulator due to the impeded performance of a MP Rotator at lower pressures.
4. The check valve shall prevent low head drainage of up to ten (10) feet of head. The pressure-regulating device shall prevent high pressure fogging of the nozzle stream by regulating the nozzle pressure to 30 psi for inlet pressure from 35 to 70 psi. Below 35 psi the pressure loss shall not exceed 6 psi. These models shall utilize the bottom inlet only.
5. Sprinklers located above grade on risers will not require check valves due to potential freeze damage in areas of the country that may experience 32 and below degree temperatures while systems are still in operation.

D. If noted on the drawings the plastic shrub adapter shall have a half (1/2) inch (FNPT) inlet and its fine-threaded outlet shall accept all plastic nozzles.
1. The plastic shrub adapter shall be constructed of rugged ultra-violet resistant plastic.
2. The plastic shrub adapter shall also include a built-in pressure compensating screen located below the adapter. The device shall regulate the nozzle pressure to 30 psi with inlet pressure from 35 to 70 psi, below 35 psi the pressure loss shall not exceed 6 psi.
3. A plastic shrub adapter with pressure regulating device shall have a half (1/2) inch (FNPT) inlet and its fine-threaded outlet shall accept all brass and plastic nozzles.

E. Spray sprinklers are to have fixed arcs, adjustable arc nozzles are not acceptable and will be rejected. The one exception is the use of the MP rotator.

F. All spray sprinkler bodies are to be produced by the same manufacturer a mix of product manufacturer's is not acceptable.

G. All sprinkler heads located in turf areas will be installed on four (4) elbow swing joints, as shown on details.

H. All high-pop sprinkler heads located in mulched plant material areas will be installed on flex pipe using the bottom inlet to the sprinkler, as shown on details.

I. Above grade risers for both pop-ups and shrub mounted sprays shall be constructed of gray Schedule 80 PVC, half (1/2") inch risers for spray heads, and three-quarter (3/4") inch risers for rotary heads. The above grade risers shall be painted flat black, secured with support stakes of rebar cut to length that will securely support the riser and sprinkler and fastened with stainless steel hose clamps.

J. Acceptable Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:
   1. Acceptable Manufactures and Products:
      a. Rain Bird Corp.
         1) Product: Spray #1806 and #1812 SAM-PRS
         2) Product: Rotor No. 5000 radius 25-45 feet
      b. The Toro Co.
         1) Product: Sprays No.570PRZ-6p and 570 PRZ-12p
         2) Product: Rotor No. S800 radius 25-45 feet
      c. Hunter Industries, Inc.
         1) Product: Sprays No.INSTITUTIONAL-06 &12-CV
         2) Product: Rotor I-20 radius 25-45 feet

2.13 IRRIGATION SPECIALTIES:

A. Drip Irrigation Emitters: In-line self-cleaning, pressure compensating variety as indicated. In-line emitters will be spaced at twelve (12), inches on-center.
   1. Acceptable Manufacturers:
      a. Netafim USA
      b. Irridelco International Corp.
      c. Rain Bird Corp.

B. Pressure Regulators: In-line pressure regulator sized as shown on drawings. Maximum regulated pressure not to exceed 45 psi.
   1. Acceptable Manufacturers:
      a. Netafim USA
      b. Rain Bird Corp.
      c. Hunter Industries
      d. Senninger

C. Automatic Flush Valves: All drip zones shall be installed with an automatic line flushing valve(s), number of valves will be based on size of zones and location of "dead ends"

D. Air/Vacuum Relief Valves: Each independent irrigation zone shall be installed with an Air/Vacuum Relief Valve at the zones highest points.

E. Specialty Nozzles: Provide where indicated on drawing using a spray sprinkler that does not have internal pressure regulation.
   1. Manufacturer: Walla Walla Sprinkler Company (a subsidiary of Nelson Irrigation Corp.)
      a. Product: MP-1000 Rotator 8' to 15' radius
      b. Product: MP- 2000 Rotator 16' to 21' radius
      c. Product; MP-3000 Rotator 22' to 30' radius

2.14 AUTOMATIC CONTROLLER:

A. Provide an electronic solid state hybrid controller system capable of fully automatic and manual operation of the system, made for control of irrigation system automatic control valves. Controller housing shall be wall or pedestal mounted, as indicated on the Drawings, in a weatherproof and lockable cabinet.

B. Provide controller, which operates on a minimum of 110 volts AC power input and is capable of operating 24 volt AC electric remote control valves, with a reset circuit breaker to protect from overload. Contractor is responsible for connection to 120 VAC power to controller.

C. Each station shall have a time setting which can be set for variable timing in increments from 0 to 60 minutes, or set to omit the station from the irrigation cycle.

D. The controller shall have a calendar for setting the programmed start-days , and a 24-hour clock for programming the irrigation cycle start time. A master “on-off: switch shall allow the valve power output to be interrupted without affecting the controller.

E. The controller shall be constructed so that all internal parts are accessible through the controller door without disturbing the cabinet installation.

F. Each Controller will be equipped with a commercial grade remote control capabilities either as a manufacturers option or a peripheral produced by a reputable manufacturer that their equipment interfaces with controller that has been installed.

G. Each controller location must be easily accessible for maintenance. Provide for the possibility of making minor timing adjustments to the controller in the field.

H. Acceptable Manufacturers and Products:
   1. The Toro Co.
      a. Product: Custom Command Series
   2. Rain Bird Corp.
      a. Product: ESP Series
   3. Hunter Industries, Inc.
      a. Product: ICC Series

2.15 WATER HAMMER ARRESTERS:

A. Water Hammer Arresters: ASME A112.26.1M, ASSE 1010, or PDI WH-201, bellows or piston-type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1M and PDI WH-201 Sizes “A” to “F”.

2.16 PRESSURE GAUGES:

A. Pressure Gauges: ASME B40.1, four and one-half (4½) inch diameter dial, liquid filled with dial range of two (2) times system operating pressures and bottom outlet.

2.17 CONCRETE BASES:

A. Concrete: Portland cement mix, 3000 psi.
   1. Cement: ASTM C 150, Type I.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Reinforcement: Steel conforming to the following:
   1. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.18 IDENTIFICATION:

A. Section Cross Reference: Refer to Division 2, Earthwork Section, for plastic underground warning tape requirements.

2.19 SLEEVES:

A. Schedule 40 PVC Pipe Type: Size as indicated on Drawings.

2.20 SURGE PROTECTION EQUIPMENT:

A. Provide lightning arrestor for controllers not equipped with primary surge protection.

2.21 MISCELLANEOUS SYSTEM COMPONENTS:

A. Provide risers, reducers, couplings, adapters, fittings as necessary to complete the irrigation system.

B. Provide and install a wireless rain sensor with adjustable shut-off point from one-eighth (1/8) inch to one (1) inch of accumulated rainfall. Rain sensor is to be installed in an obstructed location (ie; roof, top of wall). Provide and install freeze sensor that will cancel scheduled irrigation cycle if temperature is 37 degrees Fahrenheit or below. Switch will interrupt common wire. Unit shall be UL approved.

C. Acceptable Manufacturers and Products subject to compliance with requirements, provide products by one of the following:
   1. Rain Bird Corp.
      a. Product: WRS series (WRFC) Rain & Freeze Sensor
   2. Hunter Industries, Inc.
      a. Product: Wireless Rain and Freeze Clik
   3. The Toro Company
      a. TWRFS Wireless Rain and Freeze Sensor

PART 3- EXECUTION

3.01 GENERAL:

A. Observation of Work in Progress: During the installation, the Landscape Architect and Irrigation Consultant will make regular site visits and reject any work and materials which do not meet the requirements called for in the Contract Documents.

B. Inspect project site prior to start of Work to determine that all site conditions are acceptable for Work to begin. Inform the Architect of unsuitable conditions. Do not proceed with installation of irrigation system until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

C. Locate all existing underground utilities prior to trenching and/or boring operations and protect them against damage during the Work. Obtain utility locations from Owner and/or General Contractor and utilize utility locating services when necessary.

3.02 EXAMINATION:

A. Investigate and determine available water supply, water pressure and flow characteristics.

B. When unanticipated utilities that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Owner for action.

3.03 PREPARATION:

A. Layout if Mains and Laterals: Layout sprinkler mainlines and perform line adjustments and site modifications to laterals prior to execution.

B. Coordinate all installation with landscape planting work, especially fine grading, and soil preparation for planting areas.

C. Coordinate and cooperate with all other contractors to enable the work to proceed as rapidly and efficiently as possible.

D. Layout of Sprinkler Heads: Stake sprinkler head locations and check for uniformity of coverage and correctness of pattern. Minor adjustments to layout should be made based on actual field conditions. If there is a discrepancy of the actual site configuration that may cause sprinklers to cast precipitation into any public roads or walks that were not indicated on the drawings, notify the Architect and the Irrigation Consultant so revisions can be made.

E. Valve Location: Locate valves to assure ease of access for maintenance and that no physical interference with other elements of the project that are existing or planned. Valve boxes shall be placed a minimum of five (5) feet from walkways and roads. Valve boxes shall be located in mulched planting beds and away from view of pedestrians. If there are no mulched areas within forty feet of a proposed valve location valves may be located in turf areas provided no more than two valve boxes are located next to each other.

F. Furnish temporary support, adequate protection and maintenance of all underground and surface utilities, structures, drains, sewers and other obstructions encountered in the progress of the work.

G. Contractor shall acquaint himself with all site conditions. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further actions. Failure to do so will make Contractor liable for any and all damage thereto rising from his operations subsequent to discovery of such utilities not shown on the Drawing.

H. Where the grade or alignment of the pipe is obstructed by existing utility structures such as conduit, ducts, pipe branch connections to sewer mains, main drains, water services, etc., the obstruction shall be permanently supported, relocated, removed, or reconstructed by the Contractor in cooperation with the Owner of such utility. No deviation from the required line or grade shall be made without the written direction of the Architect.

3.04 EXCAVATION:

A. All excavation is unclassified and includes all materials encountered that are not classified as rock excavation.

B. Report exceptions to the Architect before excavation. An adjustment in price will be established which includes removal and disposal of the unsuitable material, and the acquiring of additional backfill material.

C. Excavation in Newly Sodded Areas: Prior to excavation, remove sod, preserve and replace after backfilling is completed.

D. Excavation in Established Grass or Newly Seeded Areas: After excavation and backfilling is completed, re-grade trenched area consistent with surrounding area and re-seed, or re-sod with 100 percent pure seed of grass type existing. Mulch with straw and water.

E. Excavation through existing asphalt, cutting, removal and replacement of asphalt, as noted on the Drawing, is the responsibility of the Irrigation Contractor.

3.05 BACKFILL:

A. Backfill material shall be free from rocks, large stones, and other unsuitable substance which could damage the pipe or create unusual settling problems. Backfill in six (6) inch layers and tamp after each layer to prevent excessive settling.

B. Backfill trenches containing plastic pipe when pipe is cool to avoid excessive contraction in cold water. Such backfilling can be done in early morning hours or the pipe may be water cooled prior to backfilling procedures.

C. Minimum depth of cover of all pipe is a follows:
   1. 1/2 inch - 1 inch pipe - minimum depth cover is 12 inches.
   2. 1 1/4 inch - 2 inch pipe - minimum depth cover is 18 inches.
   3. 2 1/2 inch - 4 inch pipe - minimum depth cover is 36 inches.
   4. 6 inch - 8 inch pipe - minimum depth cover is 42 inches.
   5. 10 inch - 12 inch pipe minimum depth cover is 54 inches.

3.06 PAVING WORK:

A. Section Cross Reference: Refer to Division 2 Hot-Mix Asphalt Paving Section for cutting and patching of asphalt paving.

B. Section Cross Reference: Refer to Division 2 Portland Cement Concrete Paving Section for cutting and patching of concrete paving.

3.07 SLEEVING:

A. Locate sleeving as shown on the Drawings. Contractor to make adjustments necessary to accommodate existing vegetation, utilities and other existing conditions.

B. Repair of damage to existing utilities, structures or other construction resulting from installation of sleeves is the responsibility of the Contractor.

3.08 PIPING INSTALLATION:

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, and in other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

B. Install piping free of sags and bends.

C. Install groups of pipes parallel to each other, spaced to permit valve servicing.

D. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.

E. Lay piping on solid subbase, uniformly slopes without humps or depressions.

F. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, boring or jacking.

G. Install piping under sidewalks and paving in sleeves.

H. Main Line: Install according to Manufacturer's Recommendations. Provide concrete thrust blocks at all directional changes on all pipe 3-inches and larger that is of the gasketed variety, as per drawings.

I. Lateral Lines and Risers:
   1. Install according to Manufacturer's Recommendations using standard techniques.
   2. Combine lateral lines and main supply lines in common trenches wherever possible.
   3. If called for install risers such that no excessive movement occurs while sprinkler head is in operation. Height of risers to be in accordance with planned and existing plant material. Height of all risers is subject to approval of the Architect, Irrigation Consultant, or Owner.
      a. Plug lines immediately upon installation to minimize infiltration of foreign matter.
   4. Flush lateral lines and risers prior to installation of sprinkler heads.
   5. Above ground risers must be dark gray or black in color.

3.09 JOINT CONSTRUCTION:

A. Polyvinyl Chloride (PVC) Piping Solvent-Cemented Joints: Construct joints according to ASTM D 2672 and ASTM D 2855.
   1. Use PVC pipe cleaner/primer and solvent cement according to pipe manufacturer's recommendations.

B. Dissimilar Materials Piping Joints: Construct joints using adapters that are compatible with both piping materials, outside diameters, and system working pressure.

3.10 VALVE INSTALLATION:

A. Valves: Install underground valves in valve boxes or pits.

B. Install according to manufacturer's recommendations, and as indicated on the Drawings. Position boxes at a height that will not cause them to interfere with maintenance machinery (e.g., mowers) and such that soil and mulch do not wash into the box. Locate valve box in mulched or natural areas one (1) foot inside the bed line. Where no mulched areas or natural areas exist within forty (40) feet of proposed valve box locations install valve box in turf area. Install no more than two (2) valve boxes together.

3.11 BACKFLOW PREVENTER INSTALLATION:

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cock. Install according to plumbing code and health department authorities with jurisdiction.

B. Install pressure-type vacuum breakers minimum of twelve (12) inches above downstream piping system.

C. Do not install bypass around backflow preventer.

D. Do not install backflow preventers with drains or vents in pits or areas subject to flooding.

E. Support backflow preventers, valves, and piping on 3000- psi minimum, portland-cement-mix concrete piers.

3.12 PRESSURE REGULATOR INSTALLATION:

A. If the pressure downstream of the backflow device exceeds the design pressure by more than 20% provide and install an approved pressure regulator with shutoff valve and strainer on inlet and pressure gauge on outlet. Install shutoff valve on outlet and valved bypass where indicated.

3.13 SPRINKLER INSTALLATION:

A. Pop-up Sprinkler Heads: Install in such a manner that top is one (1) inch above finish grade. Where finish grade has not been established extend a riser a minimum of twelve (12) inches above existing grade to mark location of head. After finish grade is established, install heads as shown on Drawings.

B. High Pop-up Shrub Heads: Install at heights indicated and as directed in the field by the Architect or Irrigation Consultant.

C. All spray sprinklers installed below grade should be accessed through the bottom inlet so as not to void the internal check valve feature.

D. Backfill around sprinkler head assembly in such a manner as to stabilize the sprinkler head so that no lateral motion is exhibited during operation.

E. Sprinkler heads on above grade risers: Install as indicated on the Drawings. High pop-up sprinkler heads shall be installed in landscape areas to retract out of sight when non-operational. Sprinklers installed on above grade risers are not to be equipped with a check valve in the base. Water checked in the sprinkler could freeze causing damage to the sprinkler.

F. Drip irrigation emitters are to be located in a manner that will provide optimum concentration of water to the plant material. Drip tubing should be located on both sides of the plant root ball parallel to each other. (two rows of drip tubing for every row of plant material) Snaking will not be allowed. Drip irrigation shall be installed in a grid pattern with a PVC distribution line with manifolds to insure hydraulic balance. Drip zones are to be pressure regulated and are NOT to be operated at pressures that exceed 45 psi, automatic flush valves at the ends of drip grid, and air relief valves at the high point(s) of the zone.

3.14 CONTROL WIRE INSTALLATION:

A. Install control wires in orderly fashion, locate in main line trench. Bundle wires together and tape at ten (10) foot intervals. Position wires to the right of the water supply line in the direction of the water flow.

B. Provide looped slack at directional changes in supply line to allow for contraction of wires.

C. Keep wires splices to a minimum and provide ten (10) inch round valve box at each splice location.

D. Pass wires under existing or future paving, construction, etc., through PVC sleeves.

E. For each open station on any given controller, there shall be spare wires to the furthest two (2) control valves located in diametrically opposed directions from the controller, plus one (1) additional spare wire.

3.15 AUTOMATIC CONTROL SYSTEM INSTALLATION:

A. Install controllers according to manufacturer's written instructions and as indicated.

1. Install surge protection equipment on primary (110 VAC) power lines. Connect each sure protection unit to at least one (1) five-eighths (5/8) inch diameter by nine (9) foot copper clad grounding electrode driven into the soil to its full depth. Place electrodes no closer than two (2) feet from controller cabinet or any control or power wire. Be consistent in locating ground rods throughout the installation with respect to controller positions.
2. Ground wire between surge protection device and grounding electrode to be a single strand bare copper wire at least one size greater than the wire supplying power to the control unit. Route ground wire away from power and control wire where possible. When it is necessary to pass through the controller cabinet wall use two (2) #L-70 copper grounding lugs and a brass bolt as noted in the drawings. Use a Cadwell system to affix

ground wire to ground rod. Bury ground wire passing between controller and ground rod a minimum of ten inches. Cover the top of the rod and the clamp itself with a four (4) inch round cover with lid at grade level.

3. Install free-standing controllers on concrete pads. Where dimensions are not indicated, furnish bases not less than thirty-six (36) inches by twenty-four (24) inches by four (4) inches thick, and not less than (6) inches greater in each direction than overall dimensions of controller. Wall mounts should be installed at approximately 66 inches from grade using grey electrical conduit for field wires.

3.16 CONNECTIONS:

A. Connect piping to sprinklers, devices, valves, control valves, specialties, and accessories.

B. Connect water supplies to irrigation systems. Include backflow preventers on potable water supplies.

C. Electrical Connections: Connect to power source, controllers, and automatic control valves.

3.17 FIELD QUALITY CONTROL:

A. Leak Test: Leakage shall be defined as the evidence of water moving through the pressurized mainline when no irrigation is taking place. After installation, charge system and test for leaks. If leakage is noted, leaks shall be found and repaired. Retest until no leaks exist.

1. Upon completion of the irrigation system, and after head installation, test the entire system for proper operation. Flush all air from the system and check components for proper operation.

3.18 BALANCING AND ADJUSTING:

A. Balance and adjust the various components of the sprinkler system so that the overall operation of the system is most efficient. This includes synchronization of the controllers, adjustments to pressure regulators, part circle sprinkler heads, and individual station adjustments on the controllers.

B. Adjust automatic control valves to provide flow rate of rate of operating pressure required for each sprinkler circuit.

C. Carefully adjust lawn sprinklers so they will be flush with, or not more than one-half (1/2) inch above, finish grade after completion of landscape work.

D. Upon completion of the irrigation system, perform a coverage test with the Owner’s representative to determine if the irrigation coverage is adequate. Correct any inadequacies.

E. Adjust settings of controllers and automatic control valves.

3.19 CLEANING AND PROTECTION:

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Upon completion of Work, clear grounds of debris, superfluous materials and all equipment. Remove from site to the satisfaction of the Architect.

C. Protect the Work and materials from damage due to irrigation operations, operations by other contractor and trades and trespassers. Maintain protection until Date of Substantial Completion.

D. Cover all openings into the system as it is being installed to prevent obstructions in the pipe and the breakage, misuse or disfigurement of the equipment.

E. Theft: Irrigation Contractor is responsible for theft of equipment and material at the job site before, during and after installation, until Date of Substantial Completion of the Work in total.

3.20 OWNER ORIENTATION:

A. Upon completion of the Work and at a time and place acceptable to the Architect and Owner, the Irrigation Contractor is responsible for the orientation of the Owner's maintenance personnel in the operation, maintenance, and repair of the system. Furnish copies of all available parts lists, trouble shooting lists and specification sheets, to the Architect.

1. Operating and Maintenance Manuals shall constitute the basis of orientation.

B. Set the initial watering schedules and programming of the automatic controllers at direction of Landscape Contractor.

3.21 WINTERIZING THE SYSTEM: (BASED ON GEOGRAPHICAL LOCATION WHERE 6"GROUND FREEZES OCCUR)

A. The irrigation system shall be winterized the first winter season following Substantial Completion of the Project in total. The irrigation piping shall be winterized by first blowing the system clear of water using compressed air (80 psi maximum) admitted into the piping at a quick coupling valve or hose bib located at a highest elevation on the system piping. Activate individual zones, higher zones first, then proceed successively through the system towards lower elevations. Proceed through all zones twice. The air compressor used to winterize the system must have an engine separate from the compressor tanks to prevent high temperature air from being injected directly into the PVC piping.

3.22 OBSERVATION AND ACCEPTANCE:

A. Periodic site visits will be made by the Architect or Irrigation Consultant to review the quality and progress of the work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected materials promptly from the project.

B. Upon completion of the work, the Architect or Irrigation Consultant will issue a punch list for work to be corrected. Where work does not comply with requirements, replace rejected Work.

C. It will be the responsibility of the Irrigation Contractor to provide a reliable communication system (i.e.: Two way radios or remote radio control activation system) for Substantial Completion and all periodic site visits.

D. If a site visit to verify Substantial Completion has been scheduled and the Architect or Irrigation Consultant arrives at the site and determines that the irrigation system is not substantially complete (all system components in place, operational and checked) the Contractor shall be responsible for all costs incurred by the Architect or Irrigation Consultant to visit the site. Reimbursable expenses include but are not limited to the following: Mileage, airfare, consultants time, parking fee, meals, rental car, etc. All incurred expenses will be deducted from the final contract amount.

END OF SECTION

SECTION 329300
LANDSCAPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Topsoil

B. Soil Amendments

C. Fertilizer

D. Planting Soil

E. Plant Materials

F. Miscellaneous Landscape Materials

1.02 RELATED REQUIREMENTS

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

1.03 SUMMARY OF WORK

A. Extent of Landscape Work is indicated on Drawings and in schedules.

B. Provide and furnish all labor, materials and equipment required or inferred from Drawings and Specifications to complete the Work of this Section.

1.04 QUALITY ASSURANCE

A. Industry Reference Standards: Refer to Division 1 References Section.
   1. National List of Scientific Plant Names, 1982.
   2. American National Standards Institute, Inc. (ANSI):
      a. ANSI Z60.1 - 96: American Standard for Nursery stock by the American Association of Nurseryman.
   3. American Wood Preservers Association (AWPA):
      a. C2-98: Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment.
   4. American Society for Testing and Materials (ASTM):
      a. D 1140-97: Test Method for Amount of Material in Soils Finer Than the No. 200 Sieve.
      b. D 1248-00: Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
      c. D 2487-00: Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
      d. D 2940-98: Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
      e. D 2974-87(95): Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
      f. D 4491-99a: Test Methods for Water Permeability of Geotextiles by Permitivity.
      g. D 4632-91(97): Test Method for Grab Breaking Load and Elongation of Geotextiles.
      h. D 4751-99a: Test Method for Determining Apparent Opening Size of a Geotextile.
      i. D 4759-88 (96): Practice for Determining the Specification Conformance of Geosynthetics.
      j. D 4972-95a: Test Method for pH of Soils.
      k. D 5268-92(96): Specification for Topsoil Used for Landscaping Purposes.

B. Qualifications:
   1. Installer Qualifications: Engage a firm specializing in landscape installation. Submit written documentation of successful completion of ten (10) projects of similar size, scope and complexity to work specified for this Project.
      a. Firm Experience Period: Seven (7) years of experience.

b. Field Foreman Experience: Five (5) years of experience with installing firm.

C. Soil-Testing Laboratory Qualifications: Engage a reputable independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct testing and analysis of existing surface soils representative of planting areas and lawn areas on site, new topsoil to be used in soil mixes and soil mixes with reference to specified plant materials. Soil report to include analysis of a minimum of three (3) soil samples from different locations for existing on site surface soils.

1.05 SUBMITTALS

A. Approval: Obtain approval from Landscape Architect for all submittals prior to the beginning of Work, unless otherwise approved.

B. Topsoil Location and Sample: Furnish Landscape Architect with written statement stating location of property from which topsoil is to be obtained, depth to be stripped, and crops grown during past two (2) years. Submit one (1) cubic foot of topsoil proposed for use.

C. Topsoil Test Report: Submit results of soil analysis by a qualified soil-testing laboratory, for information only, of topsoil proposed for use in planting soil mixes. Report shall include percentages of deleterious materials; organic matter; gradation of sand, silt, and clay content, as determined by test methods included in Part 2 - Products; cation exchange capacity; pH level; mineral, major nutrient and micro nutrient content of top soil.

D. Planting Soil Mix Sample: Submit one cubic foot of each proposed planting soil mix.

E. Planting Soil Mix Test Report: Submit results of soil analysis by a qualified soil-testing laboratory, for information only, of each planting soil mix as specified. Report shall included percentages of organic matter; pH level; mineral; major nutrient and micro nutrient content of each mix.
   1. State recommended quantities of nitrogen, phosphorus, potash and other nutrients and soil amendments to be added for suitable plant growth.

F. On Site Soil Report: Submit results of soil analysis by a qualified soil-testing laboratory, for information only, of on site soil. Report shall include pH level, mineral; major nutrient and micro nutrient content of on site soil.
   1. State recommended quantities of nitrogen, phosphorus, potash and other nutrients and lime to be added for suitable plant growth.

G. Product Data: Submit, for information only, product data for proprietary materials and items, including soil amendments, soil conditioner, and other packaged products.

H. Tree Pit Drainage Certification: Submit written documentation certifying that results of drainage test on tree pits and planting beds comply with requirements contained here in.

I. Fertilizer Analysis: Submit, for information only, label or technical data for fertilizer bearing the trade name, manufacturer's name, weight and analysis for fertilizers used in planting soil mixes and on sodded lawn areas.

J. Planting Schedule: Submit planting schedule showing scheduled dates for each type of planting in each area of site. The Owner may require special schedule requirements for specific areas of the project, prior to beginning the Work.

K. Certification: Prior to acceptance of plant material submit certificates of inspection as required by governmental authorities, and manufacturer's or vendors certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.

L. Installer Certification: Submit written documentation certifying that Installer complies with requirements of "Installer Qualifications" above.

M. Filter Fabric: Submit, manufacturer’s product data, for information only, including specifications, installation instructions and general recommendations.

1.06 MATERIAL QUANTITIES

A. It is the Contractor's responsibility to total and confirm all material quantities. Items quantified by an area (i.e., square feet - sf., square yard - sq. yd.) or volume (cubic feet - cu. ft., cubic yard - cu. yd.) shall be calculated and confirmed by the Contractor. The quantities listed on the plant list are estimated. In the event of a discrepancy between the totals listed on the plant list and the numerical callouts on the Drawings, the Drawings shall govern. The actual total quantities shall be determined by the Contractor.

1.07 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored on site.

B. Sod: Time delivery so that sod will be placed within twenty-four (24) hours after stripping. Protect sod against drying and breaking of rolled strips.

C. Trees, Shrubs and Ground Cover: Provide freshly dug trees and shrubs. Do not prune prior to delivery. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during shipment.
   1. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Deliver trees, shrubs and ground cover after preparations for planting have been completed and plant immediately. If planting is delayed more than six (6) hours after delivery, set trees, shrubs and ground cover in shade, protect from current and forecasted weather and mechanical damage, and keep roots moist.
   1. Set balled stock on ground or in partially excavated hole and cover rootbball with soil, peat moss, sawdust or other acceptable material.
   2. Do not remove container-grown stock from containers until planting time.
   3. Heal-in bare-root stock. Soak roots in water. Do not let roots dry out.
   4. Water root systems of plant material stored on-site. Water as often as necessary to maintain root systems in a moist condition.

E. Label at least one (1) tree and one (1) shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

F. Do not remove labels attached to plant material by the Landscape Architect until directed to do so.

1.08 PROJECT CONDITIONS

A. Proceed with and complete landscape work as rapidly as portions of Site become available, working within seasonal limitations for each kind of landscape work required.

B. Existing Grades: Existing grades will be within 0.2 feet of grades shown on the Civil Engineering Drawings when landscape work is to begin. Determine condition of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Determine location of existing drainage patterns and maintain patterns in completed Work. Perform Work in a manner which will avoid damage to finished grading and drainage patterns. All damage to finished grading and drainage resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.

C. Existing Utilities: Determine location of underground utilities. Perform Work in a manner which will avoid possible damage. Excavate as required. Maintain grade stakes set by others unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.

D. Existing Conditions: Perform landscape Work in the Tree Protection Zones and in existing or previously completed landscape areas to avoid damage and disturbance to these areas. Limit work in these areas to only that necessary to perform work specified herein and shown on the

Drawings. Return and repair any areas damaged or disturbed while performing the Work to the existing conditions encountered prior to the Work.

E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect in writing before planting.

F. Weather Limitations: Proceed with planting when existing and forecasted weather conditions are suitable.

G. Planting Schedule: Prepare a proposed planting schedule. Schedule dates for each type of landscape work during contract period. Coordinate schedule with General Contractor and Irrigation Contractor.

H. Coordination With Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Landscape Architect. If planting of trees and shrubs occurs after lawn Work, protect lawn areas and promptly repair damage to lawns resulting from plant operations.

1.09 WARRANTY

A. Warranty for a period of one (1) year plus twenty days, following the Date of Final Completion, all trees, shrubs, groundcovers, plants and grass against any defects including death and unsatisfactory growth, as determined by the Owner. Warranty shall include the complete cost to supply and install all replacement plant materials according to the requirements herein. Defects resulting from lack of adequate maintenance, neglect or abuse by the Owner, abuse or damage by others, or unusual phenomenon or incidents beyond the Contractor's control are excepted. Should questions arise concerning the responsibility of replacement, the Landscape Architect will be available for arbitration provided the Owner and Contractor mutually desire.

B. Remove and replace all trees, shrubs, groundcovers and lawn, or other plants found to be more than 25 percent dead or in unhealthy condition during warranty period as determined by Landscape Architect or Owner. Make replacements immediately unless required to plant in the succeeding planting season.

C. Replacements: Match adjacent specimens of same species. Replacements are subject to all requirements stated in the Contract Documents and are subject to observation by the Landscape Architect prior to digging.

D. Repair grades, lawn areas, paving and any other damage resulting from replacement planting operations, at no additional cost to the Owner.

E. Inspect Project site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner.

F. Replacements made during the Warranty Period or following the site visit for Final Acceptance will carry an additional one (1) year warranty beginning at the time of replacement.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. General: Only plant material grown in a recognized nursery in accordance with good horticultural practice will be accepted. Provide healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions or disfigurement.

B. Observation of Plant Material Prior to Digging:
   1. Contractor must locate all plant material to be supplied for the Project and inform the Landscape Architect in writing of location within thirty (30) days of the date of the Contract or notice to proceed, whichever is first.
   2. The Landscape Architect may select and tag the trees required for the Project, at the Contractor's sources. In any event the Landscape Architect shall approve 100 percent of the trees required for the Project.

3. In the event plant material is found to be unacceptable, the Contractor will pursue other sources until acceptable plant material is found, at no additional cost to the Owner. If, due to unacceptable plant material at the Contractor's source, additional tagging trips are required by the Landscape Architect, the Contractor will reimburse the Landscape Architect for his time and travel expenses.
4. Approval at the plant source does not impair the right of the Landscape Architect to observe and reject material at the time of shipping or during progress of the Work.

C. Shipping:
1. Ship landscape materials with certificates of inspection required by governing authorities. Inspection by Federal and/or State Governments at Grower does not preclude rejection of plants at the site by the Landscape Architects. Comply with regulations applicable to landscape materials. Prepare plants for shipment to prevent damage to the plants.
2. From March 15th to September 15th, ship plant material to be transported over one hundred (100) miles at night only. Make arrangements to have plant material watered during shipment as necessary to avoid excessive stress. Plant material may be rejected if not properly shipped.
3. Do not ship plant material in temperatures below 20 degrees Fahrenheit.

D. Do Not Make Substitutions: If specified landscape material is not obtainable, submit to Landscape Architect proof of non-availability and for use of equivalent material. For proof of non-availability submit a written statement from a minimum of twelve (12) reliable nursery sources (American Nurserymen's Association Members) that the plant in question is not obtainable in the surrounding geographical region.

E. Analysis and Standards: Package standard products with manufacturer's certified analysis. Including but not limited to:
1. Soil Amendments
2. Grass Materials
3. Mulch

F. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the Landscape Architect. The Landscape Architect has the right to reject any and all materials and any and all Work which, in his opinion, does not meet the requirements of the Contract Documents at any stage of the operations. The Contractor shall remove rejected work and/or materials from Project site and replace promptly.

2.02 TOPSOIL

A. Topsoil has not been stockpiled for re-use in planting soil and other Landscape Work.

B. Provide new topsoil which is fertile, friable, pervious, sandy loam, surface soil; free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than one and one-half (1½) inches in any dimension, and other extraneous or toxic matter harmful to plant growth.

C. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at Project Site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than four (4) inches; do not obtain from bogs or marshes, unless specified.

D. Topsoil: ASTM D 5268 complying with the following composition as determined by the indicated test methods:
1. Deleterious Materials: 2 percent max. by mass; ASTM D 2487. (Rock, gravel, slag, cinder, stone).
2. Organic Material: 5-10 percent min. by mass; ASTM D 2974.
3. Sand Content: 20 to 40 percent by mass; ASTM D 1140.
4. Silt and Clay Content: 40 to 50 percent by mass; ASTM D 1140.
5. pH Range: 5 to 7; ASTM D 4972.

2.03 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.

B. Aggregate Soil Conditioner: Rotary kiln expanded slate specially graded for use as a horticultural soil conditioner with the following composition as determined by the indicated test methods:
   1. Dry Loose Unit Weight: 48-55 lbs/cu.ft.; ASTM C 29.
   2. Specific Gravity: To meet 1.45 to 1.60 dry bulk; ASTM C 127.
   3. Gradation: 3/8-inch to No. 8; ASTM C 330 with 100 percent passing the 3/4-inch sieve.
   4. Absorption: Five percent or more; ASTM C 127.
   5. LA Abrasion: Weight loss between 20 percent and 30 percent; AASHTO T 96.
   6. Chemical Characteristic:
      a. pH: 6.5 to 10 range.
      b. Soluble salts: To meet horticultural rural range of 0.75 to 3.5 mmhos/cm.
   7. Process the slate using only non-hazardous fuels such as coal or natural gas.
   8. The expanded slate shall be free of clay lumps and organic impurities.
   9. Obtain aggregate soil conditioner from a single supplier.
   10. Available Products: Subject to compliance with the requirements, aggregate soil conditioners that may be incorporated in the Work includes, but is not limited to the following:
      a. Acceptable Supplier and Products:
         1) Supplier: **Caroline Stalite Company (example only)**
         2) Product: **5/16-inch Perma Till (example only)**

C. Coarse Sand: Clean, washed, natural or manufactured sand, free of extraneous or toxic matter with the following grain size distribution or coarser; ASTM C136.

Sieve Size	% Passing
.5 inch	100.0
.375 inch	98.0
#4	98.0
#10	93.0
#20	21.0
#60	1.0
#140	0.5
#200	0.5

1) ORGANIC SOIL AMENDMENTS

2.04 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 4 to 6 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 50 percent minimum of dry weight.
   2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste that meet all State Environmental Protection Agency requirements.

B. Humus: Air dried, finely shredded, and pH range suitable for intended horticultural use. Humus shall be completely decomposed forest type including composted leaves, bark and organic wastes.

C. Peat: Air dried, finely shredded or granular texture, completely decomposed and free of fibers with pH range suitable for intended horticultural use. Peat shall be a naturally occurring, highly organic and derived primarily from plant materials.

D. Organic Pre-Mixed Soil Amendment: Composted and screened 100 percent organic manufactured soil amendment.

E. Shredded Softwood Bark: Shredded bark pieces between one-half (1/2) inch and two (2) inches in length with partially decomposed bark matter.

2.05 FERTILIZER

A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial phosphate mixture, soluble, minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-released nitrogen, 50 percent derived from natural organic sources, phosphorous, and potassium in the following composition:
   1. General: For trees, shrubs and ground cover, provide a homogeneous fertilizer complete with micro nutrients having an analysis of 12-4-8 (12 pounds of nitrogen, 4 pounds of available phosphoric acid, and 8 pounds of water soluble potash respectively for each 100 pounds of mixture).
   2. For trees, shrubs, and ground cover provide fertilizer with adjusted analysis in accordance with results and recommendations of planting soil mix test reports.
   3. For lawns, provide fertilizer in accordance with results and recommendations of existing on site surface soil report relative to lawn installation. Provide nitrogen in a form that will be available to lawn during initial period of growth.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in existing on site surface soil reports from a qualified soil-testing laboratory.

2.06 PLANTING SOIL

A. Planting Soil Mix For On-Grade Plantings: Provide soil mix amended as per laboratory recommendations. Basic planting soil mix consists of:
   1. 60 percent topsoil (as specified)
   2. 40 percent prepared additives (by volume as follows):
      a. 2 parts humus, peat, and/or compost
      b. 1 part shredded pine bark (bark pieces between 1/2 inch and 2 inches in length)
      c. 1 part sterilized composted cow manure
   3. Commercial fertilizer as recommended in soil report.
   4. Lime as recommended in soil report.

B. Planting Soil Mix For Fern Plantings: Provide soil mix amended as follows by volume.
   1. 50 percent topsoil (as specified)
   2. 20 percent peat
   3. 20 percent humus and/or compost
   4. 10 percent sand (coarse sand)
   5. Commercial fertilizer recommended for Ferns and as recommended in soil report for these species.

C. Planting Soil Mix For Rhododendron/Mt. Laurel/Pieris Plantings: Provide soil mix amended as follows by volume:
   1. 35 percent topsoil (as specified)
   2. 20 percent peat
   3. 20 percent humus and/or compost
   4. 15 percent sand (coarse sand)

5. 10 percent shredded pine bark (bark pieces to be between 1/2 inch and 2 inches in length)
6. Commercial fertilizer recommended for Rhododendron/Mt. Laurel/Pieris and as recommended in soil report for these species.

D. Planting Soil Mix for Annual Color and Perennial Plantings: Provide soil mix amended as follows by volume:
1. 40 percent topsoil (as specified)
2. 25 percent humus and/or compost
3. 15 percent pine bark mulch (finger nail sized chips, 1/4 inch max.)
4. 10 percent "Natures Helper"
5. 5 percent sterilized composted cow manure
6. 5 percent sand (coarse sand) decrease amount if topsoil has a high percentage of sand.
7. Lime at a rate of 5 pounds per 50 square feet of bed area (adjust for alkaline soils).

E. Humus shall be omitted from planting soil mixes if topsoil used has an organic content of 40 percent or greater as determined by the topsoil test report.

2.07 PLANT MATERIALS

A. General:
1. Provide plants true to species and variety, complying with recommendations of ANSI Z60.1 "American Standard for Nursery Stock". Nomenclature to comply with "National List of Scientific Plant Names."
2. Specific requirements concerning plant material and the manner in which it is to be supplied are shown on the Drawings and plant list.
3. Acclimatization: Plants must have grown under climatic conditions similar to those of the locality of the project site for a minimum of two (2) years immediately prior to being planted on the Project.

B. Quality and Size:
1. Furnish nursery grown plants, freshly dug, normally shaped and well branched, fully foliaged when in leaf and with healthy well developed root systems. Plants to be free of disease, insect infestations or their eggs and larvae, and defects such as knots, sun scald, injuries, abrasions and disfigurement.
2. Furnish plants to match as closely as possible whenever symmetry is called for.
3. Provide trees and shrubs of sizes shown or specified. Trees and shrubs of larger size may be used if acceptable to the Landscape Architect, and if sizes of roots or rootballs are increased proportionately. The increased size will not result in additional cost to the Owner.
4. Stock Specified in a Size Range: Within each size range not less than 50 percent the plants must be of the maximum size specified.
5. Balled and Burlapped Plants: Plants designated "B&B" are to have firm, natural balls of soil corresponding to sizes specified in ANSI Z60.1 "American Standard for Nursery Stock". Balls to be firmly wrapped in biodegradable burlap and securely tied with biodegradable heavy twine, rope and/or wire baskets. Plants with loose, broken or manufactured rootballs will be rejected. Rootballs shall be lifted from the bottom only, not by stems or trunks.
6. Container grown plants in cans, plastic containers or timber boxes will be acceptable in lieu of balled and burlapped plants provided that they are of specified quality. The container must be removed prior to planting, with care being exercised as to not injure the plant.

C. Trees:
1. Provide trees of height and caliper listed or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are specified in the Contract Documents.
2. Provide self supporting trees with straight trunks and leaders intact. Where required in the Contract Documents, provide trees with character as described.

3. Determining dimensions for trees are caliper, height and spread. Caliper shall be measured six (6) inches above ground for trees up to and including four (4) inch caliper. Trees over four (4) inch caliper shall be measured twelve (12) inches above ground. Specified height and spread dimensions refer to the main body of the plant and not branch tip to tip. Take measurements with branches in natural position.

D. Tree Forms: Do not limb up tree forms more than two (2) feet before planting. Prune to desired shape as directed by Landscape Architect.

E. Shrubs: Provide established and well-rooted plants, in removable containers, with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

F. Ground Cover: Provide established and well-rooted plants, in removable containers or integral peat pots, having not less than minimum number and length of runners by ANSI Z60.1 for the pot size specified.

G. Grass Materials:
1. Grass Seed: Provide fresh, clean, new crop-seed complying with tolerance for purity and germination established by Association of Official Seed Analysts. Provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified on Drawings.
2. Sod: Provide viable sod of uniform density, color, and texture, strongly rooted, not less than two (2) years old and free of weeds and undesirable native grasses. Only provide sod capable of growth and development when planted (viable, not dormant). Provide machine cut sod of a uniform minimum soil thickness of five-eights (5/8) inch, plus thickness of top growth and thatch. Sod pieces to be consistent in size and shape. All sod must be a true certified turfgrass.

2.08 MISCELLANEOUS LANDSCAPE MATERIALS

A. Burlap for wrapping earthball shall be biodegradable jute mesh not less than 7.2 oz. per square yard. Wrapping materials made from man made fibers are unacceptable.

B. Guy Stakes, Upright Stakes, and Deadmen: Grade No. 2 or better, uniform grade pressure preservative treated pine AWPA C-2, or sound new hardwood or redwood free of knots, holes and other defects, two (2) by two (2) inches by thirty (30) inches long, pointed at one end.

C. Guy Anchors: No. 4 rebars or comparable size steel stakes, three (3) feet in length.

D. Guys and Wire Ties: 2-strand, twisted, pliable galvanized steel wire not lighter than No.12 gauge.
1. Hose: One half (1/2) inch diameter black reinforced rubber or plastic garden hose. Cut to required lengths to protect tree trunks from damage by wires. Used hose is acceptable.

E. Drainage/Separation Fabric: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method:
a. Grab Tensile Strength (ASTM D 4632): 100 lb.
b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard Sieve.
c. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

F. Drainage Gravel: Washed crushed stone.

G. Water and water transportation is the sole responsibility of the Contractor.

H. Mulch:
1. Rock Mulch: Round river rock mulch from a local source and shall consist primarily of particles 3” to 4” in diameter.
2. **(Note to Designer: Select additional mulches from list below used within geographic region of project and delete others)**

3. *Pinestraw: Pine needle mulch predominately composed of Longleaf Pine needles and other long needled Southern Yellow Pine species. Clean, fresh, dark brown, and free of branches, cones, foreign matter, insects and disease.*
4. *Cypress Bark Mulch: Premium grade shredded and ground, one (1) inch maximum particle size in any dimension.*
5. *Shredded Hardwood Mulch: Premium grade shredded, uniform size (approximately 1 inch in any dimension); free of deleterious material such as stones, sticks, soil or toxic materials.*

I. Lawn Anti-Erosion Mulch: Clean, threshed straw of wheat, rye, oats or barley.

J. Anti-Desiccant: Water-insoluble emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully labeled containers and mix in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 PREPARATION

A. General:
1. Contractor shall examine conditions under which planting is to be installed, review applicable architectural and engineering Drawings, and be familiar with alignment of underground utilities before digging.
2. Planting Time: Planting operations are to be performed at such times of the year as the job may require, with the stipulation that the Contractor guarantees the plant material as specified. Plant only during periods when weather conditions are suitable.
3. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's acceptance before start of excavation for planting work. Make adjustments as requested.
4. Notify Landscape Architect of adverse sub-surface drainage or soil conditions. State conditions and submit a recommendation for correction including costs. Obtain approval for method of correction prior to continuing Work in the affected area. In the event that alternate locations are selected, the Contractor shall prepare such areas at no additional expense to the Owner.

B. Excavation for Trees and Specimen Shrubs:
1. Excavate pits, beds and trenches with vertical sides, as specified and as shown on the Drawings.
2. Loosen hardpan and moisture barrier until hardpan has been broken and moisture is allowed to drain freely.
3. For balled and burlapped (B&B trees and shrubs), make excavations at least four (4) feet wider than the ball diameter for the top twelve (12) inches of the pit. For the remaining depth of the pit, excavate at least two (2) feet wider than the full diameter and equal to the ball depth, plus an allowance for setting of ball on a layer of compacted backfill. Allow for six (6) inch minimum setting layer of excavated soil.
4. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

C. Test Drainage:
1. Tree and Specimen Shrub Pits: Fill each pit with water. If percolation is less than 100 percent within a period of twelve (12) hours, drill a ten (10) inch diameter auger hole to a depth up to five (5) feet below the bottom of the pit. Fill auger hole with drainage gravel and cover with filter fabric. Retest pit. In case drainage is still unsatisfactory, notify Landscape Architect, in writing, of the condition before planting trees in the questionable areas. Contractor is fully responsible for warranty of the plant material.

D. Subsoil Removal:
1. Dispose of subsoil removed from landscape excavations at an off-site location. Do not mix with planting soil. Do not use as backfill.

3.02 PREPARATION OF PLANTING SOIL

A. Before mixing, clean topsoil, or existing surface soil if using a soil conditioner, of roots, plants, clods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

B. Mix specified soil amendments and fertilizers with topsoil, or soil conditioner with existing surface soil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

C. For pit and trench type backfill, mix planting soil prior to backfilling and keep covered until used.

D. For planting soil prepared with a manufactured soil conditioner, mix planting soil in large batches before backfilling, stock pile for use at site and keep covered until used. Do not mix soil conditioner at individual planting sites.

E. For groundcover and shrub beds, mix planting soil either prior to planting or apply on a surface layer over prepared bed area and mix both thoroughly in the bed before planting.

F. Mix lime, if required, with dry soil prior to mixing of fertilizer.

G. Prevent lime from contacting roots of acid-loving plants.

H. Apply phosphoric acid fertilizer (in addition to that constituting a portion of complete fertilizers) directly to subgrade before applying planting soil and tilling.

3.03 PREPARATION OF SHRUB AND GROUNDCOVER PLANTING BEDS

A. Layout planting beds on the ground to the lines shown on the Drawings. Have layout approved by Landscape Architect prior to constructing the bed.

B. Outline bed with a trench edge as shown on the Drawings. Place soil for trench edge within bed area.

C. Loosen existing soil to a minimum depth of twelve (12) inches using a roto tiller or similar equipment. Remove all sticks, stones, rubbish and other material detrimental to plant growth.

D. Spread four (4) inch minimum layer of planting soil mix over entire bed area. (Additional soil mix may be necessary to build up shrub beds to grade as shown on the Drawings.) Work planting soil mix into top of loosened soil with roto tiller.

E. Smooth planting areas to conform to specified grades after settlement has occurred. Slope surface of shrub beds to drain toward the trench edge.

F. Mass preparation of beds is not applicable for areas exceeding 4:1 slope.

3.04 PREPARATION OF ANNUAL COLOR AND PERENNIAL BEDS

A. Excavate bed to a depth of four (4) inches, break through 'hard pan' and remove all stone, roots, debris, etc. Remove excavated soil.

B. Roto till excavated bed to a depth of six to eight (6-8) inches.

C. Slope the base of the bed to the trench edge.

D. Spread six (6) inch minimum layer of planting soil mix over entire bed. Work planting soil mix into top of loosened soil with roto tiller.

E. Place additional planting soil mix to build up bed a minimum of six (6) inches above existing grade for annual color beds and four (4) inches above existing grade for perennial beds. Roto till entire bed to a depth of twelve (12) inches.

3.05 PREPARATION FOR PLANTING LAWNS

A. Loosen the grade of lawn areas to a minimum depth of six (6) inches. Remove stones over one and one-half (1½) inches in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.

B. Allow for sod thickness in areas to be sodded.

C. Grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.

D. Fertilize and lime prior to start of grassing operation. Apply ground limestone at the rate recommended by soil test analysis and work into top six (6) inches of soil. Apply fertilizer at the recommended rate; work into top two (2) inches of soil. The fertilizer application shall not precede the placement of sod by more than three (3) days.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

F. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

G. Preparation of Unchanged Grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Till to a depth of not less than six (6) inches; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clots, stones, roots and other extraneous matter. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of Owner's property; do not turn over into soil being prepared for lawns.

3.06 PLANTING TREES AND SPECIMEN SHRUBS

A. Set balled and burlapped (B&B) stock on layer of compacted excavated existing soil, plumb and in center of pit or trench with top of ball two to three (2-3) inches above the finish grade and also two to three (2-3) inches above the grade they bore to natural grade before transplanting. Remove all straps and ropes made of man-made fibers completely from rootball. Loosen and remove burlap and biodegradable ropes from top half of rootball. Cut and remove the top half of all wire baskets before backfilling. Use planting soil mixture to backfill plant pits. When plants are set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately two thirds (2/3) full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.

B. Remove all man made or impervious materials from the rootball and trunk before final installation of trees and specimen shrubs.

C. Set container grown stock as specified for balled and burlapped stock, except remove containers, without damaging rootballs, prior to backfilling.

D. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again after planting as per manufacturer's recommendations.

E. Mulching: Immediately after planting work has been completed, mulch pits, trenches and planting beds. Provide a minimum depth of **inches of mulch used in region (example: two (2) inches of bark or three (3) inches of pinestraw.)** Finish edges according to the Drawings.

F. Water: Soak all plants immediately after planting, continue watering thereafter as necessary until Date of Substantial Completion.

G. Smooth planting areas to conform to specified grades after full settlement has occurred and mulch has been applied.

3.07 STAKING, GUYING AND PRUNING

A. Stake and guy trees immediately after planting. Plants shall be plumb after staking or guying. Maintain stakes, wires and guys until Final Acceptance of the Work.

B. Staking trees of one (1) inch caliper and under or four (4) feet height: Use single stake with rubber hose and wire loop around trunk. Use only wooden stakes as specified.

C. Staking trees of one (1) to two and three quarters (2-3/4) inch caliper: Drive stakes securely into ground and fasten to tree with wire and tie. Use hose around wire so wire is not in contact with plant, or use Cinch-tie of appropriate size. Adhere to staking details unless alternate detail has been approved by Landscape Architect prior to beginning of planting operation.

D. Guying trees of three (3) inch caliper and larger: Guy trees according to detail. Position guys around trunk at approximately two-fifths (2/5) the height of the tree. Anchor guys in ground either to notched stakes or steel rods driven securely into ground with top end three (3) inches below finish grade.

E. Pruning: Unless otherwise directed by the Landscape Architect do not cut tree leaders. Remove only injured or dead branches from trees, if any. Prune shrubs at the direction of the Landscape Architect.

F. Remove and replace promptly any plants pruned or mis-formed resulting from improper pruning.

G. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures.

3.08 PLANTING SHRUB AND GROUNDCOVER BEDS

A. Excavate large enough area in loosened soil to install specified container grown plants.

B. Remove containers without damaging the rootball and set in excavated hole.

C. Place container grown plant in excavated hole with top of rootball even with final shrub bed elevation.

D. Backfill rootball with soil from the bed and lightly compact soil around plant to eliminate voids and air pockets.

E. Mulching: Immediately after planting mulch planting beds with a minimum depth of **inches of mulch used in region (example: two (2) inches of bark or three (3) inches of pinestraw.)** Finish edges according to the Drawings. Remove all mulch from foliage of plants.

F. River Rock Installation: Prior to installation of River Rock (used as mulch or for drainage), install a continuous layer of drainage / separation fabric for weed control

G. Watering: Soak entire area immediately after planting. Continue watering thereafter as necessary until Date of Substantial Completion.

3.09 INSTALLING LAWNS

A. Seeding New Lawns:
1. The grass seed shall be applied at the rate specified in the Seed Schedule and at the planting dates indicated.
2. Sow seed using a spreader or hydro-seeding machine.
3. Do not seed when wind velocities affect even distribution. Do not sow when seed bed is crusty or frozen. Sow in equal quantities in two (2) directions at right angles to each other.
4. GRASS SEEDING SCHEDULE

Seed Type	Seeding Rate Lbs/1000 sf	Planting Dates	Visible Seedling Stand Under Ideal Conditions	Ultimate Mowing Height
Common Bermuda	2 – 3	May 1 – Aug. 15	12 days*	1-1/4 – 1”
Tall Fescue	6 – 8	Sept 15 – Nov 15	8 days*	2 – 2-1/2”
Annual Ryegrass	4 – 6	Oct 1 – Mar 1	6 days*	2 – 2-1/2”
Bahia	4 – 5	Feb. 15 – Aug 31	8 days	2 – 3”
**5. **	**	**	**	**

*Planting dates for type 1-3 are for Atlanta/North Georgia region only. These dates differ for other areas where seasonal variations require modification. According to the Plant Hardiness Zone Map published by the United States Department of Agriculture, 1990, these dates refer to Zones 7a and 7b.

****See Civil Site Plan for seeding schedules.****

5. If seed bed is left slightly rough or furrowed, no "planting" of the seed is necessary. If seed bed is smooth and very dry, the seed should be lightly raked into the top quarter (1/4) inch of seed bed.
6. Protect seeded areas with slopes not exceeding 1:5 by spreading wheat straw or hay mulch. The quantity of mulch to be applied shall be that to uniformly form a continuous blanket at least three-quarters (3/4) of an inch and not more than one and one-half (1½) inches in loose depth over the seeded area. Spread by hand, blower, or other suitable equipment.
    a. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
7. Protect seeded areas with slopes exceeding 1:5 with erosion-control fiber mesh and 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
8. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
    a. Mix slurry with nonasphaltic tackifier.
    b. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.
9. Thoroughly moisten seeded area immediately after seeding. If rainfall is insufficient lightly water planting area until grass is established.
10. Protect seeded areas from traffic and disturbance.
11. Scarify, re-seed and re-fertilize seeded areas that do no show satisfactory growth within fifteen (15) days after sowing, until a satisfactory stand is established. Seeded areas are considered established when a dense grass stand has developed of a uniform green color, reasonably free from weeds, the specified grass is vigorous and growing well, and no bare spots larger than one (1) square foot area is apparent. Full coverage is required in thirty (30) days. Irregularities resulting from diseases and insect infestation are unacceptable. Mow grass at height specified in seeding schedule.
12. After two (2) or three (3) mowings the new lawn shall be fertilized with ammonium nitrate at the rate of f 50 lbs/acre. Nitrogen shall be applied with mechanical hand spreader capable of producing uniform coverage. One (1) application is mandatory. Nitrogen shall not be applied between October 15 and March 15, unless noted otherwise.

B. Sodding New Lawns:
1. Water soil prior to receiving sod. At the time of sod placement soil must be moist but not saturated.
2. Lay sod within twenty-four (24) hours from time of stripping. If not possible, sod may be stored on site up to thirty-six (36) hours after stripping provided sod is properly protected: unstack, unroll and place in shade and keep moist until installation.
3. Do not plant dormant sod.
4. Do not plant sod on frozen ground.
5. Lay sod to form a solid mass with tightly fitted joints. Snugly fit ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
6. Anchor sod with wood pegs to prevent slippage on slopes equal to or greater than 3:1 and wherever erosion can be anticipated. Lay sod perpendicular to slope direction, with staggered joints.

7. Water sod thoroughly with a fine spray immediately after planting until soil is damp to a depth of four (4) inches. If rainfall is insufficient, keep sodded area moist until grass has securely rooted into the planting area.

C. Reconditioning Existing Lawns:
1. Recondition existing lawn areas damaged by Contractor's operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.
2. Provide fertilizer, seed or sod and soil amendments as specified for new lawns and as required to provide a satisfactorily reconditioned lawn. Provide new topsoil as required to fill low spots and meet new finish grades.
3. Cultivate bare and compacted areas thoroughly to provide a satisfactory planting bed.
4. Remove diseased and unsatisfactory lawn areas; do not bury under soil. Remove topsoil containing foreign materials resulting from Contractor's operations including oil drippings, stone, gravel and other loose building materials.
5. Where substantial lawn remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.
6. Thoroughly water newly planted areas immediately after planting. If rainfall is insufficient, lightly water planting area until new grass is established.

3.10 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs lawns, and other plants until Date of Substantial Completion of the Work.

C. Maintain trees, shrubs, lawns and other plants by watering, pruning, cultivating, weeding, and re-mulching as required for healthy growth. Restore trench edges around mulch rings and along bed limes. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.

D. Maintain lawns by watering, weeding, mowing, repair of eroded areas and re-seeding or re-sodding as necessary to establish a uniform stand of the specified grasses.

E. Remove all trees, shrubs, ground covers, lawn or other plants which die, turn brown and/or defoliate prior to Date of Substantial Completion from the site. Replace immediately with plant material of the same species, quantity, size and meeting all requirements.

3.11 CLEAN UP AND PROTECTION

A. During Landscape Work, keep pavements clean and work area in an orderly condition.

B. Upon completion of Work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect and Owner.

C. Protect landscape Work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape Work as directed, at no additional cost to the Owner.

D. Theft: Contractor is responsible for theft of plant material at the Project site before, during and after planting, until the Date of Substantial Completion of the Work.

3.12 OBSERVATION AND ACCEPTANCE

A. Periodic site visits may be made by the Landscape Architect to review the quality and progress of the Work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected plants and materials promptly from the Project.

B. Upon completion of Work, Landscape Architect will issue a punch list for work to be corrected. Where Work does not comply with requirements, replace rejected Work and continue specified maintenance until Landscape Architect finds work to be acceptable.

END OF SECTION

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SECTION 331416
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping and specialties for potable-water service outside the building.

B. Piping and specialties for fire-protection water service outside the building.

C. This Section does not include tapping of utility company water main.

1.02 RELATED REQUIREMENTS

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

B. Division 21 Sections for fire-protection piping inside the building.

C. Division 22 Section "Plumbing Piping Systems" for potable-water piping inside the building.

D. Division 26 Section "Life Safety Systems."

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Working Pressures: The following are minimum operating pressure requirements for piping and specialties, unless otherwise indicated:
   1. Potable-Water Service: 200 psig.
   2. Fire-Protection Water Service: 350 psig.
   3. Fire-Protection Water Service, Downstream from Fire Department Connections: 350 psig.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Water meters.
   2. Backflow preventers.
   3. Pipe and fittings.
   4. Flexible pipe fittings.
   5. Valves.
   6. Fire hydrants.
   7. Fire department connections.
   8. Yard hydrants.

B. Shop Drawings: For precast concrete structures. Include frames and covers and drains.

C. Shop Drawings: For cast-in-place concrete structures. Include frames and covers and drains.

D. Record Drawings: At Project closeout of installed water-service piping according to Division 1 Section "Contract Closeout."

E. Test Reports: As specified in "Field Quality Control" Article in Part 3.

F. Purging and Disinfecting Reports: As specified in "Cleaning" Article in Part 3.

G. Maintenance Data: For specialties to include in the maintenance manuals specified in Division 1. Include data for the following:
   1. Water meters.
   2. Backflow preventers.
   3. Valves.
   4. Fire hydrants.
   5. Flushing hydrants.
   6. Yard hydrants.

1.05 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water-service piping specialties and are based on specific types and models indicated. Other

manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Comply with requirements of utility supplying water. Include tapping of water mains and backflow prevention.

C. Comply with standards of authorities having jurisdiction for potable water-service piping. Include materials, installation, testing, and disinfection.

D. Comply with NSF 61, "Drinking Water System Components--Health Effects," for materials for potable water.

E. Comply with standards of authorities having jurisdiction for fire-protection water-service piping and fire hydrants. Include materials, hose threads, installation, and testing.

F. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," for materials, installations, tests, flushing, and valve and hydrant supervision.

G. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated devices.

H. Provide listing/approval stamp, label, or other marking on piping and specialties made to specified standards.

I. Listing and Labeling: Provide electrically operated specialties and devices specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors, unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.07 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Verify that water-service piping may be installed to comply with original design and referenced standards.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions between soil

borings. Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate connection to water main with utility company and Owner.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building water distribution piping.

C. Coordinate piping materials, sizes, entry locations, and pressure requirements with building fire-protection water piping.

D. Coordinate with other utility work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

1. Drilling-Machine, Sleeves, and Corporation Stops:
    a. Ford Meter Box Co., Inc.
    b. Grinnell Corp.; Mueller Co.; Water Products Div.
    c. Lee Brass Co.
2. Bronze Corporation Stops and Valves:
    a. Ford Meter Box Co., Inc.
    b. Grinnell Corp.; Mueller Co.; Water Products Div.
    c. Lee Brass Co.
    d. Master Meter, Inc.
    e. Watts Industries, Inc.; James Jones Co.
3. Tapping Sleeves and Valves:
    a. American Cast Iron Pipe Co.; Waterous Co.
    b. East Jordan Iron Works, Inc.
    c. Grinnell Corp.; Mueller Co.; Water Products Div.
    d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa)
    e. McWane, Inc.; Kennedy Valve Div.
    f. United States Pipe & Foundry Co.
4. Gate Valves:
    a. American AVK Co.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co.
    d. East Jordan Iron Works, Inc.
    e. Grinnell Corp.; Grinnell Supply Sales Co.
    f. Grinnell Corp.; Mueller Co.; Water Products Div.
    g. Hammond Valve Corp.
    h. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa)
    i. McWane, Inc.; Kennedy Valve Div.
    j. McWane, Inc.; Tyler Pipe; Utilities Div.
    k. United States Pipe & Foundry Co.
5. Relief Valves:
    a. Bermad, Inc.
    b. Val-Matic Valve and Manufacturing Corp.
6. Water-Regulating Valves:
    a. Ames Co., Inc.
    b. Bermad, Inc.
    c. Cla-Val Co.
    d. OCV Control Valves.
    e. Watts Industries, Inc.; Water Products Div.

7. Indicator Posts and Indicator Gate Valves:
    a. American Cast Iron Pipe Co.; American Flow Control Div.
    b. American Cast Iron Pipe Co.; Waterous Co.
    c. Grinnell Corp.; Grinnell Supply Sales Co.
    d. Grinnell Corp.; Mueller Co.; Water Products Div.
    e. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa)
    f. McWane, Inc.; Kennedy Valve Div.
    g. United States Pipe & Foundry Co.
8. Dry-Barrel, Post Fire Hydrants:
    a. American AVK Co.
    b. American Cast Iron Pipe Co.; American Flow Control Div.
    c. American Cast Iron Pipe Co.; Waterous Co.
    d. American Foundry & Mfg. Co.
    e. East Jordan Iron Works, Inc.
    f. Grinnell Corp.; Mueller Co.; Water Products Div.
    g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa)
    h. McWane, Inc.; Kennedy Valve Div.
    i. McWane, Inc.; M&H Valve Co. Div.
    j. United States Pipe & Foundry Co.
    k. M & H 129T
9. Water Meters:
    a. Badger Meter, Inc.
    b. Carlon Meter Co.
    c. Grinnell Corp.; Mueller Co.; Hersey Products Div.
    d. Schlumberger Industries, Inc.; Water Div.
    e. Sensus Technologies, Inc.
10. Detector-Type Water Meters:
    a. Badger Meter, Inc.
    b. Grinnell Corp.; Grinnell Supply Sales Co.
    c. Grinnell Corp.; Mueller Co.; Hersey Products Div.
    d. Schlumberger Industries, Inc.; Water Div.
    e. Sensus Technologies, Inc.
11. Detector Check Valves:
    a. Ames Co., Inc.
    b. Grinnell Corp.; Mueller Co.; Hersey Products Div.
    c. McWane, Inc.; Kennedy Valve Div.
    d. Viking Corp.
    e. Watts Industries, Inc.; Water Products Div.
12. Backflow Preventers:
    a. Ames Co., Inc.
    b. Cla-Val Co.
    c. CMB Industries; Febco Div.
    d. Conbraco Industries, Inc.
    e. Grinnell Corp.; Mueller Co.; Hersey Products Div.
    f. Watts Industries, Inc.; Water Products Div.
    g. Zurn Industries, Inc.; Wilkins Div.
13. Keyed Couplings:
    a. McWane, Inc.; Tyler Pipe; Gustin-Bacon Div.
    b. Victaulic Co. of America.
14. Protective Enclosures:
    a. Hot Box.
    b. HydroCowl, Inc.
15. Drains:

a. Enpoco, Inc.
b. Josam Co.
c. McWane, Inc.; Tyler Pipe; Wade Div.
d. Smith Industries, Inc.; Jay R. Smith Mfg. Co.
e. Watts Industries, Inc.; Ancon Drain Div.
f. Zurn Industries, Inc.; Hydromechanics Div.

16. Sanitary-Type Yard Hydrants:
    a. Murdock, Inc.
17. Post-Type Yard Hydrants:
    a. Josam Co.
    b. McWane, Inc.; Tyler Pipe; Wade Div.
    c. Smith Industries, Inc.; Jay R. Smith Mfg. Co.
    d. Watts Industries, Inc.; Ancon Drain Div.
    e. Woodford Mfg. Co.
    f. Zurn Industries, Inc.; Hydromechanics Div.
18. Fire Department Connections:
    a. Elkhart Brass Mfg. Co., Inc.
    b. Figgie International Co.; Badger Fire Protection.
    c. Fire-End and Croker Corp.
    d. Firematic Sprinkler Devices, Inc.
    e. Grinnell Corp.; Grinnell Supply Sales Co.
    f. Guardian Fire Equipment, Inc.
    g. Reliable Automatic Sprinkler Co., Inc.
    h. Smith Industries, Inc.; Potter-Roemer Div.
19. Alarm Devices:
    a. Gamewell Co.
    b. Grinnell Corp.; Grinnell Supply Sales Co.
    c. Pittway Corp.; System Sensor Div.
    d. Potter Electric Signal Co.
    e. Reliable Automatic Sprinkler Co., Inc.
    f. Victaulic Co. of America.
    g. Watts Industries, Inc.; Water Products Div.

2.02 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Copper Tube: ASTM B 88, seamless water tube Type “K”, annealed temper.

C. Ductile-Iron, Push-on-Joint Pipe: AWWA C151, with cement-mortar lining and seal coat according to AWWA C104. Include rubber compression gasket according to AWWA C111.

D. Ductile-Iron, Mechanical-Joint Pipe: AWWA C151, with cement-mortar lining and seal coat according to AWWA C104. Include gland, rubber gasket, and bolts and nuts according to AWWA C111.

2.03 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. Copper Fittings: ASME B16.22; wrought-copper, solder-joint pressure type.

C. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300, as required for system operating pressure.

D. Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and rubber compression gaskets according to AWWA C111.

E. Ductile-Iron, Mechanical-Joint Fittings: AWWA C110, ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

F. Ductile-Iron, Grooved-End Fittings: ASTM A 47, malleable-iron; or ASTM A 536, ductile-iron casting complying with AWWA-pipe size, with grooved ends. Include cement-mortar lining and seal coat according to AWWA C104 or epoxy, interior coating according to AWWA C550. Include keyed couplings according to AWWA C606.

G. Ductile-Iron, Flanged Fittings: AWWA C110, with cement-mortar lining and seal coat according to AWWA C104 or epoxy, interior coating according to AWWA C550. Include gaskets and bolts and nuts.

H. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Units have 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections. Include 350-psig minimum working-pressure rating; epoxy, interior coating according to AWWA C550; length for offset and expansion indicated; and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

I. Ductile-Iron, Deflection Fittings: Compound coupling fitting with sleeve and flexing sections, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include 250-psig minimum working-pressure rating; cement-mortar lining or epoxy, interior coating according to AWWA C550; deflection of at least 20 degrees; and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

J. Ductile-Iron Expansion Joints: 3-piece assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include 350-psig minimum working-pressure rating; cement-mortar lining or epoxy, interior coating according to AWWA C550; length for expansion indicated; and glands, rubber gaskets, and bolts and nuts according to AWWA C111.

K. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, unless otherwise indicated.

L. AWWA C104, and rubber compression gaskets according to AWWA C111.

2.04 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

B. Ductile-Iron Piping: The following materials apply:
   1. Push-on Joints: AWWA C111 rubber gaskets and lubricant.
   2. Mechanical Joints: AWWA C111 ductile-iron or gray-iron glands, high-strength steel bolts and nuts, and rubber gaskets.
   3. Flanged Joints: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
      a. Gaskets: Rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
      b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
   4. Keyed Couplings: AWWA C606, consisting of ASTM A 536 ductile-iron housing with enamel finish, with synthetic-rubber gasket with central-cavity, pressure-responsive design, with carbon-steel bolts and nuts to secure grooved pipe and fittings and gasket suitable for hot water, unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8, BCuP Series.

D. Solder Filler Metal: ASTM B 32, Alloy Sn95, Alloy Sn94, or Alloy E, with 0.10 percent maximum lead content.

E. Pipe Couplings: Iron-body sleeve assembly, fabricated to match OD of pipes to be joined.
   1. Sleeve: ASTM A 126, Class B, gray iron.
   2. Followers: ASTM A 47, malleable iron; or ASTM A 536, ductile iron.

3. Gaskets: Rubber.
4. Bolts and Nuts: AWWA C111.
5. Finish: Enamel paint.

2.05 PIPING SPECIALTIES

A. Flexible Connectors for Nonferrous, Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends; brazed to hose.

B. Flexible Connectors for Ferrous Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1 threaded steel pipe nipples or ASME B16.5 steel pipe flanges; welded to hose.

C. Dielectric Fittings: Assembly or fitting with insulating material isolating joined dissimilar metals to prevent galvanic action and corrosion.
   1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
   2. Dielectric Unions: Factory-fabricated union assembly, designed for 350-psig minimum working pressure at 180 deg F. Include insulating material isolating dissimilar metals and ends with inside threads according to ASME B1.20.1.
   3. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 350-psig minimum pressure to suit system pressures.
   4. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
      a. Provide separate companion flanges and steel bolts and nuts for 350-psig minimum working pressure to suit system pressures.
   5. Dielectric Couplings: Galvanized-steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 350-psig minimum working pressure at 225 deg F.
   6. Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 350-psig working pressure at 225 deg F.

2.06 VALVES

A. Nonrising-Stem, Metal-Seated Gate Valves, 3-Inch NPS and Larger: AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze, double-disc gate, bronze gate rings, bronze stem, and stem nut. Include 200-psig minimum working-pressure design; interior coating according to AWWA C550; and mechanical-joint ends, unless otherwise indicated.

B. Nonrising-Stem, Resilient-Seated Gate Valves, 3-Inch NPS and Larger: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig minimum working-pressure design, interior coating according to AWWA C550, and push-on- or mechanical-joint ends.

C. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves, 3-Inch NPS and Larger: AWWA C509, ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 250-psig minimum working-pressure design, interior coating according to AWWA C550, and push-on- or mechanical-joint ends.

D. Nonrising-Stem Gate Valves, 4-Inch NPS and Larger: UL 262, FM approved, iron body and bonnet with flange for indicator post, bronze seating material, inside screw, 175-psig working pressure, and mechanical-joint ends. Provide with flanged ends for pit installation.

E. Nonrising-Stem Gate Valves, 2-Inch NPS and Smaller: MSS SP-80; body and screw bonnet of ASTM B 62 cast bronze; with Class 125 threaded ends, solid wedge, nonrising copper-silicon-alloy stem, brass packing gland, PTFE-impregnated packing, and malleable-iron handwheel.

F. Valve Boxes: Cast-iron box with top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

1. Provide steel tee-handle operating wrench with each valve box. Include tee handle with one pointed end, stem of length to operate valve, and socket-fitting valve-operating nut.

G. Indicator Posts: UL 789, FM-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve.

H. Curb Stops: Bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet to match service piping material.

I. Service Boxes for Curb Stops: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover with lettering "WATER," and bottom section with base of size to fit over curb-stop and barrel approximately 3 inches in diameter.
   1. Provide steel tee-handle shutoff rod with each service box. Include tee handle with one pointed end, stem of length to operate curb stop, and slotted end fitting curb-stop head.

J. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.
   1. Tapping Sleeve: Cast- or ductile-iron, 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical-joint ends with rubber gaskets or sealing rings in sleeve body. Include sleeve matching size and type of pipe material being tapped and of outlet flange required for branch connection.

K. Service Clamps and Corporation Stops: Complete assembly, including service clamp, corporation stop, and bolts and nuts. Include service clamp and stop compatible with drilling machine.
   1. Service Clamp: Cast iron or ductile iron with gasket and AWWA C800 threaded outlet for corporation stop, and threaded end straps.
   2. Corporation Stops: Bronze body and ground-key plug, with AWWA C800 threaded inlet and outlet matching service piping material.
   3. Manifold: Copper with 2 to 4 inlets as required, with ends matching corporation stops and outlet matching service piping.

L. Ball Valves: AWWA C507, Class 250. Include interior coating according to AWWA C550.

M. Butterfly Valves: AWWA C504, with 150-psig working-pressure rating. Include interior coating according to AWWA C550.

N. Check Valves: AWWA C508, with 175-psig working-pressure rating. Include interior coating according to AWWA C550.

O. Check Valves: UL 312, with swing clapper and 175-psig working-pressure rating.

2.07 SPECIALTY VALVES

A. Pressure-Regulating Valves: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550 and ASTM A-536. Include 250-psig working-pressure design, bronze pressure-reducing pilot valve and tubing, and means for discharge pressure adjustment.

B. Flow-Regulating Valves: Automatic, pilot-operated, cast-iron body with interior coating according to AWWA C550. Include 250-psig working-pressure design, bronze pressure-reducing pilot valve and tubing, and means for flow adjustment.

C. Air-Release Valve: AWWA C512 and ASTM A-240, hydromechanical device to automatically release accumulated air. Include 300-psig working-pressure design.

D. Air/Vacuum Valve: AWWA C512 and ASTM A-240, direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping. Include 300-psig working-pressure design.

E. Combination Air Valves: AWWA C512, float-operated, hydromechanical device to automatically release accumulated air or to admit air. Include 300-psig working-pressure design.

2.08 WATER METERS

A. Water meters: Contractor is to coordinate water meter installation with the local utility provider.

B. Description: AWWA C700, displacement type, bronze main case. Register flow in gallons.

C. Description: AWWA C703, UL listed, FM approved, main line, proportional, detector type, 150-psig working pressure, with meter on bypass. Register flow in gallons, unless cubic feet are indicated.
   1. Bypass Meter: AWWA C702, compound type, bronze case; size at least one-half nominal size of main-line meter.
   2. Bypass Meter: AWWA C701, turbine type, bronze case; size at least one-half nominal size of main-line meter.

D. Remote Registration System: Utility company standard; direct-reading type complying with AWWA C706. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

E. Remote Registration System: Utility company standard; encoder-type complying with AWWA C707. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
   1. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
   2. Visible Display Units: Comply with utility company requirements for type and quantity.

2.09 WATER-METER BOXES

A. Description: Plastic body and cast-iron cover for positive displacement-type water meter. Include lettering "WATER METER" in cover; and slotted, open-bottom base section of length to fit over service piping.
   1. Option: Base section may be cast-iron, PVC plastic, clay or other pipe.

2.10 PITS

A. Description: Precast, reinforced-concrete pit, designed for A-16 load designation according to ASTM C 857, and made according to ASTM C 858.

B. Ladder: ASTM A 36, steel or polyethylene-encased steel steps.

C. Manhole: ASTM A 48, Class No. 35 minimum tensile strength, gray-iron, traffic frame and cover.
   1. Weight and Dimensions: Not smaller than 24-inch diameter, unless otherwise indicated.

D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron, 24-inch minimum-diameter traffic frame and cover.
   1. Weight and Dimensions: Not smaller than 24-inch diameter, unless otherwise indicated.

E. Drain: ASME A112.21.1M, cast-iron area drain, of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.11 FREESTANDING FIRE HYDRANTS

A. Description: Cast-iron body, compression-type valve, opening against pressure and closing with pressure, 6-inch mechanical-joint inlet, and 200-psig minimum working-pressure design or as required by the governing municipal agency.

B. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

C. Operating and Cap Nuts: Pentagon 1-1/2 inch point to flat.

D. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.

E. Exterior Finish: Gloss enamel paint. Per Governing Municipal Requirements.

F. Dry-Barrel Fire Hydrants: AWWA C502, two 2-1/2-inch NPS and one 6-inch NPS outlets, 5-1/4-inch main valve, drain valve, and 6-inch NPS mechanical-joint inlet. Include 250-psig minimum working-pressure design and interior coating according to AWWA C550.

2.12 FIRE DEPARTMENT CONNECTIONS

A. Exposed, Freestanding, Fire Department Connections: UL 405, cast-brass body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate.
   1. Connections: Per Local Fire Department requirements.
   2. Inlet Alignment: Per Local Fire Department requirements.
   3. Finish Including Sleeve: Per Local Fire Department requirements.
   4. Escutcheon Plate Marking: Per Local Fire Department requirements.

2.13 DETECTOR CHECK VALVES

A. Detector Check Valves: UL 312, galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends; designed for 200-psig working pressure. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
   1. Water Meter: AWWA C700, disc type, of size at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

B. Detector Check Valve: UL 312, FM-approved detector check, iron body, corrosion-resistant clapper ring and seat ring material, 200-psig working pressure, flanged ends, with connections for bypass and installation of water meter.

2.14 BACKFLOW PREVENTERS

A. General: Manufactured backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.

B. Working Pressure: 200 psig minimum, unless otherwise indicated.

C. 2-Inch NPS and Smaller: Bronze body with threaded ends.

D. 2-1/2-Inch NPS and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

E. Interior Lining: AWWA C550, epoxy coating for backflow preventers with cast-iron or steel body.

F. Interior Components: Corrosion-resistant materials.

G. Strainer on inlet if strainer is indicated.

H. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

I. Reduced-Pressure-Principle Backflow Preventer: ASSE 1013, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves for continuous-pressure application.
   1. Pressure Loss: 12 psig maximum through middle third of flow range.

J. Reduced-Pressure-Principle Backflow Preventer: AWWA C511, with OS gate valves on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves for continuous-pressure application.
   1. Pressure Loss: 12 psig maximum through middle third of flow range.

K. Double-Check Backflow Prevention Assemblies: ASSE 1015, with valves on inlet and outlet and strainer on inlet. Include test cocks with 2 positive-seating check valves for continuous-pressure application.
   1. Pressure Loss: 5 psig maximum through middle third of flow range.

L. Double-Check-Valve Assembly: AWWA C510, with OS&Y gate valves on inlet and outlet, and strainer on inlet.
   1. Pressure Loss: 5 psig maximum through middle third of flow range.

M. Double-Check-Valve Assembly: UL 312, FM approved. Assembly has two UL 312, FM-approved, iron-body, 200-psig working-pressure, flanged-end check valves, with two UL 262, FM-approved, iron-body, OS&Y, flanged, 200-psig working-pressure gate valves.
   1. Pressure Loss: 5 psig maximum through middle third of flow range.

N. Antisiphon, Pressure-Type Vacuum Breakers: ASSE 1020, with valves, spring-loaded check valve, and spring-loaded floating disc. Include test cocks and atmospheric vent for continuous-pressure application.
   1. Pressure Loss: 5 psig maximum through middle third of flow range.

O. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves, test cocks, and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer, for continuous-pressure application.
   1. Pressure Loss: 12 psig maximum through middle third of flow range.

P. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include 2 positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous-pressure application.
   1. Pressure Loss: 5 psig maximum through middle third of flow range.

2.15 ANCHORAGES

A. Clamps, Straps, and Washers: ASTM A 506, steel.

B. Rods: ASTM A 575, steel.

C. Rod Couplings: ASTM A 197, malleable iron.

D. Bolts: ASTM A 307, steel.

E. Cast-Iron Washers: ASTM A 126, gray iron.

F. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig.
   1. Cement: ASTM C 150, Type I.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

2.16 ALARM DEVICES

A. Description: UL 753, FM approved, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with 2 SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 A 125 V, ac and 0.25 A 24 V, dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: SPDT, designed to signal valve in other than full open position.

D. Pressure Switches: SPDT, designed to signal increase in pressure.

2.17 IDENTIFICATION

A. Refer to Division 2 Section "Earthwork" for underground warning tape materials.

B. Arrange for detectable warning tapes made of solid blue film with metallic core and continuously printed black-letter caption "CAUTION--WATER LINE BURIED BELOW."

C. Nonmetallic Piping Label: Engraved, plastic-laminate label at least 1 by 3 inches, with caption "CAUTION--THIS STRUCTURE HAS NONMETALLIC WATER-SERVICE PIPING," for installation on main electrical meter panel.

PART 3 EXECUTION

3.01 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavation, trenching, and backfilling.

B. Refer to Division 2 Section "Hot-Mix Asphalt Paving" for cutting and patching of existing paving.

C. Refer to Division 2 Section "Portland Cement Concrete Paving" for cutting and patching of paving.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications:

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

C. Do not use flanges or keyed couplings for underground piping.
   1. Exception: Piping in boxes and structures, but not buried, may be joined with flanges or keyed couplings instead of joints indicated.

D. Flanges, keyed couplings, and special fittings may be used on aboveground piping.

E. Potable Water-Service Piping: Use the following:
   1. Up to NPS 5: Soft coppet tube, Type K (Type A); wrought-copper fittings and brazed joints.
   2. NPS 6 and larger: Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

F. Fire-Protection Water-Service Piping: Use the following:
   1. 4- to 8-Inch NPS: Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
   2. 4- to 8-Inch NPS: Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3.03 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, 3-Inch NPS and Larger: AWWA, gate valves, nonrising stem, with valve box.
   2. Underground Valves, 4-Inch NPS and Larger: UL/FM, gate valves, nonrising stem, with indicator post.
   3. Pit and Aboveground Installation Valves, 3-Inch NPS and Larger: AWWA, OS&Y gate valves.
   4. Pit and Aboveground Installation Valves, 2-1/2-Inch NPS and Larger: UL/FM, OS&Y gate valves.
   5. Pit and Aboveground Installation Valves, 2-Inch NPS and Smaller: MSS, nonrising-stem gate valves.
   6. Pit and Aboveground Installation Valves, 2-Inch NPS and Smaller: UL/FM, OS&Y gate valves.

3.04 JOINT CONSTRUCTION

A. Ductile-Iron Piping, Gasketed Joints: According to AWWA C600.

B. Ductile-Iron Piping, Gasketed Joints for Fire-Service Piping: According to UL 194 and AWWA C600.

C. Flanged Joints: Align flanges and install gaskets. Assemble joints by sequencing bolt tightening. Use lubricant on bolt threads.

D. Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape or joint compound, and apply wrench to fitting and valve ends into which pipes are being threaded.

E. Ductile-Iron, Keyed-Coupling Joints: Cut-groove pipes. Assemble joints with keyed couplings, gaskets, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

F. Copper Tubing, Brazed Joints: According to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

G. Copper Tubing, Soldered Joints: According to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube."

H. Copper Tubing, Soldered Joints: According to CDA's "Copper Tube Handbook."

I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, OD, and system working pressure. Refer to "Piping Systems - Common Requirements" Article below for joining piping of dissimilar metals.

3.05 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

B. Install piping at indicated slope.

C. Install components with pressure rating equal to or greater than system operating pressure.

D. Install piping free of sags and bends.

E. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

F. Install fittings for changes in direction and branch connections.

G. Piping Connections: Unless otherwise indicated, make piping connections as specified below:
   1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
   3. Install dielectric fittings to connect piping of dissimilar metals.

3.06 SERVICE ENTRANCE PIPING

A. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with valve and cap, plug, or flange as required for piping material. Make connections to building water piping systems when those systems are installed.

B. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

D. Anchor service-entry piping to building wall.

3.07 PIPING INSTALLATION

A. Water-Main Connection: Arrange for tap in water main, of size and in location indicated, from water utility.

B. Make connections larger than 2-inch NPS with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to manufacturer's written instructions.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Install gate valve onto tapping sleeve. Comply with AWWA C600. Install valve with stem pointing up and with cast-iron valve box.
   4. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.

C. Comply with NFPA 24 for fire-protection water-service piping materials and installation.

D. Install ductile-iron piping according to AWWA C600.

E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
   1. Under Driveways: With at least 36 inches cover over top.
   2. Under Railroad Tracks: With at least 48 inches cover over top.
   3. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

G. Install piping under streets and other obstructions that cannot be disturbed, by tunneling, jacking, or combination of both.

3.08 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Potable-Water Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Potable-Water Piping: According to AWWA M23.
   3. Fire-Service Piping: According to NFPA 24.

B. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

3.09 VALVE INSTALLATION

A. General Application: Use mechanical-joint-end valves for 3-inch NPS and larger underground installation. Use threaded- and flanged-end valves for installation in pits. Use nonrising-stem UL/FM gate valves for installation with indicator posts. Use bronze corporation stops and valves, with ends compatible with piping, for 2-inch NPS and smaller installation.

B. AWWA-Type Gate Valves: Comply with AWWA C600. Install underground valves with stem pointing up and with cast-iron valve box.

C. UL/FM-Type Gate Valves: Comply with NFPA 24. Install underground valves and valves in pits with stem pointing up and with vertical cast-iron indicator post.

D. Bronze Corporation Stops and Curb Stops: Comply with manufacturer's written instructions. Install underground curb stops with head pointed up and with cast-iron curb box.

3.10 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA-Type Fire Hydrants: Comply with AWWA M17.

D. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.12 PIT CONSTRUCTION AND INSTALLATION

A. Construct pits of cast-in-place concrete pits, with manhole frame and cover, ladder, and drain. Include sleeves with waterproof mechanical sleeve seals for pipe entry and exit. Refer to Division 3 Section "Cast-in-Place Concrete."

B. Install precast concrete pits according to ASTM C 891.

C. Connect area drain outlet to storm drainage piping. Refer to Division 2 Section "Storm Drainage."

3.13 DETECTOR CHECK VALVE INSTALLATION

A. Install detector check valves in pits for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

B. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.14 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to plumbing and health department authorities having jurisdiction.

B. Do not install reduced-pressure-principle type in pit.

C. Do not install bypass around backflow preventer.

D. Support backflow preventers, valves, and piping on brick or concrete piers.

3.15 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connections of types and features indicated.

B. Install ball drip valves at each check valve for fire department connection to mains.

3.16 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with curb boxes do not require supervision. Coordinate with Section 15300 – “Fire Protection”.

B. Supervisory Switches: Supervise valves in open position.
   1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
   2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:
   1. Valves: Install chain and padlock on open OS&Y gate valve.
   2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in pit. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building fire alarm system. Refer to Division 16 Section "Fire Alarm Systems" for wiring and devices not specified in this Section.

3.17 FIELD QUALITY CONTROL

A. Contractor will engage a qualified independent testing agency to perform field quality-control testing. Testing agency must be acceptable to the municipality having jurisdiction over the work being tested.

B. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.
   1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage to be per municipal requirements. Remake leaking joints with new materials and repeat test until leakage is within above limits.
   2. The amount of leakage in piping shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed two quarts per hour per 100 gaskets or joints irrespective of pipe diameter.
   3. The amount of leakage specified above may be increased by one fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section. If dry barrel hydrants are under pressure, an additional five ounces per minute leakage is permitted for each hydrant.
   4. Test certificate contained at the end of this Section shall be submitted.

D. Prepare reports for testing activities.

3.18 CLEANING

A. Clean and disinfect water distribution piping as follows:
   1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by that authority, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
   3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities, use procedure described in AWWA C651 or as described below:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine. Isolate system or part thereof and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. Following allowed standing time, flush system with clean, potable water until chlorine does not remain in water coming from system.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION

SECTION 333113
SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage outside the building.

1.02 RELATED REQUIREMENTS

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

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

B. Force-Main Pressure Ratings: At least equal to system operating pressure, but not less than 150 psig.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Stainless-steel drainage systems.
   2. Backwater valves and cleanouts.
   3. Manhole cover inserts.

B. Shop Drawings: Include plans, elevations, details, and attachments for the following:
   1. Precast concrete manholes, including frames and covers.
   2. Cast-in-place concrete manholes and other structures, including frames and covers.

C. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.07 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with municipal requirements, provide products by one of the following:
   1. Stainless-Steel Drainage Systems:
      a. Josam Co.; Blucher-Josam Div.
   2. Gray-Iron Backwater Valves and Cleanouts:
      a. Josam Co.
      b. McWane, Inc.; Tyler Pipe; Wade Div.
      c. Smith: Jay R. Smith Mfg. Co.
      d. Watts Industries, Inc.; Ancon Drain Div.
      e. Watts Industries, Inc.; Enpoco, Inc. Div.
      f. Zurn Industries, Inc.; Hydromechanics Div.
   3. PVC Backwater Valves and Cleanouts:
      a. Canplas, Inc.
      b. IPS Corp.
      c. NDS, Inc.
      d. Plastic Oddities, Inc.
      e. Sioux Chief Manufacturing Co., Inc.
   4. Manhole Cover Inserts:
      a. FRW Industries, Inc.
      b. Knutson Manufacturing Co.
      c. Parson Environmental Products, Inc.

2.02 PIPING MATERIALS

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

2.03 PIPES AND FITTINGS

A. Ductile-Iron Sewer Pipe: ASTM A 746, AWWA C150 and AWWA C151, for push-on joints.
   1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
   2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
   3. Gaskets: AWWA C111, rubber.
   4. Be thickness pressure class 350.
   5. Be cement lined in accordance with AWWA C104.

B. PVC Pressure Pipe: AWWA C900, Class 150, for gasketed joints.
   1. PVC Pressure Fittings: AWWA C907, for gasketed joints.
   2. Gaskets for PVC Piping: ASTM F 477, elastomeric seals.
   3. Ductile-Iron, Compact Fittings: AWWA C153, for push-on joints.
   4. Gaskets for Ductile-Iron Fittings: AWWA C111, rubber.

C. PVC Sewer Pipe and Fittings: According to the following:
   1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.
      a. Gaskets: ASTM F 477, elastomeric seals.
   2. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-1 wall thickness, bell and spigot for gasketed joints.
      a. Gaskets: ASTM F 477, elastomeric seals.

2.04 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
   1. Sleeve Material for Concrete Pipe: ASTM C 443, rubber.
   2. Sleeve Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.

3. Sleeve Material for Plastic Pipe: ASTM F 477, elastomeric seal.
4. Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.
5. Bands: Stainless steel, at least one at each pipe insert.

B. Bushing-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe, for nonpressure joints.
1. Material for Concrete Pipe: ASTM C 443, rubber.
2. Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
3. Material for Plastic Pipe: ASTM F 477, elastomeric seal.
4. Material for Dissimilar Pipe: Compatible with pipe materials being joined.

C. Pressure-Type Pipe Couplings: AWWA C219, iron-body sleeve assembly matching OD of pipes to be joined, with AWWA C111 rubber gaskets, bolts, and nuts. Include PE film, pipe encasement.

D. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated. Include PE film, pipe encasement.

E. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees deflection. Include PE film, pipe encasement.

F. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated. Include PE film, pipe encasement.

2.05 PE FILM, PIPE ENCASEMENT

A. ASTM A 674 or AWWA C105; PE film, tube, or sheet; 8-mil thickness.

2.06 MANHOLES

A. Heavy Duty- Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
1. Diameter: 48 inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Gaskets: ASTM C 443, rubber.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
8. Steps: Conforming to ASTM-C478, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12 inch intervals.
9. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
1. Ballast: Increase thickness of concrete, as required to prevent flotation.

2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
3. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.
4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.

C. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter cover. Include indented top design with lettering "SANITARY SEWER" or as required by the governing municipality, cast into cover.

2.07 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
a. Invert Slope: 0.2’ fall measured from inlet to outlet.
2. Benches: Concrete, sloped to drain into channel.
a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.08 PROTECTIVE COATINGS (IF REQUIRED ON DRAWINGS)

A. Description: Two-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:
1. Concrete Manholes: On interior surface.
2. Manhole Frames and Covers: On surfaces that will be exposed to sewer gases.

2.09 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
1. Horizontal Type: With swing check valve and hub-and-spigot ends.
2. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.
3. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves: Similar to ASME A112.14.1, horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.10 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
   1. Light Duty: In earth or grass foot-traffic areas.
   2. Medium Duty: In paved foot-traffic areas.
   3. Extra-Heavy Duty: In all vehicle-traffic service areas.
   4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.02 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
   1. Use warning tape or detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.03 PIPING APPLICATIONS

A. General: Include watertight joints.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.

C. Gravity-Flow Piping: Use the following:
   1. NPS 4 and NPS 6: Ductile-iron sewer pipe; standard-pattern, ductile-iron fittings; gaskets; and gasketed joints.
   2. NPS 4 and NPS 6: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
   3. NPS 8 and NPS 10: Ductile-iron sewer pipe; standard-pattern, ductile-iron fittings; gaskets; and gasketed joints.
   4. NPS 8 and NPS 10: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
   5. NPS 12 and NPS 15: PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.

3.04 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
   1. Use the following pipe couplings for nonpressure applications:
      a. Sleeve type to join piping, of same size, or with small difference in OD.
      b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
      c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
   2. Use pressure-type pipe couplings for force-main joints. Include PE film, pipe encasement.

B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.05 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
   1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
   2. Install piping with 36-inch minimum cover.

F. Extend sanitary sewerage piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

G. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

3.06 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.
   1. Install PE film, pipe encasement over ductile-iron sewer pipe and ductile-iron fittings according to ASTM A 674 or AWWA C105.

C. PVC Sewer Pipe and Fittings: As follows:
   1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
   2. Join profile sewer pipe fittings with gaskets according to ASTM D 2321 and manufacturer's written instructions.
   3. Install according to ASTM D 2321.

D. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

E. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

F. Install with top surfaces of components, except piping, flush with finished surface.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Form continuous concrete channels and benches between inlets and outlet.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops at elevations noted on the drawings.

D. Install precast concrete manhole sections with gaskets according to ASTM C 891.

E. Construct cast-in-place manholes as indicated.

3.08 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.09 BACKWATER VALVE INSTALLATION

A. Install horizontal units in piping where indicated.

B. Install combination units in piping and in structures where indicated.

C. Install terminal units on end of piping and in structures where indicated. Secure units to structure walls.

3.10 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, per the details on the drawings. Set with tops at elevations noted on the drawings.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.11 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

C. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

D. Make branch connections from side into existing piping, NPS 21 or larger, or to underground structures by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
   1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
   2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.12 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
   1. Place plug in end of incomplete piping at end of day and when work stops.
   2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects. All testing listed below shall be performed by the Contractor with certification of all testing provided by the Owner's Testing Agency.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate reports for each test.
5. If authorities having jurisdiction do not have published procedures, perform tests as follows:
a. Sanitary Sewerage: Perform hydrostatic test.
1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.
2) Close openings in system and fill with water.
3) Purge air and refill with water.
4) Disconnect water supply.
5) Test and inspect joints for leaks.
6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig.
b. Sanitary Sewerage: Perform air test according to UNI-B-6.
1) Option: Test concrete piping according to ASTM C 924.
c. Sanitary Sewerage: Perform mandrel testing as follows:
1) Test shall be conducted no less thatn one (1) month afer backfill has been properly installed. The maximum allowable deflection shall not exceed five (5) percent of the pipe's internal diameter.
2) Mandrel testing shall be performed on not less than 25% of the pipeline.
3) If any section fails, then the Owner may require that all sections of the pipeline be tested.
4) Any pipeline found not to conform to these requirements shall be replaced by the Contractor at no additional cost to the Owner and shall be retested.
5) Mandrel shall be equal to the "Wortco 9-Arm Mandrel" five (5) percent deflection for flexible or semi-rigid pipe as approved by the Owner and/or the Engineer.
6. Manholes: Perform hydraulic test according to ASTM C 969.
7. Leaks and loss in test pressure constitute defects that must be repaired.
8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 334101
SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes subdrainage systems for the following:
   1. Retaining Walls.
   2. Foundation drains

1.02 RELATED REQUIREMENTS

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

1.03 DEFINITIONS

A. PVC: Polyvinyl chloride.

1.04 SUBMITTALS

A. Product Data: For drainage conduit, drainage panels, and geotextile fabrics.
   1. Perforated pipe.
   2. Vertical drainage panels.

1.05 COORDINATION

A. Drainage panel materials and installation shall be compatible with waterproofing of walls below grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to various application articles in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.03 DRAINAGE PIPES AND FITTINGS

A. Perforated, PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.04 SPECIAL PIPE COUPLINGS

A. Description: ASTM C 1173. Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined.

2.05 CLEANOUTS

A. PVC Pipe: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.06 FABRIC DRAINAGE PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Akzo Nobel Geosynthetics Co.
   2. Tensar Earth Technologies, Inc.

B. Description: Prefabricated, composite drainage panels, made with drainage core and filter fabric, for use as part of retaining-wall drainage system.

C. Drainage Core: 3-dimensional, PE strand, 0.25-inch- (6.3-mm-) thick, nonwoven net.
   1. Minimum Flow Rate: 5 gpm per foot (62 L/min. per m) at hydraulic gradient of 1.0 and normal pressure of 3600 psig (172 kPa) when tested according to ASTM D 4716.

D. Filter Fabric: Nonwoven geotextile filter fabric of PP or polyester fibers, or combination of both. Flow rates range from 120 to 200 gpm per sq. ft. (81 to 136 L/s per sq. m) when tested according to ASTM D 4491.

2.07 SOIL MATERIALS

A. Impervious Fill: Clay, gravel, and sand mixture.

B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Size No. 57, with 100 percent passing 1-1/2-inch (37.5-mm) sieve and not more than 5 percent passing No. 8 (2.36-mm) sieve.

2.08 GEOTEXTILE FILTER FABRICS

A. Woven or nonwoven geotextile filter fabric of PP or polyester fibers, or combination of both. Flow rates range from 110 to 330 gpm per sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491. Available styles are flat and sock.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

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

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.03 SUBDRAINAGE SYSTEM APPLICATIONS

A. NPS 4 (DN 100) Piping:
   1. Perforated, PVC sewer pipe and fittings for loose, bell-and-spigots.

3.04 RETAINING-WALL DRAINAGE INSTALLATION

A. Drainage Fill: Place supporting layer of drainage fill over compacted subgrade to compacted depth of not less than 4 inches (100 mm). After installing drainage piping, add drainage fill to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests. After satisfactory testing, cover piping to width of at least 6 inches (150 mm) on side away from footing and above top of pipe to within 12 inches (300 mm) of finish grade. Place drainage fill in layers not exceeding 3 inches (75 mm) in loose depth; compact each layer placed.
   1. Before installing drainage fill, lay flat-style geotextile filter fabric in trench and overlap trench sides. After installing drainage fill, wrap top of drainage fill with flat-style geotextile filter fabric.
   2. After installing drainage fill, place one layer of geotextile filter fabric over top of drainage fill, overlapping edges at least 4 inches (100 mm).

B. Install vertical drainage panels as follows:
   1. Coordinate placement with other drainage materials.
   2. Wrap bottom of panel around drainage pipe.
   3. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Use construction adhesives or mechanical fasteners. Do not penetrate waterproofing. Before using adhesives or fasteners, discuss with waterproofing manufacturer.
   4. Cut panel as necessary to keep top 12 inches (300 mm) below finish grade.
   5. For inside corners, bend panel. For outside corners, cut core to provide 3 inches (75 mm) for overlap.

C. Fill to Grade: Place native fill material over compacted drainage fill and drainage panels. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Fill to finish grade.

3.05 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
   1. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm), unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
   2. Lay perforated pipe with perforations down.
   3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Install PVC piping according to ASTM D 2321.

3.06 PIPE JOINT CONSTRUCTION

A. Join perforated, PVC pipe and fittings according to ASTM D 2729, with loose, bell-and-spigot joints.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.07 RETAINING-WALL SUBDRAINAGE CLEANOUT INSTALLATION

A. Install cleanouts from subdrainage piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

B. In nonvehicular-traffic areas, use NPS 4 (DN 100) PVC pipe and fittings for subdrainage piping branch fittings and riser extensions to cleanout plug. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

3.08 CONNECTIONS

A. Connect low elevations of subdrainage system to storm drainage system.

3.09 FIELD QUALITY CONTROL

A. Testing: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

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SECTION 334600
STORMWATER MANAGEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storm drainage outside the building.

1.02 RELATED REQUIREMENTS

A. Division 3 Section "Cast-in-Place Concrete" for concrete structures.

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

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene-monomer rubber.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.05 SUBMITTALS

A. Product Data: For the following:
   1. Backwater valves, cleanouts, and drains.

B. Shop Drawings: Include plans, elevations, details, and attachments for the following:
   1. Precast concrete manholes and other structures, including frames, covers, and grates.
   2. Cast-in-place concrete manholes and other structures, including frames, covers, and grates.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.07 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions. No utility interruptions are allowed without the Owner’s written permission.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Gray-Iron Backwater Valves, Cleanouts, and Drains:
      a. Josam Co.
      b. McWane, Inc.; Tyler Pipe; Wade Div.
      c. MIFAB.

d. Smith: Jay R. Smith Mfg. Co.
e. Watts Industries, Inc.; Ancon Drain Div.
f. Watts Industries, Inc.; Enpoco, Inc. Div.
g. Zurn Industries, Inc.; Hydromechanics Div.

2. PVC Backwater Valves and Cleanouts:
a. Canplas, Inc.
b. IPS Corp.
c. NDS, Inc.
d. Plastic Oddities, Inc.
e. Sioux Chief Manufacturing Co., Inc.

2.02 PIPING MATERIALS

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

2.03 PIPES AND FITTINGS

A. Ductile-Iron Sewer Pipe: ASTM A 746, for push-on joints.
1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
3. Gaskets: AWWA C111, rubber.

B. Ductile-Iron Culvert Pipe: ASTM A 716, for push-on joints.
1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
2. Gaskets: AWWA C111, rubber.

C. Corrugated-Steel Pipe: ASTM A 760/A 760M, Type I, made from ASTM A 929/A 929M, zinc-coated steel sheet for banded joints.
1. Fittings: Fabricated to types indicated and according to same standards as pipe.
2. Connecting Bands: Standard couplings made for corrugated-steel pipe to form soiltight joints.
3. Pipe shall have full bituminous coating and paved invert conforming to the requirements of AASHTO M190.

D. PVC Sewer Pipe and Fittings: According to the following:
1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.
a. Gaskets: ASTM F 477, elastomeric seals.

E. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, Class III, Wall B, for gasketed joints.
1. Gaskets: ASTM C 443, rubber.

2.04 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
1. Sleeve Material for Concrete Pipe: ASTM C 443, rubber.
2. Sleeve Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
3. Sleeve Material for Plastic Pipe: ASTM F 477, elastomeric seal.
4. Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.
5. Bands: Stainless steel, at least one at each pipe insert.

B. Bushing-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe, for nonpressure joints.
1. Material for Concrete Pipe: ASTM C 443, rubber.
2. Material for Cast-Iron Soil Pipe: ASTM C 564, rubber.
3. Material for Plastic Pipe: ASTM F 477, elastomeric seal.
4. Material for Dissimilar Pipe: Compatible with pipe materials being joined.

C. Pressure-Type Pipe Couplings: AWWA C219, iron-body sleeve assembly matching OD of pipes to be joined, with AWWA C111 rubber gaskets, bolts, and nuts. Include PE film, pipe encasement.

D. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated. Include PE film, pipe encasement.

E. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees deflection. Include PE film, pipe encasement.

F. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated. Include PE film, pipe encasement.

2.05 PE FILM, PIPE ENCASEMENT

A. ASTM A 674 or AWWA C105; PE film, tube, or sheet; 8-mil thickness.

2.06 MANHOLES

A. Normal-Traffic Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
   1. Diameter: 48 inches minimum, unless otherwise indicated.
   2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   3. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   4. Riser Sections: 5-inch minimum thickness, and lengths to provide depth indicated.
   5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   6. Gaskets: ASTM C 443, rubber.
   7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
   8. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12 inch intervals.
   9. Steps: ASTM C 478, individual steps or ladder.
   10. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
   1. Ballast: Increase thickness of concrete, as required to prevent flotation.
   2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
   3. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.
   4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.

C. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

D. Masonry units, brick or concrete masonry units, shall not be utilized as riser sections, rings or leveling material.

2.07 CATCH BASINS

A. Normal-Traffic, Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.
   1. Base Section: 6-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   2. Riser Sections: 5-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
   3. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   4. Gaskets: ASTM C 443, rubber.
   5. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and grate.
   6. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast steps or anchor ladder into base, riser, and top section sidewalls at 12 inch intervals.
   7. Steps: ASTM C 478, individual steps or ladder.
   8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated.
   1. Bottom, Walls, and Top: Reinforced concrete.
   2. Channels and Benches: Concrete.
   3. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast steps or anchor ladder into sidewalls at 12 inch intervals.
   4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include flat grate with small square or short-slotted drainage openings.
   1. Size: 24 by 24 inches minimum, unless otherwise indicated.
   2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

D. Masonry units, brick or concrete masonry units, shall not be utilized as riser sections, rings or leveling material.

2.08 STORMWATER INLETS

A. Curb Inlets: Vertical curb opening, of materials and dimensions indicated.

B. Gutter Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavy-duty frames and grates.

C. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

D. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.
   1. Material: ASTM A 536, Grade 60-40-18 minimum, ductile-iron casting.
   2. Material: ASTM A 48, Class 30 minimum, gray-iron casting.

3. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.09 STORMWATER DETENTION STRUCTURES

A. Cast-in-Place Concrete, Stormwater Detention Structures: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16, heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
   1. Ballast: Increase thickness of concrete, as required to prevent flotation.
   2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch diameter frame and cover.
   3. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.
   4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A 615/A 615M and encased in polypropylene complying with ASTM D 4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12 inch intervals.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

2.10 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious ratio.
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water-cementitious ratio.
   1. Include channels and benches in manholes.
      a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
         1) Invert Slope: as noted on the drawings.
      b. Benches: Concrete, sloped to drain into channel.
         1) Slope: 8 percent.
   2. Include channels in catch basins.
      a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
         1) Invert Slope: as noted on the drawings.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious ratio.
   1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.11 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.
4. Extra-Heavy Duty: In roads.
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.12 DRAINS

A. Gray-Iron Area Drains: ASME A112.21.1M, round, gray-iron body with anchor flange and round, secured, gray-iron grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated. Use units with top-loading classifications according to the following applications:
1. Medium Duty: In paved foot-traffic areas.
2. Heavy Duty: In vehicle-traffic service areas.

B. Gray-Iron Trench Drains: ASME A112.21.1M, 6-inch wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular, secured grate. Include units of total lengths indicated and number of bottom outlets with inside calk or spigot connections, of sizes indicated. Use units with top-loading classifications according to the following applications:
1. Medium Duty: In paved foot-traffic areas.
2. Heavy Duty: In vehicle-traffic service areas.
3. Extra-Heavy Duty: In roads.

C. Steel Trench Drains: Fabricated from ASTM A 242/A 242M steel plate, to form rectangular body with uniform bottom slope of 2 percent down toward outlet, anchor flange, and grate. Include units of total lengths indicated, bottom outlet of size indicated, outlet strainer, and acid-resistant enamel coating on inside and outside surfaces. Include grate openings with total free area at least two times outlet cross-sectional area and with the following features:
1. Plate Thickness: 1/4 inch.
2. Overall Width: 12-1/2 inches.
3. Grate: 3-by-3/8-inch slots.
4. Cover: Solid with diamond pattern, if indicated.
5. Weep holes in body and flashing clamping ring for units used with waterproof membrane.
6. See Division 15 – Plumbing Specialties for interior trench drain assemblies.

2.13 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone.
1. Average Size: NSA No. R-5, screen opening 6 inches.

C. Filter Stone: NSA No. FS-2, No. 4 screen opening, average-size, graded stone.

D. Energy Dissipators: NSA No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.02 IDENTIFICATION

A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.03 PIPING APPLICATIONS

A. General: Include watertight, silttight, or soiltight joints.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.

C. Gravity-Flow Piping: Use the following:
1. NPS 8 to NPS 15: Ductile-iron sewer pipe; standard-pattern, ductile-iron fittings; gaskets; and gasketed joints in NPS 8 to NPS 12. Use ductile-iron culvert pipe; standard-pattern, ductile-iron fittings; gaskets; and gasketed joints in NPS 14 to NPS 16.
2. NPS 8 to NPS 15: Corrugated-steel pipe and fittings, connecting bands, and banded joints.
3. NPS 8 to NPS 15: Corrugated PE drainage tubing and fittings, silttight couplings, and coupled joints in NPS 8 and NPS 10. Use corrugated PE pipe and fittings, silttight couplings, and coupled joints in NPS 12 and NPS 15.
4. NPS 8 to NPS 15: PVC, SDR 35, sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
5. NPS 12 and NPS 15: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints. Do not use nonreinforced pipe instead of reinforced concrete pipe in NPS 8 and NPS 10.
6. NPS 18 to NPS 36: Ductile-iron culvert pipe; standard-pattern, cast-iron or ductile-iron fittings; gaskets; and gasketed joints.
7. NPS 18 to NPS 36: Corrugated-steel pipe and fittings, connecting bands, and banded joints.
8. NPS 18 to NPS 36: PVC, ribbed drain pipe and fittings; gaskets; and gasketed joints.
9. NPS 18 to NPS 36: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
10. NPS 18 to NPS 36: Reinforced-concrete arch pipe, sealing bands, and banded joints.
11. NPS 18 to NPS 36: Reinforced-concrete, elliptical pipe, Type HE, horizontal; sealing bands; and banded joints.
12. NPS 42 to NPS 120: Corrugated-steel pipe and fittings, connecting bands, and banded joints.
13. NPS 42 to NPS 144: Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

3.04 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
1. Use the following pipe couplings for nonpressure applications:
a. Sleeve type to join piping, of same size, or with small difference in OD.
b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints. Include PE film, pipe encasement.

B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.05 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements,

and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
   2. Install piping with cover as noted on the drawings.

F. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

G. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

3.06 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.
   1. Install PE film, pipe encasement over hubless cast-iron soil pipe and fittings according to ASTM A 674 or AWWA C105.

B. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.
   1. Install PE film, pipe encasement over ductile-iron sewer pipe and ductile-iron fittings according to ASTM A 674 or AWWA C105.

C. Install with top surfaces of components, except piping, flush with finished surface.

D. Corrugated-Steel Pipe: Join and install according to ASTM A 798. Use soiltight joints made with coupling bands and gaskets, unless otherwise indicated.

E. PVC Pressure Pipe and Fittings: Join and install according to AWWA M23.

F. PVC Sewer Pipe and Fittings: As follows:
   1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
   2. Install according to ASTM D 2321.

G. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual." Use the following seals:
   1. Round Pipe and Fittings: ASTM C 443, rubber gaskets.

H. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

I. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.07 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Form continuous concrete channels and benches between inlets and outlet.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

D. Install precast concrete manhole sections with gaskets according to ASTM C 891.

E. Construct cast-in-place manholes as indicated.

3.08 CATCH-BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.09 STORM DRAINAGE INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipators at outlets, as indicated.

3.10 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.11 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions.

B. Assemble and install stainless-steel drainage systems according to ASME A112.3.1 and manufacturer's written instructions.

C. Install with top surfaces of components, except piping, flush with finished surface.

D. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

E. Embed channel sections and drainage specialties in 4-inch minimum concrete around bottom and sides.

F. Fasten grates to channel sections if indicated.

G. Assemble trench sections with flanged joints.

H. Embed trench sections and drainage specialties in 4-inch minimum concrete around bottom and sides.

I. Make piping connections and install stainless-steel piping with gasketed joints between system components.

3.12 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, per the details on the drawings. Set with tops at grade elevations noted on the drawings.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.13 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

3.14 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

C. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

D. Make branch connections from side into existing piping, NPS 21 or larger, or to underground structures by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
   1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
   2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.15 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
   2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Structures: Excavate around structure as required and use one procedure below:
   1. Remove structure and close open ends of remaining piping.
   2. Remove top of structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
   3. Backfill to grade according to Division 2 Section "Earthwork."

3.16 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
   1. In large, accessible piping, brushes and brooms may be used for cleaning.
   2. Place plug in end of incomplete piping at end of day and when work stops.
   3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

END OF SECTION

SECTION 335000

GASOLINE DISPENSING AND UNDERGROUND STORAGE TANK SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Provide a complete gasoline fueling system, including but not limited to underground storage tanks, submersible turbine pumps, electrical wiring, electronic control/monitoring/leak detection system, Stage I vapor recovery systems, vent lines, fill risers, product piping, fittings, valves, caps, unions, and necessary appurtenances, as specified, shown on the drawings, and as required for a complete and operating system.

B. The complete fueling system shall include storage tank, piping, sumps, gasoline dispensers, and electrical controls as shown on drawings.

C. The complete operational gasoline dispensing system shall be certified and registered and shall have all necessary permits to conduct dispensing of gasoline. Contractor shall obtain and pay for all construction permits and applications.

D. The UST system shall be registered with the State and comply with State, County, and local regulations governing underground storage tank systems (UST regulations). (https://www.deq.virginia.gov/) State (or local authority) environmental regulatory agency notifications, registrations, and/or certifications will be generated by CarMax Environment, Health, and Safety (EH&S) and coordinated with the Owner by the Owner's Agent and CenterPoint (www.centerpoint-is.com).

E. Post installation underground tank tightness testing (pre–Grand Opening) shall be performed by Tanknology, arranged by the Owner's Agent for the project and provided through the CarMax fuel system maintenance vendor (Mansfield Oil).

F. Provide complete double-wall product piping system, including secondary containment and accessories as specified, shown on the drawings, and as required to prevent the possibility of contamination of air, soil, water, or groundwater.

G. Provide gasoline dispensing system including dispensers, control consoles, interconnecting devices and accessories as required for a complete and operating system.

H. Provide submersible turbine fuel pump(s) including pump riser pipe as specified, shown on the drawings, and required for a complete and operating installation. Provide check valves, ball valves, metal flex connectors and shut-off (isolation) valves as required.

I. Provide fiberglass-reinforced plastic (FRP) double-wall underground fuel storage tanks including hold-down devices (deadmen or anchor slab), as recommended by the tank manufacturer, installed per the tank manufacturer's instructions, and sealed turbine (piping sump) pump enclosures as specified, shown on the drawings, and required for a complete and operating system.

J. Provide tank monitoring/inventory control/release detection (Automatic Tank Gauge – ATG) system including console with alarm capability, automatic tank gauging equipment, electronic line leak detectors for primary piping, sensors for all secondary containment (including tank, piping and dispenser sumps), an overfill alarm with acknowledgement switch, and accessories as specified, shown on the drawings, and required for a complete and operating system.

K. Provide the excavation, trenching, and backfill as required for installation of the fuel system. Backfill shall meet tank manufacturer requirements and installation instructions. Excavation, tank installation, backfill, and cover pad shall meet or exceed the tank manufacturer's UST installation instruction requirements.

L. The Owner's Agent and Centerpoint Integrated Solutions (Centerpoint-is.com) will develop the Storage Tank Notification Form, the Facility Registration Form and notify the Owner of any other state regulatory (or local authority) environmental documents required for the installation and operation of gasoline storage and dispensing facilities as required by the New Kent County, Virginia Uniform Statewide Building Code, Code of Virginia, and Virginia Department Environment and Quality. **The Contractor shall coordinate the construction of the fuel storage system with the Owners Agent and provide written notification no less than 21 calendar days before fuel system construction begins. Centerpoint will submit the Registration document to CarMax Environment Health & Safety (EH&S – email address; environmental@carmax.com) and notify the Owner of the need to develop the SPCC Plan. Registrations, permits, applications include:**

1. State registered UST installer and UST inspector is required.

2. Inspection from local Fire Marshal after completion of construction.

3. Local initial permit by New Kent Building Office and annual inspection by fire department.

4. Notification within 30 days of use to Virginia Department Environment and quality and registration.

5. Local building department to conduct inspections.

M. Coordinate installation construction with applicable sections within Division 16 - Electrical work and all other trades.

1.2 QUALITY ASSURANCE:

A. Comply with the following codes and standards (use the most recent version):

1. NFPA No. 30, Flammable and Combustible Liquids Code.

2. NFPA No. 30A, Automotive and Marine Service Station Code.

3. NFPA No. 70, National Electrical Code

4. NFPA No. 329, Handling Underground Release of Flammable and Combustible Liquids

5. EPA 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Architects and Operators of Underground Storage.

6. OSHA 29 CFR Part 1910.106, Flammable and Combustible Liquids.

7. ASTM D2310-80, Standard Classification for Machine-Made Reinforced Thermosetting-Resin Pipe.

8. ASTM D2517-81, Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings.

9. ASTM D2996-88, Standard Specification for Filament-Wound "Fiberglass" (Glass Fiber-Reinforced Thermosetting Resin) Pipe.

10. ASTM D4021-86, Standard Specification for Glass-Fiber-Reinforced Polyester Underground Petroleum Storage Tanks.

11. UL 79, Power-Operated Pumps for Petroleum Product Dispensing Systems.

12. UL 87, Power-Operated Dispensing Devices for Petroleum Products.

13. UL 567, Pipe Connections for Flammable and Combustible Liquids and LP-Gas.

14. UL 842, Valves for Flammable Fluids.

15. UL 860, Pipe Unions for Flammable and Combustible Fluids and Fire Protection Service.

16. UL 1238, Control Equipment for Use with Flammable Liquid Dispensing Devices.

17. UL 1316, Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products.

18. API 1615 (1996) Installation of Underground Petroleum Storage Systems.

19. API 1628 (1996) A Guide to the Assessment and Remediation of Underground Petroleum Releases (if a release is expected).

20. California Air Resources Board (CARB) Executive Orders applicable to system.

21. California Air Resources Board (CARB) Test Procedures applicable to system.

22. PEI RP 100-05 Recommended Practices for Installation of Underground Storage Systems.

23. PEI RP 300-04 Recommended Practices for Installation and Testing of Vapor Recovery Systems at Vehicle Fueling Sites.

24. PEI 400-02 Recommended Procedures for Testing Electrical Continuity of Fuel-Dispensing.

25. All other applicable ASTM and UL standards.

26. All applicable EPA requirements relating to release detection, spill and overfill prevention, and corrosion protection.

27. All other applicable Local, County, State, and Federal codes, standards, licensing and registration requirements, including those required by the Virginia DEQ, Virginia Uniform Statewide Building Code, Code of Virginia, New Kent Building office, and local fire department.

B. Contractor Experience and Licensing:

1. Contractor shall certify that he (or installation sub-contractor) has at least four years experience installing underground gasoline storage tanks, fiberglass underground piping, and dispensing equipment, and is certified to install underground fuel tank systems by the AHJ (most States require contractors to be UST “Certified”/licensed).

2. The Contractor shall assure that the gasoline fuel system shall be installed by skilled workmen, licensed by the State in which the project is constructed (if required by State regulations). The contractor shall be trained and certified by the equipment/product manufacturers (including tank, piping, fiberglass sump entry fitting manufacturer, and ATG manufacturer). The Contractor’s installer and electrician shall have prior experience with fuel systems and related equipment. As evidence of this experience, a list of the most recent three fuel system installations performed by this contractor with complete descriptions of the location, the project name, the equipment installed, and date of project shall be submitted to the Architect before construction begins.

3. Contractor Certification of Licensing and Experience. Contractor shall certify that (or installation subcontractor) is a certified installer and/or Authorized Service Contractor for the following equipment manufacturers, as applicable to the system being installed:

   a. Dispenser manufacturer (Gasboy)

   b. Veeder-Root (ATG system)

   c. Red Jacket Submerged Turbine Fuel Pump installation.

   d. NOV Fiber Glass (formerly Smith Fiberglass, Ameron)

   e. Xerxes or Containment Solutions Underground fuel tank installation.

   f. Bravo systems (fiberglass sump entry fittings).

4. Contractor shall also certify that he (or his installation subcontractor) holds all necessary licenses for construction and installation required under this contract at the project location. These certifications shall be submitted in writing to the Architect before construction begins. Changing of subcontractors after this certification will require re-certification of the new subcontractor, showing requisite experience.

5. Contractor shall certify that the installation of the petroleum system related electrical components will be done by an experienced contractor or

subcontractor. This contractor shall have experience with fuel systems similar to those installed under this contract. Petroleum system related components are those essential to the legal operation of the petroleum storage, dispensing, pump fill-automatic fill systems, leak detection, and emergency equipment. They include, but are not limited to: dispensers, submersible pumps, pump controllers, leak detection equipment, vapor recovery systems, emergency shut-off switches, and all conduit and wiring related to these systems. As evidence of this experience, a list of the most recent three (3) fuel system installations performed by this contractor with complete descriptions of the location, the project name, the equipment installed, and date of the project shall be submitted to the Architect/engineer before construction begins. NOTE: It is preferred, but not mandatory that the petroleum electrical subcontractor be a subcontractor to the petroleum system installer. If the petroleum electrical installer is a subcontractor to the petroleum system installer as described in 1 above, and worked on the projects submitted under that paragraph, the contractor shall so certify and no additional projects need to be reported.

C. Detailed drawings and descriptions of proposed departures due to actual field conditions or other causes shall be submitted to the Architect for coordination of approval. The contractor shall carefully examine the drawings and shall be responsible for the proper fitting of materials and equipment without substantial alteration. Materials and equipment installed in the system shall be suitable for the pressures and temperatures expected to be encountered and suitable to the climate and environmental conditions of the location of the project.

D. Contractor's responsibilities under this quality assurance section include, but are not limited to, the following:

1. Receipt and storage of all items of equipment in a location protected from theft, vandalism, inclement weather, or other damage.

2. Providing required interconnections to product pumps and emergency disconnect systems.

3. Construction of openings, depressions, and sleeves for mechanical and electrical piping and conduit as required.

4. Providing hardware and related items as required to assure that equipment components are properly mounted, securely anchored, adequately ventilated, or where required, are adequately sealed from vapors.

5. Verifying size of components to assure space required for dispensers, consoles and interconnecting devices does not exceed designated space available as indicated on drawings.

6. Determining if unusual conditions or circumstances exist at the site (or in the vicinity of the installation) which could damage the electronic components or circuitry, or otherwise impair the proper function of the system, and incorporating, in such event, the necessary protective devices into the installation.

1.3 SUBMITTALS:

A. Submit shop drawings for the following in accordance with these specifications:

1. Dispenser
2. Dispenser sumps
3. Product piping and fittings
4. Pump/tank sumps and watertight lid assemblies
5. Sump penetration fittings (primary/secondary pipe and electrical conduit)
6. Spill Containers (fill and vapor recovery buckets)
7. Overfill prevention devices
8. Submersible fuel pump(s)
9. Underground fuel storage tank(s)
10. Tank monitoring / inventory control / release detection system (ATG System)
11. Surface manholes for UST piping sumps, fills, and interstitial sensor

B. No work shall be performed without the shop drawing having been approved by Architect/Engineer or his designated agent.

C. Contractor shall provide a proposed schedule of the phases of the work for the installation of the gasoline storage tanks, piping and dispensing systems.

D. Other underground fuel storage tank submittals shall include:

1. Contractor shall submit an electronic version of shop drawings for each tank system of same size/capacity. Drawings shall include all critical dimensions and show locations of all fittings and accessories, i.e., manways, hold-down straps, etc. All shop drawings/submittals shall be submitted at the same time.
2. Two conversion charts shall be left with the Owners Representative upon the completion of construction and included in the project documentation.
3. Fuel System Environmental Compliance Documentation and Records. The following documents or the State/location equivalent of these records will be furnished to the Owner's Agent with the close-out documents in an electronic format:

a. Any construction permit, unique to the fuel storage and dispensing system. Copies of all State/County/City (AHJ) fuel system related registrations, Notices to Install, Permits, Checklists, and inspection reports (local AHJ site visits).

b. Underground tank manufacturer's Tank Installation Checklist.

c. "Monitoring System Equipment Test Checklist – Installer Certification" This document is available from the Engineer and must be completed and provided to the Engineer as part of the final construction review.

d. As-built plans or site map with layout of tanks and piping.

e. Manufacturer's manuals (owner's operator's and maintenance manuals) for all system components and equipment (including tanks, lines, leak detection components, dispensers, nozzles, etc.).

f. Manufacturer's warranty documentation for all system components and equipment (including tanks, lines, leak detection components, dispensers, nozzles, etc.) **This includes the "Veeder-Root Monitoring Systems Warranty Registration and Checkout Form (WRACO)."** This form is available directly from Veeder Root www.veeder.com/page.Support .

g. Initial Compliance Test Records (if not included with Installer Certification above).

1) Tanks (tank manufacturer installation checklist)
2) Lines
3) Stage I (CARB TP 201.1E and TP 201.3)
4) Dispenser Calibration and continuity test.

h. Training Roster for O & M Training given to the Owner.

i. Fuel System Final Inspection Report (by local AHJ – where applicable).

j. UST registration (aka "State Registration, UST Registration") for each tank including any changes to registration. Responsibility of Carmax EH&S and CenterPoint, coordinated by the Owner's Agent.

k. Fuel tank tightness testing results ("third-party" testing). Responsibility of Tanknology, arranged by the Owner's Agent for the project and provided through Mansfield Oil (CarMax fuel system maintenance vendor).

l. Installer Certification of the UST system – may be same as "UST Registration" (May be EPA Form 7530). Must be coordinated with the Owner (EH&S) by the Owner's Agent.

4. Digital photographs of main stages of tank installation and other construction activities, as shown below. Sufficient photographs to adequately document and represent the activity will be taken. Any problems encountered or authorized deviations from the drawings or specifications will be documented with appropriate photographs. The contractor will submit the photographs to the Owner's Agent as soon as possible but not later than 5 business days prior to any scheduled technical inspection (or 5 business days prior to the final inspection if documenting work done between the last technical inspection.

5. Digital copies of a chronological Installation Report of the complete tank system installation construction documenting all major activities related to the installation of the underground storage tanks, piping, dispensing and release

detection equipment shall be provided to the Owner's Agent. Contractor's Installation Report shall include documentation of construction activities and photographs of the construction work in progress. Documentation of specific construction activities shall include, at a minimum the following:

	CONSTRUCTION ACTIVITIES	DOCUMENTED BY	REMARKS
1	Excavation of Tank Hole	Photographs Installation Report	Report shall include measured dimensions of the excavation and details about shoring and site conditions.
2	Final Tank Hole Excavation (with fabric liner as applicable under site specific conditions)	Photographs Installation Report	Report shall include final measured dimensions of the excavation and details about preparation for tank placement.
3	Delivery of the Underground Storage Tanks	Shipping manifest	Report shall note delivery condition of tanks
4	Air Test of Tanks Upon Delivery (Pre-Installation or immediately after installation; as required by manufacturers recommendations)	Statement of testing protocol with results of air testing (signed by tank contractor)	Air test must be conducted at 3-5 PSI (air gauge must be equipped with a pressure relief valve set at 5 PSI), and must follow manufacturer's procedures
5	Deadman Anchors or Slab Construction	Photographs, Field notes in Installation Report	Report shall note size and quantity of rebar used, as well as, final measured dimensions of anchoring devices
6	Placement of Tanks on Clean Backfill	Photographs, Field notes in Installation Report	Report shall note placement details to include conditions like wet-hole, caving, amount of backfill beneath the tanks, etc.
7	Tank Hole Excavation Backfilling Operations	Photographs, Field notes in Installation report	Report shall indicate how manufacturer's recommended procedures were followed
8	Installing the Product Lines	Photographs	Follow piping manufacturer's procedures
9	Installing the Vapor Recovery Lines	Photographs	Follow CARB and RP300 procedures
10	Installing the Tank Vent lines	Photographs	Ensure proper slope of vent lines
11	Air / Soap Testing of All Piping	Photographs Field notes (signed)	Air test must follow manufacturer's procedures (air gauge must be equipped with a pressure relief valve set @ 60 PSIG)
12	Placement of Containment Sumps	Photographs	Follow sump manufacturer's procedures
13	Placement of Electrical Conduit	Photographs	
14	Forming / Pouring Concrete for Canopy Footings	Photographs	
15	Backfilling the Pipechase	Photographs	Document proper installation of piping
16	Installation of Dispensers	Photographs	
17	Purging of Product Piping of Air	Field notes (signed)	
18	Notification of System Testing to Regulators	Copy of Notification	Presence of regulator may be required
19	Calibration of Dispensers	Field Notes (signed)	Verify proper calibration tolerances
20	Flow Rate Determination	Field Notes (signed)	Verify flow rate not to exceed 10 GPM
21	Certification of Fueling System: Tank & Line Tightness Tests	Test Reports, copy of the Performance Criteria for the Test	Using an EPA third-party certified method

	CONSTRUCTION ACTIVITIES	DOCUMENTED BY	REMARKS
22	Certification of Vapor Recovery System: Stage I and Stage II (as required)	Test Reports	Following CARB Test Procedures
23	Certification of the Fueling Facility Operators (Training Documentation)	Outline of Course Content & Rosters	
24	Installer Certification of UST Installation	Affidavit/Oath	Signed EPA Form 7530 or State Form
25	Registration of Tank System	Copy of Registration	Signed EPA Form 7530 or State Form
26	Registration of Vapor Recovery System (as required)	Copy of Registration	Signed State Form
27	Warranty/Registration Paperwork for Equipment	Copy of Warranty and Registration	

E. Contractor shall submit an electronic copy of catalog data of submersible turbine pumps along with proper pump selection, performance chart, and installation, operation, and service manuals.

F. Certification of Experience and Qualifications

1. Contractor shall submit Documentation of contractor or installer sub-contractor and of petroleum systems electrician's experience as required in B.1. of this specification section.

2. Contractor shall provide for approval the name of the testing company he will use to perform pressure testing of tanks and piping, and startup compliance testing of the Vapor Recovery system per manufacturers' instruction and as specified in this specification. Contractor-retained testing company shall have a minimum of three years of experience in performing such tests for retail gasoline stations and shall be responsible for notifying the Architect of the schedule for testing, following proper testing protocol, and prompt notification of test results.

G. Contractor shall provide a digital version of an Operations and Maintenance (O&M) Manual. This manual will describe all systems and equipment installed by the contractor, including but not limited to: underground storage tanks, piping and distribution lines, tank monitoring and release detection systems, vapor recovery systems, dispensers, and alarms. O&M Manual will list the manufacturers (including addresses and telephone numbers), make, model and serial numbers of all equipment and systems. Equipment warranty registrations shall be included in the O&M Manual. The O&M Manual will be written in simple language and will give the operator information necessary to operate and maintain the system. Maintenance that is required but not normally performed by the operator will be so noted. The requirement for an O&M Manual may be met by compiling copies of materials provided by the manufacturers of the systems or equipment. However, if the manufacturer's materials do not explain how the system or equipment works as installed, Contractor will provide necessary supplemental information.

H. Contractor shall provide digital copies of the Veeder Root "Warranty Registration and Checkout" form (WRACO) and the associated printouts described therein to the Owner's Agent. See supplement at the end of this specification section.

I. Copies of the release detection system operation and maintenance manuals shall be provided to the Owner's Agent.

J. Copies of all documents, permits, applications and registrations required State, County, and Local shall be submitted to the Architect in a report documenting details of the installation. Report to be provided with the close put documentation.

K. **GENERAL CONTRACTOR TO PROVIDE RECORD DRAWINGS OF COMPLETE FUELING SYSTEM TO THE ARCHITECT PRIOR TO TURNING OVER OF PROJECT.**

1.4 DRAWINGS: Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories that may be required. The contractor shall carefully investigate the site and job conditions affecting all work and shall arrange work accordingly, furnishing such fittings, valves and accessories as may be required to meet such conditions, at no additional cost.

1.5 PROTECTION OF MATERIALS AND EQUIPMENT: Pipe openings shall be closed and protected with caps or plugs (not tape) during installation. Equipment shall be tightly covered and protected against dirt, water, chemical or mechanical injury. Backfill material shall be kept clear of all trash and debris. Dispenser and tank sumps shall be closed or covered to prevent water and construction debris from accumulating within. Underground storage tanks and piping system shall be protected by barricades and construction fencing. Upon completion of all work, the materials and equipment shall be thoroughly cleaned, adjusted and operated. Belts, pulleys, gears, couplings, projecting setscrews, keys and other rotating parts shall be fully enclosed or properly guarded.

1.6 WARRANTIES:

A. Contractor shall warrant the work specified according to the terms of the General Provisions. In addition, upon acceptance of the gasoline dispensing system for beneficial use by the Owner, he shall provide to the Architect the manufacturer's standard equipment warranty or warranties covering both parts and labor for the period of time stated in the Owner-Contractor Agreement Document. Warranty service shall be provided promptly upon request within 12 hours on weekdays and 24 hours on weekends. Contractor shall be responsible for the warranty of the equipment he furnished.

B. Fuel storage tanks shall carry a thirty-year warranty against failure from internal or external corrosion and from structural failure. Manufacturer's installation checklist must be completed and submitted to the manufacturer by the Contractor in order to provide a valid warranty. A photocopy of this document shall be included in the O&M manual and also be provided to the Architect.

PART 2 - PRODUCTS

2.1 GENERAL: Contractor-furnished materials and equipment shall be as specified and/or as shown on the drawings. Equipment shall be the product of manufacturers regularly engaged in the manufacture of such products and shall be of the best quality used for

the purpose in commercial practice. Each major component of equipment shall have the manufacturer's name, address and catalog number on a durable plate securely affixed in a conspicuous place. The nameplate of the distributing agent only will not be acceptable. Substitution of the specified equipment is acceptable upon review and approval by the Architect or Engineer and must be in writing. To obtain approval, Contractor shall make a written request to the Architect. Contractor's request will include or attach all data and information available on the equipment including warranties, guarantees, and UL certifications (if applicable).

2.2 COMPATIBILITY WITH ETHANOL: All equipment, products, accessories that come in direct contact with the stored product ("gasoline", pure gasoline (no ethanol), gasoline with 9.5% oxinol, gasoline with 5% methanol and co solvent, gasoline with up to 15% ethanol, and gasoline with 20% MTBE) shall be compatible with the stored.

2.3 PIPING, FITTINGS AND SPECIALTIES:

A. All pipes, fittings, appurtenances, manways, accessories, and valves shall be provided by the Contractor after submittal to the Architect of shop drawings showing manufacturer and model number of each.

B. Piping and piping accessories (valves, couplings, fittings, etc.) exposed to pressure shall meet the requirements of 2012 NFPA Chapter 27.4, and ASME B31, "Code for Pressure Piping" (except as provided for in 2012 NFPA 30 27.4).

C. All-metal flex connectors shall be used in all dispenser containment sumps, and be as shown in the drawings with all-metal tubes (no Teflon), hose ends, galvanized malleable iron or stainless steel nipples/fittings at both ends affixed with crimped fittings, maximum overall length 24".

D. Aboveground vent piping shall be schedule 40 galvanized steel pipe (or painted black steel) with 150 lb. malleable iron screw fittings and couplings. Joints shall be connected using appropriate adhesive/sealant compatible with gasoline, alcohol-gasoline blended, and reformulated fuels. Vents shall be a minimum of 12 feet above finished grade or 24 inches above the building exterior wall. Vents shall be mounted (as shown on the drawings) to the building exterior wall or braced to stainless steel or galvanized steel pole which shall extend to 12 inches below the top of the vent.

E. Underground vent and vapor recovery piping shall be Underwriters Laboratory, Incorporated approved rigid fiberglass-reinforced plastic (FRP) pipe with molded fittings and adapters. Manufacturer for vent and vapor recovery piping is NOV Fiber Glass Systems (formerly A.O. Smith or Ameron) - AO Smith "Red Thread II" or equivalent by Ameron.

F. Thread sealant certified for petroleum service should be used for all steel threaded fittings. Sealants certified for methanol and other fuels (for example, ethanol and MTBE blends) should be used when these substances are to be placed in the UST system. Projects being built where there are containment requirements for fill risers shall comply with that requirement.

G. **Underground fuel tank hydrostatic sensor riser shall be schedule 40 PVC or fiberglass (steel shall NOT to be used).**

H. Provide buried warning tape or line markers for all underground piping to allow for verification of the piping location in the future.

I. Fill piping and vapor recovery risers shall be schedule 40 galvanized steel piping. As a minimum, couplings and fittings should be 150-pound malleable iron. A thread sealant certified for petroleum service should be used for all fittings. Sealants certified for methanol and other fuels (for example, ethanol and MTBE blends) should be used when these substances are to be placed in the UST system. Projects being built where there are containment requirements for fill risers shall comply with that requirement.

J. Contractor shall provide fiberglass (FRP) tank sumps as shown/noted, and manway covers as shown on the drawings and identified in the Bill of Materials. Each manway cover will be API color-coded with matching skirt, stabilizer kit and locking mechanism. Lifting tools will be supplied for each manway by contractor. An ID plate shall be provided for each fill port. The ID plates will specify the tank capacity, and product type. The manway cover assembly shall be as shown on the drawings.

K. Contractor shall provide and install single-product, single-hose type, dispenser.

2.4 DOUBLE-WALL PRODUCT PIPING AND SECONDARY CONTAINMENT SYSTEM:

A. All underground product piping shall be NOV Fiber Glass Systems www.fgspipe.com (formerly AO Smith and/or Ameron) Red Thread 2 inch fiberglass primary pipe with Thread pipe fittings, or equivalent Ameron Dualoy. Ameron “LCX” piping is an acceptable alternate to the conventional “size over size” fiberglass pipe, however the proper and matching sump entry fittings must be provided.

B. All underground non-metallic petroleum product and containment piping shall be UL971 rated.

C. All underground containment piping shall be NOV Fiber Glass Systems www.fgspipe.com (formerly AO Smith and Ameron) Red Thread fiberglass containment pipe with AO Smith Red Thread pipe fittings, in three inch (3”) or four inch (4”) sizes as shown on the drawings, or equivalent Ameron Dualoy. The piping installation shall strictly follow the recommended installation practices described by the manufacturer. The secondary containment pipe shall contain product leaked from the product pipe and drain to a tank piping sump or dispenser sump for leak detection and recovery of the released product.

D. **UST sump/underground sump entry fittings for flat sided sumps single-walled sump** fuel piping entry fittings for conventional “size-over-size” piping shall be by Bravo Systems Angle Adjustable F-Series Entry Fittings (Model Series F-32-TS-T-ADJ-MP [3” over 2”] or F-43 –xxxx for 4” over 3”), by NOV Fiber Glass Systems as shown on the drawings. If LCX piping is installed, Bravo F-22-LS-T-MP fittings shall be used. The only acceptable alternative entry fitting is the Bravo F-32U-T.

E. **UST sump/underground sump entry fittings for curved surface single-walled sump** (single-walled sumps are not allowed in California) fuel piping entry fittings shall be by Bravo Systems F-Series Entry Fittings model F-32-TS-T-MP-RND-D [3” over 2”]. The only acceptable alternative entry fitting for product/vent/vapor recovery piping entry fitting is the Bravo F-32U-T

F. Underground sump electrical conduit entry fittings shall be Bravo model F-17-RR-D-RND (3/4" Rob Roy electrical conduit. Substitute "10" for "17" for 1" conduit), F-17-SS-RND (3/4" galvanized electrical conduit. Substitute "10" for "17" for 1" conduit) or equivalent for larger diameter piping/conduit.

G. **Installing contractor must be trained and certified in the installation of Bravo Systems fittings, or NOV Fiber Glass fittings. Secondary containment pipe pass-through fittings are not acceptable and will not be approved for use. Non-fiberglass (rubber/flexible) sump entry fittings are not acceptable and will not be approved for use. RUBBER BOOTS OR REDUCER FITTINGS ARE NOT PERMITTED THROUGH OR INSIDE ANY UST SUMP, DISPENSER SUMP, OR TRANSITION SUMP.**

H. Termination of product lines shall be within containment sumps with proper sealing of the ends to prevent water, liquid and debris from entering the sumps.

I. All containment sumps shall be capable of passing a hydrostatic water test conducted to ensure that the sumps are liquid tight.

2.5 DETECTABLE WARNING TAPE (Underground Fuel Piping):

A. Shall be Seton, 3" wide detectable warning tape (part # 85509) with the wording "Caution Buried Fuel Line Below"

B. Warning tape shall be buried no more than 12" below grade, directly above buried fuel piping.

2.6 FUEL DISPENSING/DISPENSER SYSTEM:

A. The dispenser shall be a single-product, double-hose type, dispensers to the contractor for installation. The contractor is responsible for receiving, verifying, storing, uncrating and protecting the equipment. Contractor shall coordinate the delivery and installation dates with Architect in advance to meet the construction schedule.

B. The dispenser will be Gas Boy model as shown on the drawings. All hoses, nozzles, swivels and safety breakaways shall be provided by the Contractor.

C. Dispenser hose shall be a maximum of 18 feet in length. dispenser hose shall be provided with breakaway device designed to retain liquid on both sides of a breakaway point. Nozzle valve to be automatic-closing-type with or without a latch-open device. The nozzle valve shall not be capable of being opened unless the delivery hose is pressurized. Hose nozzle hall be designed so that the nozzle is retained in the fill pipe during the filling operation. The system shall include a feature that requires the closing of the hose nozzle valve before product flow can be resumed or before the hose nozzle valve can be replaced in its normal position in the dispenser.

D. A dispenser service representative under shall review and assist the contractor during installation and will perform initial start-up of each dispenser. Actual installation of the dispenser is not the responsibility of this service representative. The general contractor is responsible for providing knowledgeable dispenser installers as well as coordinating the assistance of the service representative.

2.7 SUBMERSIBLE CONSTANT SPEED SUBMERGED TURBINE FUEL PUMP:

A. Pumps shall have an explosion-proof motor that is electrically compatible with the local power service and shall carry UL listing. Pumps shall have standard 4" NPT tank fitting. Upper assembly shall contain all functional elements, check valve, air eliminator, expansion relief valve, siphon nozzle and venturi, siphon check valve and pressure test screw. The entire assembly shall be removable. The pump shall have a thermal over current overload protector with automatic reset. Capacitors and electric disconnect shall be accessible. Lower assembly shall consist of permanent split-phase capacitor motor, 25% glass-filled "Celcon" impeller and diffuser. Impeller shall be hydraulically balanced providing a positive and evenly distributed drive. The pump shall be designed or equipped so that no part of the system shall be subjected to pressure above its allowable working pressure. Pumps shall be designed for Class 1, Group D atmosphere. Pump shall be cooled and lubricated by discharging the pumped fluid into the storage tank regardless of dispensed quantity. An isolation valve (ball valve) shall be installed in an assembly connecting the pump to the product line to facilitate isolation of the product line during tightness testing. Manufacturer of Pumps: Red Jacket. No other substitute pumps shall be allowed.

2.8 UNDERGROUND FUEL STORAGE TANKS - DOUBLE-WALL FRP:

A. Requirements:

1. Tanks shall be capable of storing gasoline, or gasohol (up to 20% methanol or ethanol) fuel at ambient underground temperatures.

2. All tanks shall be equipped with a fiberglass hydrostatic interstitial reservoir.

3. All tanks shall show hold down strap locations.

4. All tanks shall be supplied with manufacture’s designed concrete deadmen anchoring system or slab system.

5. Tanks shall be designed to provide hydrostatic monitoring capability. Tanks shall have one 4" NPT fitting located as per drawings for accessibility to the tank bottom between the primary and secondary walls. This fitting shall have counter-sunk pipe plug provided by manufacturer.

6. Provide glass fiber-reinforced plastic anchor straps for each tank. Location and quantities of straps shall be as specified by manufacturer. Straps shall be standard as supplied by the tank manufacturer.

7. Underwriter's Laboratory label shall be permanently affixed to each individual underground storage tank.

8. Provide lifting lugs on all tanks. Lugs shall be capable of withstanding weight of tank with a safety factor of 3-to-1.

9. Tank bottom deflector gauge plates shall be provided under all primary tank fittings to prevent tank damage.

10. Tank shall be equipped with a sump containment collar for each piping sump.

11. Reservoir sensor shall be as specified in paragraph 2.07 of this specification.

12. Hydrostatic monitoring system shall have third party certification that it meets EPA and NFPA 329 criteria as a precision tank test. The test procedure shall be documented.

B. Manufacturer of Tanks:

1. Containment Solutions

2. Xerxes International

2.9 TANK INVENTORY CONTROL AND RELEASE DETECTION SYSTEM

A. Provide Veeder-Root TLS-450Plus (860091-301) with integral printer and full VGA LCD display, application software (33545-001), Feature Enhancement software - CSLD (332972-006) and Digital Pressure Line Leak Detection software (332972-008). The Veeder-Root system consists of tank inventory control, release detection system (for tank, piping, and all sumps), control console, integral printer, tank probes, hydrostatic interstitial tank monitoring probes, sump sensors, fittings, etc., for a complete and operating system.

B. Tank monitor and inventory control system shall have the following features:

1. Console – 8247 Microprocessor-based, 66MHZ system clock, 128MB RAM on Central Processing Unit. Standard model console provided with RS232 and RS422 communication interface ports with external communication capability for automatic inventory control. CarMax will connect to the ethernet port - a contractor (other than the fuel system contractor will provide the cable and conduit from the CarMax server to the new V-R ATG. The console shall be wall mounted using external mounting tabs, at a height of not more than 5 feet from the floor.

2. Inventory/Leak Detection Probe: Veeder-Root Series 846390-109-MAG Plus magnetostrictive probe.

3. Tank Sump and Dispenser Sump Sensor: Veeder-Root 794380-208.

4. Digital Pressure Line Leak Detector: Complete assemblies for detecting leaks in product piping. Veeder-Root Series DPLLD 859080-001 for TRJ Red Jacket Pumps connected to controller in the building.

5. Hydrostatic Reservoir Sensor for Underground Tanks (dual-point): Veeder-Root Series 794380-303 to be incorporated into the integral tank reservoir (underground tank systems with hydrostatic reservoirs).

6. Tank Interstitial Sensor for Aboveground Tanks; 794390-420 or 794380-344.

7. Overfill Alarm and Acknowledgement Switch: Veeder-Root Series 790091-001 for the alarm and Series 790095-001 for the acknowledgement switch.

8. Modules:

a. A SiteFax/Modem Interface Module will NOT be required. CarMax will connect to the ATG console via the Ethernet port.

b. One CSLD Software Enhancement Module #332972-006 (Underground tank systems only, CSLD is not required on aboveground tank systems).

c. One Sixteen-Input Universal Probe/Sensor Interface Module #332812-001.

d. One Universal Input/Output Interface Module #332813-001.

e. One Risk Management Software Enhancement for DPLLD #332972-008.

f. One USB/Ethernet Dual Interface Module #332913-001.

g. One 'L2 Three Year Extended Storage Module #332971-003.

9. Console Features:

a. Printer: The console shall be equipped with an integral, thermal printer for hard-copy documentation of reports. Reports shall be printed in rows/columns format.

b. Display: The console shall be equipped with 7.4 inch full VGA LCD touch screen display for on-site viewing of information, programming, operating and reporting functions.

c. Remote Access/Control: Direct Access TM.

2.10 DISPENSER, TANK PIPING SUMPS:

A. Underground tank piping sumps shall be manufactured by Petroleum Containment Inc (www.petroleum-containment.com). Dispenser and transition sumps shall be by Petroleum Containment Inc, Bravo Systems, or approved equal by the tank manufacturer (approval to use tank manufacturer sumps must be in writing by the engineer). Tank piping sump lids shall be the water-tight type.

B. The contractor shall furnish and install pump and piping sump/enclosure as shown on the drawings. Depending upon the burial depth of the tanks, the contractor shall furnish and install the appropriate sump with the required extension/height as required so the top of the sump lid is no more than 6" below the underside of the surface manhole. The sump and lid shall be a "watertight" type. The contractor shall provide all tank sump accessories as shown on the documents.

C. The sumps and accessories shall be chemically compatible with products to be stored (gasoline, gasoline with 9.5% oxinol, gasoline with 5% methanol and cosolvent, gasoline with 10% ethanol, and gasoline with 20% MTBE).

D. All joints, connections, covers, pipe and conduit entries (including angular entries) shall be liquid-tight.

E. Sumps shall not be deformed by backfill pressure or backfilling operations.

F. The contractor shall furnish and install liquid-tight dispenser containment sumps under the product dispensers, to prevent any leaks or spills from escaping into the

environment. The dispenser sumps shall be made of fiberglass and shall be compatible with the product being dispensed and with the chemicals and conditions found naturally in the underground environment.

G. Dispenser sumps shall be specifically designed for installation with the dispenser provided. All required stabilizers for shear valves and pipe entry conduits shall be factory-furnished. All sumps shall be liquid-tight to ground and surface water.

H. Dispenser containment sumps shall be as compatible with the piping system selected.

2.11 UNDERGROUND TANK PIPING SUMP SURFACE MANHOLES:

A. Underground tank piping sumps surface manholes shall be (OPW http://www.opwglobal.com/) “Conquistador” Composite Cover Manholes, either Roto-Lock (model 44CD-RL10), or bolt-down (model 44CD-WT10) cover type, Bravo Systems (http://sbravo.com/) Titan Series 42” Composite (with water tight o-ring seal, or Emco Wheaton model A0716-044C (Cam -Lock with water resistant seal).

PART 3 - EXECUTION

3.1 INSTALLATION OF DOUBLE-WALL PIPING SYSTEM WITH SECONDARY CONTAINMENT:

A. The Contractor shall install the double-wall piping system in strict accordance with manufacturer's recommended installation practices and instructions. Particular attention will be paid to connection of fittings according to manufacturer’s specifications. If the piping manufacturer specifies the use of particular tools to avoid over-tightening of fittings and damage to O-rings, contractor shall obtain and use recommended tools. Hanging hardware for dispensers shall be tested for continuity by experienced and knowledgeable personnel in accordance with PEI/RP-400-02.

B. The primary and secondary underground piping shall be tested as described below.

1. All underground primary piping (product, vent, vapor recovery) shall successfully pass a air pressure test of 50 pounds per square inch (50 psi) for a minimum of three hours. After the three hour test, the pressure may be reduced to forty pounds per square inch (40psi). During the pressurizing period all fittings shall be observed for leaks by applying a soapy water solution to all exposed primary pipe.

2. The contractor shall follow the manufacturer’s recommendation that after the primary piping has passed a 50 psig pressure test, the product line pressure should be reduced and maintained at a pressure of no less than 40 psig until all paving has been completed, with pressure gauge assemblies in place on each line for daily observation and verification that the pipe is holding pressure.

3. All underground secondary piping (product, vent, vapor recovery secondary) shall successfully pass an air pressure test of five pounds per square inch (5 psig) after bleed back pressure stabilization, which shall be established by

bringing the line pressure to a point between five and ten pounds per square inch (5-10 psi) for a minimum of three hours. During the pressurizing period all fittings shall be observed for leaks by applying a soapy water solution.

4. The contractor shall follow the manufacturer's recommendation that after the secondary piping has passed a 10 psig pressure test, the product line pressure should be reduced and maintained at a pressure of no less than five psig (5 psig) until all paving has been completed, with pressure gauge assemblies in place on each line for daily observation and verification that the pipe is holding pressure.

5. Pressure gauge assemblies for testing shall be calibrated prior to use and be equipped with the proper pressure safety valve as recommended by piping manufacturer's testing procedures. Dual gage assemblies are highly recommended.

C. The contractor shall conduct at least two tests, one at the time of installation, and the other while other construction activities are underway. Pressure shall be maintained on all underground piping during construction, with verification that pressure is being maintained (holding) as the product dispensing system is being primed, calibrated and tested before pacing into service. The Contractor shall furnish written reports of the test results to the Architect. trenches must be large enough to accommodate the piping, together with sufficient spacing and backfill material to provide protection from damage that might be caused by settlement, abrasion, vibration, expansion, contraction, or foreign materials. Vapor-return piping will be separated from product piping by at least twice the largest nominal pipe diameter, with at least six inches of distance between the piping and the trench excavation walls. Trenching width shall be sufficient to maintain the clearance between the pipes and side walls as shown on the drawings and of a depth sufficient to provide the proper bed and cover, and pitch of the lines.

D. The minimum cover to finish grade over underground product lines in paved areas is 12 inches and 18 inches in non-paved areas. Pipe chase in the concrete or asphalt paving shall be constructed as detailed on the drawings and as located on the plot plan. The minimum spacing between adjacent pipes is twice the pipe diameter between pipes; however, piping runs shall not be layered. Piping crossover must be minimized, but where piping runs must cross, the manufacturer's crossover fittings shall be used. Piping will be installed in a manner that will facilitate testing, resist corrosion, and prevent damage and movement of system components.

3.2 INSTALLATION OF ALL-METAL FLEXIBLE CONNECTORS:

A. All-Metal flexible connectors (flex connectors) are to be installed as indicated on the drawings.

B. Flexible connectors shall be installed so that there is no radial stress or twist in the hose when joints are assembled. Follow manufacturer's installation instructions.

C. Flex connectors shall be UL-listed for such application and meet the requirements of NFPA 30A for being fire-safe. Teflon-lined flex connectors will not be permitted.

3.3 SLOPING OF VENT LINES AND VAPOR RETURN PIPING:

A. A minimum slope of 1/8" per foot (sloping downward toward the tank) is required for all underground vent and vapor return piping. No less than this minimum slope shall be used within requirements for cover over piping and depth of tanks. Only rigid FRP piping compatible with the fuel stored shall be permitted for vent and vapor return piping. Pipe cover requirements are detailed on the drawings. Piping shall be installed on pre-graded compacted bed material. No support or spacing material other than the bed and backfill will be left in contact with the piping. This method of installation should prevent the possibility of any sags or sumps which might cause a liquid trap in the lines and which will not be permitted.

3.4 INSTALLATION OF TANK FITTINGS, MANWAYS AND APPURTENANCES

A. Requirements for Tank Fittings, Manways, and Appurtenances:

1. Contractor shall be responsible to provide proper clearance between tank shell and submerged pumps or fill tubes. Contractor shall check the tank diameter at the pump and fill pipe opening and make necessary adjustments to maintain the specified minimum clearance of six inches from the bottom of the tank.

2. When installing spill containment basins at the fill points and Stage I vapor recovery adapters, contractor shall provide a minimum of 3" and a maximum of 6" clearance between the top of the cap and bottom of the manway cover. Proper clearance shall be provided between the top of the automatic tank gauge and its cover, and the interstitial monitoring probe and its cover.

3. Pump and fill manways and/or connecting piping shall be self-supporting and shall not contact the tank. No spacing materials shall be allowed on the top of the tank.

4. All manway covers and lids will be API color-coded according to the following: Regular unleaded covers will be white with a black cross, mid-grade unleaded covers will be blue with a white cross, and high-grade (premium) will be red with a white cross. Vapor Recovery covers will be orange. Observation well covers will be white with a black triangle. If applicable to the project, used oil covers will be marked with a purple square.

3.5 TRENCHING AND PIPE CHASES: Pipe trenches must be large enough to accommodate the piping, together with sufficient spacing and backfill material to provide protection from damage that might be caused by settlement, abrasion, vibration, expansion, contraction, or foreign materials. Vapor-return piping will be separated from product piping by at least twice the largest nominal pipe diameter, with at least six inches of distance between the piping and the trench excavation walls. Trenching width shall be sufficient to maintain the clearance between the pipes and side walls as shown on the drawings and of a depth sufficient to provide the proper bed and cover, and pitch of the lines. Note that the minimum cover to finish grade over product lines in paved areas is 12 inches and 18 inches in non-paved areas**.** Pipe chase in the concrete or asphalt paving shall be constructed as detailed on the drawings and as located on the plot plan. The minimum spacing between adjacent pipes is twice the pipe diameter between pipes; however, piping runs shall not be layered. Piping crossover must be minimized, but where piping runs must cross, the

manufacturer's crossover fittings shall be used. Piping will be installed in a manner that will facilitate testing, resist corrosion, and prevent damage and movement of system components.

3.6 BEDDING AND BACKFILL MATERIAL:

A. Backfill around fiberglass tanks and piping shall be pea gravel and shall strictly follow manufacturer instructions and recommendations: Standard bedding and backfill material shall be a naturally-rounded aggregate, clean and free flowing, with particle size not less than 1/8" or more than 1/2" in diameter. Prior to tank installation, Contractor shall furnish the pea gravel sieve analysis from the supplier to the Architect. Backfill around tanks and piping shall strictly follow manufacturer instructions and recommendations. Backfill material sieve analysis shall be furnished to the Architect by the contractor from the supplier.

B. Storage and Handling of Bed/Backfill Material on Site:

1. Contractor shall store these materials so as not to allow bed/backfill material to intermix with any excavated soil or other material on site. Contamination of self-compacting gravel could result in need for mechanical compaction, as the minimum/maximum particle sizes specified are critical for self-compaction.

2. In freezing conditions, material must be kept dry and free of ice.

3. Do not intermix gravel, stone or gravel crushing, or sand in the same excavation or connected excavations.

C. Poor Soil Conditions/Soils Stabilization and Filter Fabric:

1. Where soils of low bearing capacity are found such as plastic clays or where sand/sand-gravel may be of a free-flowing nature, a separation is necessary between the pea gravel backfill and the soil to prevent penetration or migration.

2. Contractor shall line the excavation completely with an inert filter fabric, as per manufacturer's recommendations.

3. Approved manufacturers are:

a. DuPont "Typar" Style 3401 - 4 oz./Sq. Yd.

b. Monsanto "Bidim" C-22 - 4 oz./Sq. Yd.

c. Phillips "Supac" Fabric - 4.1 oz./Sq. Yd.

d. Celanese "Mirafi" 140 Fabric - 4.1 oz./Sq. Yd.

4. Material shall be cut to an appropriate width for the depth and width of the excavation so that there is sufficient material to overlay the top edges of the excavation during installation. Laps of material along the excavation should be a minimum of 2 feet.

D. Bedding of Product Lines: A minimum of six inches deep compacted bed, graded to give the proper slope of depth of pipe runs, shall be laid in the trench before pipe

runs are installed. Pipe runs shall be fabricated at grade and installed and properly spaced on the completed bed. After making necessary connections of runs, branches or fittings which shall be made up in the trench, bed material should be placed back under the piping and properly compacted.

3.7 BACKFILLING OF PIPING: After satisfactory completion of required testing and observation of piping, backfilling of trenches to subgrade elevation shall be completed. A minimum of six inches of backfill shall be bedded under the piping and minimum of 18 inches of combined cover (including surface paving and backfill material) over the piping is required. Ensure that marking tape or wire (for future location of piping) has been placed in the backfill at this time.

3.8 INSTALLATION OF PUMPS (STP's) AND CONTROLLERS:

A. Pumps shall be installed in accordance with manufacturer's instructions. Installer shall be familiar with such practices and procedures and shall strictly follow the same during installation.

B. Contractor shall measure the diameter of each tank at each 4" NPT tank fitting.

C. Contractor shall verify length of submersible pump. In any case, there shall be minimum 6" clearance between the tank and the bottom of the pump.

D. Pump shall be installed in 4" tank opening with approved non-setting thread sealant. Sealant shall be compatible/suitable for use with product being stored in the tank.

E. 4" riser pipe shall be tightened and pump shall be lined up with discharge outlet and fuel lines.

F. Electrical connections shall be made with approved fittings to junction box. Install ground wire using standard color codes.

G. Submersible pumps shall not be wired to run continuously.

H. Submersible pumps shall never be used to pump water from the tank.

3.9 INSTALLATION OF UNDERGROUND TANKS:

A. Tanks shall be installed in accordance with the manufacturer's instructions. Only pea gravel not less than 1/8" or more than 1/2" shall be used. Proper burial depth shall be determined by a float-out calculation and shall allow for sloping the piping from the dispensers back to the tanks (minimum depth is 36 inches and maximum depth is 7 feet). Anchoring and tank spacing shall be as shown on the drawings. If there is any conflict between the procedure provided in the specification and manufacturer's instructions, contractor shall contact Architect prior to proceeding with work. The owner nor the Architect or Engineer assumes any responsibility or liability for the consequences of any testing practice.

B. During construction and prior to final acceptance, all installed tanks shall be ballasted as required per manufacturer's recommendations. Upon acceptance by the Architect or his representative, the contractor shall empty the tanks for product fill, disposing of the ballast material in an environmentally safe manner.

3.10 The Contractor is required to include a copy of the tank manufacturers Installation Checklist with the project close-out documentation. INSTALLATION OF FUEL DISPENSING EQUIPMENT: Dispensers will be mounted on islands that are protected from damage from vehicle collisions by posts, bollards or concrete bumpers as denoted on the plans. Installation shall be in strict compliance with manufacturer's written instructions. If unusual conditions or circumstances exist which could damage or impair the system and the special protective measures required are not covered in these instructions, their installation shall be coordinated directly with the manufacturer. Actual installation of equipment and related components shall be under direct supervision at all times to assure compliance with specified requirements. Shear valves or breakaway devices will be installed on each product line and on each vapor return line and carefully tested for functioning. Actuation must be free and unobstructed. Shear valves for the product line must be double-poppet type. Dispenser sumps shall be placed such that the sump edge sets ½ inch above the finished surface of the dispenser island. Dispensers will be securely bolted to their mounting surface according to the manufacturer's instructions to ensure proper functioning of the shear valves

3.11 INSTALLATION OF INVENTORY/LEAK DETECTION SYSTEM:

A. Installation of Veeder-Root tank inventory control and release detection system shall be in strict accordance with manufacturer's recommendations. The Contractor shall retain the services of the nearest authorized Veeder-Root distributor/installer. Name of the nearest distributor can be obtained by contacting Veeder-Root. This distributor shall be responsible for receiving and storing equipment, helping contractor to locate the conduits as shown on the drawings and installing the entire system excluding conduits and power wiring. At the completion of the installation, the contractor and installer shall test and shall certify the entire system. This distributor shall provide warranty for his work excluding hardware failure.

B. Programming shall be in accordance with local operational conditions and applicable regulations. The program shall include, but not limited to, tank and line tightness monitoring, tank level monitoring, interstitial monitoring, tank overfill alarms, tank low level alarms, and tank/dispenser sump monitoring. The contractor shall print a complete Veeder-Root program report and leave with the manager. Programming and operations of the Veeder-Root system shall be documented by a certified Veeder-Root technician. A TLS-450/350 system/console data backup is also recommended at the initial startup and on a regular schedule if a USB communication port is provided on the console.

C. The Veeder-Root (V-R) technician responsible for programming the console shall follow the "System Setup and Configuration Requirements for CarMax Locations" document, see the supplement at the end of this specification section.

D. CarMax will connect to the ethernet port - a contractor (other than the fuel system contractor will provide the cable and conduit from the CarMax server to the new V-R ATG.

E. The contractor shall download a calibration chart from the UST manufacturer (for the actual tank installed) and use that information to program/calibrate the V-R console. If a pre-programmed chart for the specific UST installed is not available or cannot be downloaded, a minimum of six (6) points shall be entered into the product level-capacity programming.

F. The Contractor shall complete the “Veeder Root Post System Checklist” and provide the reports/printouts described therein. See the supplement at the end of this specification section.

G. The Contractor shall complete the “Monitoring System Equipment Test Checklist – Installer Certification” (available from the Engineer), and present to the Engineer/Architect at the final construction review meeting (and include with the project documentation).

H. All circuits shall be run in rigid conduit. Conduit shall be sealed off and jointed in explosion proof boxes. Conductor runs between all inventory and leak detection equipment, and the Veeder-Root system shall be made with continuous conductors (no splices). Inventory and leak detection circuits shall be in separate conduits for dispenser and pump power runs.

3.12 INSTALLATION OF OVERFILL ALARM AND ACKNOWLEDGMENT SWITCH: The mounting location for the overfill alarm and acknowledgment switch shall be in the immediate vicinity of the storage tank delivery points and shall be clearly visible to and easily accessible to the fuel delivery driver. Alarm shall activate at 90% of the tank’s actual storage capacity.

3.13 EMERGENCY SHUT-OFF SWITCH:

A. Install the master emergency shut-off switch in the location shown on the drawings. Add additional emergency shut-off switches outside at a well-lighted location that is not less than 20 feet from the nearest dispenser nor more than 100 feet from the farthest dispenser. The switch shall be visible from all dispenser locations; if this requires more than one switch, the appropriate number of duplicate switches will be provided and installed. Each switch will be identified by an all-weather sign with letters at least 1 inch high with text as shown in the drawings. Lettering shall be reflective and will be in contrasting color to sign background, and the sign will be mounted at least 5 feet above ground level. The switch shall be installed in such a manner this it is clearly visible from the dispensers and meets ADA requirements.

B. The emergency shut-off switch shall terminate electric power to all dispensers, pumps, and dispenser control devices. Power for the illumination of all dispensing areas will not be affected by the activation of the switch. The switch shall be of such a design or installed in such a way that it cannot be reset by customers. Unless a fire alarm box or automatically self-dialing telephone is located adjacent to the emergency shut-off, activation of the emergency shut-off switch shall transmit an alarm to the fire station or 24-hour security desk or other emergency agency. Contractor shall coordinate with facility officials regarding the final location of the alarm transmittal.

3.14 PURCHASE OF GASOLINE: The Owner will purchase gasoline for the facility (coordinated by the Owner's Agent). The General Contractor shall communicate the need to purchase gasoline for testing purposes or when the system is ready to be filled with the Owner Agent. To allow for a timely delivery of the fuel (gasoline), the General Contractor shall notify the CarMax Owner Agent at least 14 days prior to the date that fuel is needed.

3.15 SYSTEM CHECKING:

A. In addition to normal construction observation, three formal system checks shall be conducted. The Contractor shall inform the Architect/Engineer one week in advance of the day and time of each test. Each test shall be performed in the presence of the Architect/Engineer. The Contractor is cautioned that all components of the system being tested shall be installed, prepared for testing, exposed and in proper operating condition for each test. All costs associated with retesting or additional visits by the Architect/Engineer or other third-party technicians shall be at the expense of the Contractor.

B. The manufacturer's recommendations for installation, in addition to the codes and standards listed in paragraph 1.02, A of this specification shall be referenced to determine proper installation and procedures for each system check. Documentation of each test (including copies of field notes) shall be provided to Architect and the Architect/Engineer. The Architect/Engineer assumes no responsibility or liability for the consequences of any testing practice.

C. The Contractor shall provide laborers and technicians to assist the Architect and the Architect/Engineer in the system operation and testing. All testing procedures shall be conducted by the Contactor for observation by the Architect and the Architect/Engineer. The following system checks shall be conducted:

1. Tank Installation. Observed for proper installation and use of materials in conformance with plans and specifications. Pressure and soap testing of each tank. Tank bedding and deadman placement shall be observed. Bedding material shall be observed for conformance to specifications. Excavation size and maximum burial depth confirmed. Placement of the tanks observed. Backfill of tank excavation observed.

2. Product/Vent Lines and Sumps. Observed for proper installation and use of materials in conformance with plans and specifications. Observation of proper line placement, bedding and slope. Pressure test of the complete piping system prior to backfilling of piping. Soap test all pipe runs including fittings and joints. Water test all dispenser and tank pump sumps.

3. Final System Check: Observed for proper installation and use of materials in conformance with plans and specifications. Observation of dispenser sumps and sensors. Observation of tank pump, fill, vent and hydrostatic systems, sumps and sensors. Observation of Veeder-Root system programming and detection of sensors floats.

D. At the end of each system check, all results shall be noted. The Contractor shall provide copies of the manufactures certifications indicating designation as a certified installer, authorized service contractor and technician shall be provided during final system check. Copies of the technician's certifications (i.e. Veeder-Root) provided shall be from the individuals responsible for installation of the appropriate system

component. Full documentation of test results, including the test procedure used (and a copy of the test procedure's third-party certification) shall be provided to the Architect/Engineer.

E. System checks listed above are not intended to be exhaustive checks or detailed inspections of the work. Therefore, the Architect/Engineer assumes no responsibility or liability for the completeness or proper installation of the work. The system checks listed above do not relieve the Contractor of responsibilities under this Contract or relieve him of any portion of the system warranty.

3.16 FINAL ITEMS:

A. All product piping (including dispensers) shall be bled completely of all trapped air as submerged pumps are tested. System shall be tested for tightness and proper operation of leak detectors and impact valves. At least 300 gallons (100 gallons of each product) of fuel shall be pumped through each nozzle of each dispenser to ensure that all trapped air is purged from the product lines.

B. After meter calibration of each dispenser, filters shall be removed and replaced.

C. Flow restriction devices must be installed if the system is determined to dispense fuel at more than 10 gallons per minute (GPM).

D. Projects constructed where rules require Stage I Vapor Recovery Systems to meet efficiency standards, shall be successfully tested by the contractor according to CARB Test Procedures. This project is in a Stage I area, so testing is required.

3.17 TESTING: During installation and upon completion of installation, the tank and underground piping system shall be tested, and the testing documented. Post installation tank tightness testing (pre–Grand Opening) shall be performed by Tanknology, arranged by the Owners Agent for the project and provided through the Owner's fuel system maintenance vendor, Mansfield Oil. This testing shall be conducted using EPA third-party and CARB certified methods as applicable. Where applicable, contractor shall perform and report the results of a full start-up compliance test of the Stage I and Stage II vapor recovery systems as noted below. At a minimum, tank and line tightness tests, pressure decay and dynamic backpressure (liquid blockage) tests of the vapor recovery system shall be performed by the and a written report documenting all the results shall be provided to the Owner's Agent. Following testing and certification, the system shall be shown to function under simulated actual use conditions, demonstrating the function and operation of the equipment. Hydrostatic testing of the piping sumps and fill/spill bucket assemblies shall be performed if required by the State of County. Pressure testing of the primary and secondary piping shall be performed. As a condition of acceptance, written certification shall be furnished to the Architect/Engineer in evidence of full compliance with the requirements specified herein.

3.18 TRAINING OF OWNERS PERSONNEL: Contractor shall provide total 4 hours of training of Owners employees on the operation and maintenance of all equipment and systems (including tank, dispensing, and ATG system). Training shall not be conducted during final testing and testing of the tank system, so that the quality of instruction is not compromised. A training attendance roster shall be completed for each training session held. The roster shall indicate the training subject, training date, length of the training

class, the name, phone number and signature of the instructor, the name of the company he represents, as well as the full name, office symbol and complete telephone number of each attendee. A copy of class rosters and accompanying photograph of the class attending each session and instructor will be placed in each copy of the O&M manual.

END OF SECTION 335000