TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 00 General Bidding Conditions
00 01 10 Table of Contents

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00 Summary
01 22 00 Unit Pricing Form
01 23 00 Alternates
01 25 00 Substitution Procedures
01 25 00.1 Contractor's Request for Substitution Form
01 26 00 Contract Modification Procedures
01 29 00 Payment Procedures
01 31 00 Project Management and Coordination
01 32 00 Construction Progress Documentation
01 32 33 Photographic Documentation
01 33 00 Submittal Procedures
Digital Data Letter of Agreement
01 40 00 Quality Requirements
01 42 00 References
01 50 00 Temporary Facilities and Controls
01 56 39 Tree and Plant Protection
01 60 00 Product Requirements
01 73 00 Execution
01 74 00 Construction Waste Management and Disposal
01 77 00 Closeout Procedures
01 78 23 Operations and Maintenance Data
01 78 39 Project Record Documents
01 79 00 Demonstration and Training

DIVISION 03 – CONCRETE

03 30 00 Cast-In-Place Concrete (Site)

DIVISION 04 – MASONRY

04 20 00 Unit Masonry
04 72 00 Cast Stone Masonry

DIVISION 05 – METALS

05 50 00 Metal Fabrications
05 73 00 Decorative Metal Railings

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

06 10 00 Rough Carpentry
06 10 63 Exterior Rough Carpentry
06 16 00 Sheathing
06 17 15 Engineered Structural Wood
06 40 30 Exterior Architectural Woodwork
06 40 23 Interior Architectural Woodwork

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 21 19 Foamed-In-Place Insulation
07 27 26 Fluid-Applied Membrane Air Barries
07 41 13.16 Standing Seam Metal Roof Panels
07 46 46 Fiber-Cement Siding
07 62 00 Sheet Metal Flashing and Trim
07 92 00 Joint Sealants

DIVISION 08 – OPENINGS

08 11 13 Hollow Metal Doors and Frames
08 14 16 Flush Wood Doors
08 36 13 Sectional Doors
08 41 13 Aluminum Framed Entrances and Storefronts
08 56 93 Transaction Windows
08 80 00 Glazing
08 91 19 Fixed Louvers

DIVISION 09 – FINISHES

09 29 00 Gypsum Board
09 51 13 Acoustical Panel Ceiling
09 65 13 Resilient Base and Accessories
09 65 19 Resilient Tile Flooring
09 67 23 Resinous Flooring
09 91 13 Exterior Painting
09 91 23 Interior Painting

DIVISION 10 – SPECIALTIES

10 21 13.17 Phenolic-Core Toilet Compartments
10 28 00 Toilet and Bath Accessories
10 51 33 Changing Room Benches
10 73 01 Metal Awnings
10 73 19 Manufactured Metal Canopies
10 75 00 Flagpoles

DIVISION 11 – Equipment

11 68 33 Athletic Field Equipment

DIVISION 12 – FURNISHINGS

12 36 31 Solid Surfacing Countertops

DIVISION 22 – PLUMBING

22 05 00 Common Work Results for Plumbing
22 05 23 General Duty Valves for Plumbing Piping
22 05 29 Hangers and Supports for Plumbing Piping and Equipment
22 05 53 Identification for Plumbing Piping and Equipment
22 07 00 Plumbing Insulation
22 11 16 Domestic Water Piping
22 13 16 Sanitary, Waste, and Vent Piping
22 13 19 Sanitary Waste Piping Specialties
22 33 00 Electric Domestic Water Heaters
22 40 00 Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

23 05 00 Common Work Results for HVAC
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing Adjusting and Balancing for HVAC
23 07 00 HVAC Insulation
23 23 00 Refrigerant Piping
23 31 13 Metal Ducts
23 33 00 Air Ducts Accessories
23 34 23 HVAC Power Ventilators
23 37 13 Diffusers, Registers, and Grilles
23 81 26 Split Systems Heat Pump Units
23 82 39 Unit Heaters

DIVISION 26 – ELECTRICAL

26 05 00 Basic Electrical Requirements
26 05 00 Common Work Results for Electrical
26 05 10 Electrical Submittals
26 05 11 Electrical Work Closeout
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 29 Hangers and Supports for Electrical Systems
26 05 33 Raceways and Boxes for Electrical Systems
26 05 43 Underground Ducts and Raceways for Electrical Systems
26 05 48 Vibration and Seismic Controls for Electrical Systems
26 05 53 Identification for Electrical Systems
26 09 23 Lighting Control Devices
26 10 00 Basic Materials
26 24 00 Switchboards and Panelboards
26 27 26 Wiring Devices

26 40 00 Distribution Equipment
26 56 00 Exterior Lighting

DIVISION 31 - EARTHWORK

31 10 00 Site Clearing
31 10 10 Soils – Structural
31 11 00 Aggregate
31 20 00 Earth Moving
31 22 00 Grading
31 22 19 Finish Grading
31 23 00 Excavating, Trenching and Backfilling for Pipelines
31 25 00 Erosion, Sedimentation & Pollution Control Measures

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 11 23 Graded Aggregate Base Course
32 12 16 Hot-Mixed Asphalt Paving
32 12 16.13 Asphalt Trail Paving
32 13 13 Concrete Paving
32 14 00 Unit Paving
32 18 13 Synthetic Grass Surfacing
32 18 23.53 Asphalt Pickleball Court Surface Color Coating Surface
32 31 13 Chain Link Fence and Gates
32 33 00 Site Furnishings
32 84 00 Landscape Irrigation
32 91 00 Amended in Place Soils
32 91 20 Organic Planting Soil
32 91 50 CU Structural Soil
32 92 00 Turf Grass and Sod
32 93 00 Plants and Landscape Accessories

DIVISION 33 - UTILITIES

33 41 00 Storm Drainage Utilities
33 42 00 Water Distribution Systems
33 43 00 Sanitary Sewer Systems

APPENDICES

Geotechnical Engineering Report

END OF SECTION

SECTION 01 10 00 – SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Owner-furnished/Owner-installed (OFOI)
5. Work restrictions.
6. Specifications and Drawing conventions.

1.02 PROJECT INFORMATION

A. Project Identification: Crossings Park, Phase 1 – Pickleball.

1. Project Location: 4 Haig Point Ct., Hilton Head Island, SC 29928.

B. Owner: Town of Hilton Head Island.

1. Owner's Representative: Neal Eike, Senior Project Manager, Town of Hilton Head Island, 1 Town Center Court, Hilton Head Island, SC 29928. (843) 715-8243.

C. Owner Consultant: Owner has retained the following design professional who has prepared designated portions of the Contract Documents:

1. MKSK - Landscape Architects: 462 Ludlow Alley, Columbus, Ohio 43215. Phone: (614) 621-2796.

a. Landscape Architect: Matt Kellogg; email mkellogg@mkskstudios.com.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project Work is defined by the Contract Documents and consists of the following:

1. Work includes but not limited to the following items: a 3,000 sq. ft. amenity structure for pickleball constructed of masonry wall with hardboard trim exterior finish. Program spaces include toilet and changing rooms, a club room, 2 small offices The site itself consists of 18 tournament sized pickleball courts, shade structures, a parking lot with asphalt drive aisles and vehicular porous paver parking stalls, concrete curbs and walks, pedestrian unit pavers, synthetic lawn, fencing and gates, new utilities including; water lines, sanitary sewer service, storm sewers, electrical power and site lighting and charging stations, fiber optics with site security cameras, irrigation and landscaping.

B. Type of Contract:

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

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

A. The Owner will furnish and install products indicated.

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

1. Vending machines.

1.05 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of the Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

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

1.06 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work in the existing building to normal business working hours from 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Coordinate with Owner.

2. Early Morning Hours: Coordinate with Owner.

3. Construction activities are prohibited on Sundays, Thanksgiving, Christmas Day and New Year's Day.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Obtain Architect's and Owner's written permission before proceeding with utility interruptions.

3. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Requires personnel to use identification tags at all times.

1.07 SUBSURFACE CONDITIONS

A. Underground Facilities: Underground facilities are shown or indicated on the drawings, information and data regarding the presence or location of underground facilities are not intended to be categorized, identified, or defined as Technical Data, which is identified as such below with respect to existing subsurface conditions at or adjacent to the site.

B. Reliance by Contractor on Technical Data: Contractor may rely upon the accuracy of the Technical Data expressly identified below with respect to such reports and drawings, but such reports and drawings are not Contract Documents.

C. Limitation of Other Data and Documents: Contractor may not rely upon any claim against Owner or Engineer, or any of the officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. The completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. Other data, interpretations, opinions, and information contained is such reports or shown or indicated in such drawings;

3. The content of other Site-related documents made available to Contractor such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
4. Any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

D. The following table lists the reports of explorations and test of subsurface conditions at the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical data*
Geotechnical Engineering Report For Crossings Park Improvements Helmsman Way and Arrow Road Hilton Head Island, SC; Report No. 01-08-25-5	January 8, 2025	Boring methods, level of subsurface water, boring logs, laboratory test methods and results, and boring locations.

Engineer accepts no responsibility for accuracy of the soil data or water level information. Soil information, included with these Documents, was not obtained for the purposed of designing excavations and trenches. Soil information was used by Engineer for design purposes only. Contractor shall assure itself by personal examination as to subsurface conditions and shall provide its own investigations and make its own assumptions to comply with OSHA and any other applicable laws and regulations regarding excavation and trenching requirements

1.08 SPECIFICATION AND DRAWING CONVENTIONS

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

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

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

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

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

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 22 00 - UNIT PRICING FORM

TEMPORARY PLACEHOLDER - DOCUMENT FORTH COMING.

END OF SECTION

SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.01 SUMMARY

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

B. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into the project. Include as part of each alternate, miscellanous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

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

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

1.02 DEFINITIONS

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

1.03 ACCEPTANCE OF ALTERNATES

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

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Multi-Use Path.
   1. Base Bid: Work shall consist of the purchase, delivery, equipment and labor required for the installaion of a multi-use path extension, associated clearing, grading, and planting for the pathway. This work includes the crosswalks and curb ramps.
   2. Deduct Alternate : Non-performance of the installation of the multi-use path extension, associated clearing, grading, plantings, crosswalks and the curb ramps.

B. Alternate No. 2: Maintenance Shed, fence, and curb extension.
   1. Base Bid: Work shall consist of the purchase, delivery, equipment and labor required for the installation of a maintenance shed, fence, and curb extension.
   2. Deduct Alternate: Non-performance of the purchase, delivery, equipment and labor required for the installation of a maintenance shed, fence, curb extension and additional plantings.

C. Alternate No. 3: Shade Sail.
   1. Base Bid: Work shall consist of the purcahse, delivery, equipment, and labor required for the installation of a Shade Sail including lighting and appurtenances.
   2. Deduct Alternate: Non-performace of the purcahse, delivery, equipment, and labor required for the installation of a Shade Sail and addition of light poles.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

DOCUMENT 012500.1 – CONTRACTOR'S REQUEST FOR SUBSTITUTION FORM

Project:	Crossings Park Phase One	Project No.:	5600-240499
To:	LS3P	Specification Section #:	
	321 West Congress Street, Suite 301		
	Savannah, GA 31401	Contractor:	
Attn.:	John Hughes	Requested by:	
Phone:	912.695.2111	Phone:	
Fax:		Fax:	
Email:	johnhughes@ls3p.com	Email:	

Reason for not providing specified item:

Savings to Owner for accepting substitution:

Specified Product/Fabrication Method
(List name/description; model no.; manufacturer):

Required Information for ***Specified*** Product:	Attached:
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

Proposed Product/Fabrication Method
(List trade name/description; model no.; manufacturer) :

Required Information for ***Proposed*** Product:	Attached:
Point by Point Comparative Product Data	☐ (Required)
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

List of Related Changes/Modifications:

Differences between proposed substitution
and specified product:

Proposed product/fabrication method
affects other parts of the Work ☐ No ☐ Yes: Explain _____

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product as utilized for this project, except as noted herein.
- Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.
- Same special warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source for replacement parts, as applicable, is available as that specified.
- Proposed substitution does not affect dimensions and functional clearances, except as noted herein.
- Proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
- Failure of proposed substitution to produce indicated results will not be considered grounds for additional payment or time.

For the Contractor:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Email: _____

For the Manufacturer:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Email: _____

END OF CONTRACTOR'S REQUEST FOR SUBSTITUTION FORM

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

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

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

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided in the Project Manual.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
g. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
h. Research reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.

k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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 of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order 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.

1.4 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.

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

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

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

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

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

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

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 EXTENSION OF TIME DUE TO WEATHER

A. General: This article establishes conditions and procedures for amending the Contract Time when excess adverse weather conditions have repeatedly caused cancellation of schedule critical activities, resulting in delay to the Project.

B. Definitions:

1. Adverse Weather: Job site environmental conditions in which precipitation, or soil conditions resulting from precipitation, or ambient temperature conditions during working hours preclude carrying out a Scheduled Critical Activity. The following conditions may be considered by the Architect in determining the extent of excess adverse weather conditions, depending upon the nature of the delayed project tasks:

    a. Precipitation greater than 0.1 inch of water equivalent per day.
    b. Days on which the average air temperature does not exceed 40 degrees F.
    c. Other weather conditions deemed hazardous by the Contractor.

2. Scheduled Critical Activity: Project tasks, the delay of which will directly result in a delay in the completion of the project.

3. Excess Adverse Weather: Adverse weather occurring in excess of the normal, cumulative number of calendar days of adverse weather as listed below:

Month	Normal	Month	Normal
January	7	July	7
February	6	August	7
March	7	September	5
April	6	October	4
May	6	November	5
June	6	December	6
		Total Annual	73

C. Claim for Extension of Time Due to Weather:

1. Contractor shall file claim for each month during which adverse weather occurs.
    a. Attach copies of Contractor's Daily Reports for each day of adverse weather, describing fully the weather conditions, schedule activities delayed, and reasons for the delay.
    b. Include photographs where applicable for documenting soil conditions.
    c. Attach copy of NCDC/NOAA Local Climatological Data report for given month, or other published U.S. or state monthly weather data acceptable to Architect.
2. Claim shall be filed for a calendar month by attaching the completed form to the Application for Payment submitted the following month.
3. Architect shall review and approve or take other action upon Contractor's Claim for Extension of Time. Adjustment of Contract Time shall be made by a single Change Order prepared at project closeout.
4. Claim shall include an updated construction schedule supporting impact to the project critical path.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

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

B. Related Requirements:
   1. Section 01 22 00 "Unit Prices" for administrative requirements governing the use of unit prices.
   2. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   3. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.02 DEFINITIONS

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

1.03 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Landscape Architect through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Landscape Architect.
      c. Landscape Architect's Project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.

g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
   1) Labor.
   2) Materials.
   3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site.
5. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.04 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Landscape Architect and Construction Manager and paid for by Owner.

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

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 or approved documents as form for Applications for Payment.
   1. Other Application for Payment forms proposed by the Contractor shall be acceptable to Landscape Architect and Owner. Submit forms for approval with initial submittal of schedule of values.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Landscape Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit PDF signed and notarized original copies of each Application for Payment to Landscape what are thArchitect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.

8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Landscape Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706.
   5. AIA Document G706A.
   6. AIA Document G707.
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final liquidated damages settlement statement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. RFIs.
   4. Digital project management procedures.
   5. Web-based Project management software package.
   6. Project meetings.

B. Related Requirements:
   1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.02 DEFINITIONS

A. BIM: Building Information Modeling.

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

1.03 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.

1.04 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.05 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to scale. Do not base coordination drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate required installation sequences.
e. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Landscape Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
2. Landscape Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
a. Landscape Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in ???Insert name and version of digital data software program and operating system???.
c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Landscape Architect.

1.06 REQUEST FOR INFORMATION (RFI)

A. General Procedure: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Landscape Architect will return without response those RFIs submitted to Landscape Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Landscape Architect and Construction Manager.
5. RFI number and subject, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.

11. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Landscape Architect's and Construction Manager's Action: Landscape Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Landscape Architect's response for each RFI. RFIs received by Landscape Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Landscape Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Landscape Architect's action may include a request for additional information, in which case Landscape Architect's time for response will date from time of receipt by Landscape Architect or Construction Manager of additional information.
   3. Landscape Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Landscape Architect and Construction Manager in writing within 3 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project software.
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Landscape Architect and Construction Manager.
   4. RFI number including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Landscape Architect's and Construction Manager's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
   9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

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

1.07 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Landscape Architect's Digital Data Files: Digital data files of Landscape Architect's CAD drawings will be provided by Landscape Architect for Contractor's use during construction.
   1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
   2. Landscape Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
   3. Digital Drawing Software Program: Contract Drawings are available in CAD.
   4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Landscape Architect.
      a. Subcontractors, and other parties granted access by Contractor to Landscape Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Landscape Architect.

B. Web-Based Project Software: Provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
   1. Web-based Project software site includes, at a minimum, the following features:
      a. Compilation of Project data, including Contractor, subcontractors, Landscape Architect, Landscape Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
      b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
      c. Document workflow planning, allowing customization of workflow between project entities.
      d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
      e. Track status of each Project communication in real time, and log time and date when responses are provided.
      f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
      g. Processing and tracking of payment applications.
      h. Processing and tracking of contract modifications.
      i. Creating and distributing meeting minutes.
      j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
      k. Management of construction progress photographs.
   2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Landscape Architect. Provide data in locked format to prevent further changes.
   3. Provide one of the following web-based Project software packages under their current published licensing agreements:
      a. Autodesk; Constructware.
      b. Corecon Technologies, Inc.
      c. Deltek, Inc.
      d. Meridian Systems; Prolog.
      e. Newforma, Inc.

f. Procore Technologies, Inc.
g. Viewpoint, Inc.; Viewpoint Team.

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

1.08 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Landscape Architect of scheduled meeting dates and times a minimum of seven working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Landscape Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Landscape Architect, but no later than 15 days after execution of the Agreement.
1. Agenda: Discuss items of significance that could affect progress, including the following:
a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Critical work sequencing and long lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Use of web-based Project software.
g. Procedures for processing field decisions and Change Orders.
h. Procedures for RFIs.
i. Procedures for testing and inspecting.
j. Procedures for processing Applications for Payment.
k. Distribution of the Contract Documents.
l. Submittal procedures.
m. Sustainable design requirements.
n. Preparation of Record Documents.
o. Use of the premises.
p. Work restrictions.
q. Working hours.
r. Responsibility for temporary facilities and controls.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.

v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

2. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Landscape Architect, Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility requirements.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Landscape Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Construction Manager, Landscape Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of Record Documents.
      b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
      c. Procedures for completing and archiving web-based Project software site data files.
      d. Submittal of written warranties.
      e. Requirements for completing sustainable design documentation.
      f. Requirements for preparing operations and maintenance data.
      g. Requirements for delivery of material samples, attic stock, and spare parts.
      h. Requirements for demonstration and training.
      i. Preparation of Contractor's punch list.
      j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
      k. Submittal procedures.
      l. Coordination of separate contracts.
      m. Owner's partial occupancy requirements.
      n. Installation of Owner's furniture, fixtures, and equipment.
      o. Responsibility for removing temporary facilities and controls.
   4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

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

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
    1) Interface requirements.
    2) Sequence of operations.
    3) Resolution of BIM component conflicts.
    4) Status of submittals.
    5) Status of sustainable design documentation.
    6) Deliveries.
    7) Off-site fabrication.
    8) Access.
    9) Site use.
    10) Temporary facilities and controls.
    11) Progress cleaning.
    12) Quality and work standards.
    13) Status of correction of deficient items.
    14) Field observations.
    15) Status of RFIs.
    16) Status of Proposal Requests.
    17) Pending changes.
    18) Status of Change Orders.
    19) Pending claims and disputes.
    20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Startup construction schedule.
   2. Contractor's Construction Schedule.
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Material location reports.
   6. Site condition reports.
   7. Unusual event reports.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

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

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

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

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time belongs to Owner.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.03 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.

2. PDF file.

B. Startup construction schedule.
   1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
   3. Total Float Report: List of activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

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

F. Daily Construction Reports: Submit at weekly intervals.

G. Material Location Reports: Submit at weekly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Unusual Event Reports: Submit at time of unusual event.

J. Qualification Data: For scheduling consultant.

1.04 QUALITY ASSURANCE

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

1.05 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.06 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Landscape Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
   4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   5. Commissioning Time: Include no fewer than 15 days for commissioning.
   6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Landscape Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
   7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Uninterruptible services.
      c. Use-of-premises restrictions.
      d. Provisions for future construction.
   3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
      a. Subcontract awards.
      b. Submittals.
      c. Purchases.
      d. Mockups.
      e. Fabrication.
      f. Sample testing.
      g. Deliveries.
      h. Installation.
      i. Tests and inspections.
      j. Adjusting.
      k. Curing.

l. Building flush-out.
m. Startup and placement into final use and operation.

4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities.
   a. Structural completion.
   b. Temporary enclosure and space conditioning.
   c. Permanent space enclosure.
   d. Completion of mechanical installation.
   e. Completion of electrical installation.
   f. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
   1. Temporary enclosure and space conditioning.

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
   1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and the Contract Time.

H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

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

J. Distribution: Distribute copies of approved schedule to Landscape Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.

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

1.07 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.08 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
   1. Base schedule on the startup construction schedule and additional information received since the start of Project.

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

1.09 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. Approximate count of personnel at Project site.
   3. Equipment at Project site.
   4. Material deliveries.
   5. High and low temperatures and general weather conditions, including presence of rain or snow.
   6. Testing and inspection.
   7. Accidents.
   8. Meetings and significant decisions.
   9. Unusual events.
   10. Stoppages, delays, shortages, and losses.
   11. Meter readings and similar recordings.
   12. Emergency procedures.
   13. Orders and requests of authorities having jurisdiction.
   14. Change Orders received and implemented.
   15. Construction Change Directives received and implemented.
   16. Services connected and disconnected.
   17. Equipment or system tests and startups.
   18. Partial completions and occupancies.
   19. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Material stored following previous report and remaining in storage.

C. Site Condition Reports (Field Report): Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
   1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Final completion construction photographs.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.
   2. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
   3. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.02 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs.
   1. Digital Images: Submit a complete set of digital image electronic files via email or on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.
   2. Identification: Provide the following information with each image description in file metadata tag:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Landscape Architect and Construction Manager.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.
   3. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Landscape Architect.

1.03 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1.04 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

1. Include scale references such as people or rulers.

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. Preconstruction Photographs: Before commencement of excavation, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Landscape Architect.
   1. Take photographs to show existing conditions adjacent to property before starting the Work.
   2. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
   3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take photographs monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as Project Record Documents. Landscape Architect will inform photographer of desired vantage points.

F. Additional Photographs: Landscape Architect or Construction Manager may request photographs in addition to periodic photographs specified.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIGITAL DATA LETTER OF AGREEMENT

An Agreement between LS3P ASSOCIATES LTD. (the "Architect") and ___ (the "Licensee," either Original or Third Party, as the case may be) for Licensing of Digital Data

Architect: LS3P ASSOCIATES LTD.
321 West Congress Street, Suite 301,
Savannah, Georgia 31401

Contact: John Hughes

Licensee:
Original __
3rd Party __

Project No.: 5600-240499
Project Name: Crossing Park Phase One
Location: Hilton Head Island, SC
Date: _____

The Architect will provide the following Digital Data, dated as of the particular transmission, to the Licensee **for information purposes only:**

Sheet XXX (.dwg format)
Sheet XXX (.dwg format)
Sheet XXX (.dwg format)
Sheet XXX (.dwg format)

Revit MODEL (Revit 20XX)

Digital Data was prepared using the following:

Software: Revit (.rvt) **Version:**

Digital Data to be delivered via the following media: Newforma Website posting

Licensee shall pay the Architect a service fee of $0.00 and other good and valuable consideration.

TERMS AND CONDITIONS

1. The Architect and its consultants make no representation as to the compatibility of the Digital Data with any hardware or software. The Licensee shall notify the Architect within five (5) business days of any problems associated with accessing and/or using the Digital Data.

2. The Licensee acknowledges and agrees that the Digital Data may change or degrade during the transmission process. The Licensee acknowledges and agrees that the Architect and its consultants may remove all indications of ownership from the Digital Data prior to transmission.

3. All Digital Data shall be considered the property of the Architect and/or its consultants and shall not be used for other Projects, for additions to this Project without the prior written permission of the Architect and/or its consultants. Digital Data shall not be re-transmitted by the Original Licensee to a Third-Party Licensee without prior execution of an agreement identical to this Agreement between the Architect, the Original Licensee, and

the Third-Party Licensee. Under no circumstances shall the transmission of the Digital Data be considered a sale of goods or a sale of copyrights.

4. **THE ARCHITECT AND THE ARCHITECT'S CONSULTANTS HEREBY EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES, BOTH EXPRESS AND IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AS WELL AS ANY WARRANTY OF ACCURACY, COMPLETENESS, AND/OR PERMANENCE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.** Addenda information and/or revisions made to the most current Digital Data after any date of transmission have not been incorporated into the transmitted Digital Data. In the event of a conflict between the Architect's printed instruments of service (2D Documents) whether sealed or unsealed) and the Digital Data (3D Model), the printed instruments of service shall govern. The Licensee acknowledges and agrees that the duty to determine the existence of any and all conflicts between the Digital Data and any other information upon which the Licensee relies rests solely upon the Licensee. The Digital Data shall not be considered Contract Documents or Construction Documents as defined by any General Conditions of Contract for Construction. The Digital Data is being provided for information only and on a strictly "AS IS" basis.

5. Licensee agree the extent of its reliance on any Digital Data shall be limited to the uses identified in this Agreement.

6. Licensee may use and rely upon the Digital Data only for programming, site analysis, design review, 3D coordination of structural, mechanical, plumbing, and electrical systems, and preconstruction activities.

7. The Level of Development (LOD) describes the minimum dimensional, spatial, quantitative, qualitative, and other data included in the Digital Data to support the uses and reliance included in this Agreement. The LOD of the Digital Data transmitted is LOD 200. LOD 200 is defined as model and model elements that are generically and graphically represented within the Digital Data with approximate quantity of major components, size, shape, location, and orientation.

8. If Licensee discovers or becomes aware of any discrepancies, inconsistencies, errors, or omissions in any Digital Data transmitted, they shall promptly report the discrepancy, inconsistency, error, or omission in writing to the Architect. Licensee shall not use any discrepancy, inconsistency, error, or omission in the Digital Data as the basis of a claim.

9. Any reliance on the Digital Data not in accordance with this Agreement shall be at the sole risk of the Licensee.

10. The use and/or provision of the Digital Data prepared by the Architect and/or its consultants shall not in any way reduce or obviate the Licensee's duty to check and coordinate dimensions, details, and quantities of materials as required to facilitate construction of the Project in a complete and quality manner consistent with the applicable standards of care. Confirmation of existing conditions is the sole responsibility of the Licensee.

11. The Licensee agrees to the extent permitted by applicable law, to indemnify, hold harmless, and release the Architect and/or its consultants, their officers, shareholders, employees, and sub-consultants from any and all injuries, claims, demands, expenses, suits, liabilities, losses, damages, costs, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses related to the Digital Data, including but not limited to, attorneys' fees, expert witness fees, and court costs arising out of or in any way related to or connected with any negligent act and/or omission in the generation, provision, and/or use of the Digital Data by the Licensee and/or any of its subcontractors, suppliers, and/or consultants and waive any and all rights to such claims and causes of action.

12. The Licensee waives damages against the Architect for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, and/or claim expenses arising out of or relating to this Agreement and/or generation, provision, and/or use of the Digital Data, including, but not limited to, consequential damages and reasonable attorneys' fees and defense costs.

13. The Architect's and/or the Architect's consultants' liability to the Licensee and/or any of its subcontractors, suppliers, and/or consultants for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses arising out of or relating to this Agreement and/or the Digital Data, including, but not limited to, reasonable attorneys' fees and defense costs, regardless of the nature of the claim or damage, shall not exceed, either individually or in the aggregate, the total amount of $1,000.00. Such causes include, but are not limited to, the Architect's and/or the Architect's consultants' negligence, errors, omissions, strict liability, breach of contract, and/or breach of warranty.

14. To the best of the Architect's knowledge, information and belief, there are no licensing or copyright fees due to others based on the transmission of the Digital Data, but to the extent that such unknown fees do exist, the Licensee agrees to pay the required fees and hold the Architect and/or its consultants harmless from any associated costs or penalties.

15. Upon execution of this Agreement, the Architect grants to the Licensee a non-exclusive, non-transferable (except as set forth herein), limited license to use the Digital Data solely and exclusively for informational purposes on the identified Project only, provided that the Licensee substantially performs its obligations under this Agreement.

16. Any purchase order number provided by the Licensee is for the Licensee's accounting purposes only. The Licensee acknowledges and agrees that purchase order terms and conditions are null, void, and inapplicable to this Agreement.

17. This Agreement constitutes the entire agreement between the parties relative to the Digital Data and shall be governed by the laws of the State of South Carolina without regard to principles of conflicts of law.

AUTHORIZED ACCEPTANCE

by Architect:
LS3P ASSOCIATES LTD.

_____
Signature

_____
Print Name and Title

_____
Date

by Original Licensee:

_____
Signature

_____
Print Name and Title

_____
Date

by Third Party Licensee:
_____

_____
Signature

_____
Print Name and Title

_____
Date

WE SO CONSENT:

by Owner:
_____

_____
Signature

_____
Print Name and Title

_____
Date

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Submittal schedule requirements.
   2. Administrative and procedural requirements for submittals.

B. Related Requirements:
   1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
   2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
   3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
   4. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
   5. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
   6. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   7. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   8. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Landscape Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

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

1.03 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Landscape Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Landscape Architect's and Construction Manager's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.04 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
    1. Project name.
    2. Date.
    3. Name of Landscape Architect.
    4. Name of Construction Manager.
    5. Name of Contractor.
    6. Names of subcontractor, manufacturer, and supplier.
    7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
    8. Category and type of submittal.
    9. Submittal purpose and description.
    10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
    11. Drawing number and detail references, as appropriate.
    12. Indication of full or partial submittal.
    13. Location(s) where product is to be installed, as appropriate.
    14. Other necessary identification.
    15. Remarks.
    16. Signature of transmitter.

B. Options: Identify options requiring selection by Landscape Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Landscape Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.05 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Email: Prepare submittals as PDF package and transmit to Landscape Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Landscape Architect.
      a. Landscape Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
   2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Landscape Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Landscape Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Landscape Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 10 days for review of each resubmittal.

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

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Landscape Architect's and Construction Manager's action stamp.

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

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Landscape Architect's and Construction Manager's action stamp.

1.06 SUBMITTAL REQUIREMENTS

A. 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 published data are unsuitable 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 catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams that show factory-installed wiring.
      b. Operational range diagrams.
      c. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. 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 unless submittal based on Landscape Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.

2. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
   1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
   2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
      a. Project name and submittal number.
      b. Generic description of Sample.
      c. Product name and name of manufacturer.
      d. Sample source.
      e. Number and title of applicable Specification Section.
      f. Specification paragraph number and generic name of each item.
   3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
   4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
      a. Number of Samples: Submit three sets of Samples. Landscape Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
         1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
         2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.

2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

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

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:
1. Certificates and Certifications Submittals: Submit a 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. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:
1. Compatibility Test Reports: Submit 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 substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit 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:
    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.07 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
    1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Landscape Architect.

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

1.08 CONTRACTOR'S REVIEW

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

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include 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.
    1. Landscape Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

C. 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, checked, and approved for compliance with the Contract Documents.

1.09 LANDSCAPE ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Landscape Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return.
   1. PDF Submittals: Landscape Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action.
      a. Insert description of each action indicated on Landscape Architect's (and Construction Manager's) stamp.
   2. Submittals by Web-Based Project Management Software: Landscape Architect and Construction Manager will indicate, on Project management software website, the appropriate action.
      a. Actions taken by indication on Project management software website have the following meanings:
         1) Insert description of each action indicated on Landscape Architect's (and Construction Manager's) stamp.

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

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

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

E. Landscape Architect and Construction Manager will return without review submittals received from sources other than Contractor.

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.

B. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2026.

1.02 SUMMARY

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

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and quality-control services required by Landscape Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

C. Related Requirements:
   1. Section 01 32 00 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

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

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

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

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

G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

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

1.04 DELEGATED-DESIGN SERVICES

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

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.05 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Landscape Architect for direction before proceeding.

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

1.06 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups.

1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
2. Indicate manufacturer and model number of individual components.
3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.07 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: 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.

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

F. Reports: Prepare and submit certified written reports and documents as specified.
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

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

1.08 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Landscape Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Landscape Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.09 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, telephone number, and email address of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
   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.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. 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.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, 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.

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 in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

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

I. 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.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

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

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

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Landscape Architect or Construction Manager.
3. Notify Landscape Architect and Construction Manager 7 days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Landscape Architect's and Construction Manager's approval of mockups before starting corresponding work, fabrication, or construction.
a. Allow seven days for initial review and each re-review of each mockup.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed unless otherwise indicated.

1.11 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

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

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

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

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

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Associated Contractor Services: Cooperate with agencies and representatives 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 inspection. 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 inspection 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 inspection.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Landscape Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Landscape Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Landscape Architect's and Construction Manager's reference during normal working hours.
   1. Submit log at Project closeout as part of Project Record Documents.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

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

1.1 DEFINITIONS

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

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

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

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

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

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

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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

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

1.2 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.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

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

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

1.3 ABBREVIATIONS AND ACRONYMS

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

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

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

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

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

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Signs and Construction Site Banners: Depending on type of signage required for Project, show fabrication and installation details., including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

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

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

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

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

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

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

1. Store combustible materials apart from building.

2.2 EQUIPMENT

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

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

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

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

3.2 INSTALLATION, GENERAL

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

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

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

3.3 TEMPORARY UTILITY INSTALLATION

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

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

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

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

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

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

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

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

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

1. Install electric power service overhead unless otherwise indicated.

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

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

A. Project Signs and Construction Site Banners: Coordinate and verify requirements of project signage and/or construction site banners with Architect. LS3P Marketing available to assist with layout and design of signage.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

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

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

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals,

so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

3.6 OPERATION, TERMINATION, AND REMOVAL

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

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

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

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

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

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 01 56 39 - TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. The scope of work includes all labor, materials, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with protection of existing trees and other plants as shown on the drawings and as specified herein.
   1. Provide tree and plant protection fencing.
   2. Provide protection of root zones and above ground tree and plants.
   3. Coordinate with the requirements of Section Planting Soil for modifications to the soil within the root zone of existing trees and plants.
   4. Remove tree protection fencing and other protection from around and under trees and plants.
   5. Clean up and disposal of all excess and surplus material.

1.02 CONTRACT DOCUMENTS

A. This section intends that the requirements apply to all sections of the project specification, so any subcontractor must comply with the restrictions on work within designated Tree and Plant Protection Areas.

1.03 REFERENCES

A. References: The following specifications and standards of the organizations and documents listed form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specifications conflict with this specification section, the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other, the more stringent requirement shall prevail.
   1. ANSI A300 (Part 5) – Standard Practices for Tree, Shrub, and other Woody Plant Maintenance, most current editions.
   2. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign Il, most current edition.

1.04 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Owner’s Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner’s Representative.

1.05 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

1.06 DEFINITION

A. All terms in this specification shall be as defined in the "Glossary of Arboricultural Terms" or as modified below.

B. Owner's Representative: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

C. Reasonable and reasonably: When used in this specification is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that plants are not free of defects, and that plant conditions change with time. This specification also recognizes that some decisions cannot be totally based on measured findings and that profession judgment is required. In cases of differing opinion, the Owner's Representative expert shall determine when conditions within the plant are judged as reasonable.

D. Shrub: Woody plants with mature height approximately less than 25 feet.

E. Tree and Plant Protection Area: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and defined by a circle centered on the trunk with each tree with a radius equal to the crown dripline unless otherwise indicated by the owner's representative.

F. Tree: Single and multi-stemmed plants, including palms with anticipated mature height approximately greater than 25 feet or any plant identified on the plans as a tree.

1.07 SUBMITTALS

A. Arborist Report: Prior to the start of construction, submit, for approval by the Owner's Representative, the report of a consulting arborist who is a registered Consulting Arborist® (RCA) with American Society of Consulting Arborists or an ISA Board Certified Master Arborist, which details the following information for all trees to remain within the area designated on the drawings as the Tree and Plant Protection Area. The report shall include the following:

1. The report shall note all trees or parts of trees, which are considered a hazard or significant or extreme risk level. Include the International Society of Arboriculture hazard evaluation sheet for each tree, which may reasonably be identified as a potential hazard tree.
2. Recommendations as to treatment of all insect, disease and structural problems encountered.
3. Recommendations for fertilizer treatments, if any.
4. A plan of the site showing the location of all trees included in the report.

B. Product Data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal four weeks before the start of any work at the site.

C. Qualifications Submittal: For each applicable person expected to work on the project, provide copies of the qualifications and experience of the Consulting arborist, proof of either the registered Consulting Arborist® (RCA) with American Society of Consulting Arborists or an ISA Board Certified Master Arborist and any required Herbicide/Pesticide license to the Owner's Representative, for review prior to the start of work.

1.08 OBSERVATION OF THE WORK

A. The Owner's Representative may inspect the work at any time.

1.09 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre - construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.
   1. The following Contractors shall attend the preconstruction conference:
      a. General Contractor.
      b. Arborist.
      c. Subcontractor assigned to install Tree and Plant Protection measures.
      d. Earthwork Contractor.
      e. All site utility Contractors that may be required to dig or trench into the soil.
      f. Building / Site Demolition Contractor.
      g. Landscape subcontractor.

B. Prior to this meeting, mark all trees and plants to remain and or be removed as described in this specification for review and approval by the Owner's Representative.

1.10 QUALITY ASSURANCE

A. Contractor qualifications:
   1. All pruning, branch tie back, tree removal, root pruning, and fertilizing required by this section shall be performed by or under the direct supervision of ISA Certified Arborist. Submit aforementioned individual's qualifications for approval by the Owner's Representative.
   2. All applications of pesticide or herbicide shall be performed by a person maintaining a current state license to apply chemical pesticides valid in the jurisdiction of the project. Submit copies of all required state licensing certificates including applicable chemical applicator licenses.

PART 2 - PRODUCTS

2.01 TREE PROTECTION FENCING

A. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 degF; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi.
   1. Height: 48 inches.
   2. Color: High-visibility orange, nonfading.
   3. Post: 6 ft. T-shape galvanized-steel post driven into the ground of sufficient depth to hold the fabric solidly in place without sagging.
      a. Spacing: As indicated on the drawings.
      b. Wire Ties: Galv. or Stainless Steel, min. 16-18 gauge wire, 3 per post.

B. Gate: For each fence type and in each separate fenced area, provide a minimum of one 3 foot wide gate. Gates shall be lockable. The location of the gates shall be approved by the Owner's Representative.

C. Submit suppliers product data that product meets the requirements for approval.

2.02 TREE PROTECTION SIGN

A. Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering: "TREE PROTECTION ZONE: DO NOT ENTER".
   1. Pursuant with Town of Hilton Head LMO Sec. 16-6-104.J.3.b.
   2. Spacing: No more than 150 feetapart.

2.03 MATTING (ONLY WHEN APPLICABLE)

A. Shredded hardwood mulch as shown on the drawings

2.04 GEOGRID (ONLY WHEN APPLICABLE)

A. Geogrid shall be woven polyester fabric with PVC coating, Uni-axial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, acids.
   1. Geogrid shall be Miragrid 2XT as manufactured by Ten Cate Nicolon, Norcross, GA. http://www.tencate.com or approved equal.

B. Submit suppliers product data that product meets the requirements for approval.

2.05 FILTER FABRIC (ONLY WHEN APPLICABLE)

A. Filter Fabric shall be nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids.
   1. Mirafi 135 N as manufactured by Ten Cate Nicolon, Norcross, GA. http://www.tencate.com or approved equal.

B. Submit suppliers product data that product meets the requirements for approval.

PART 3 - EXECUTION

3.01 SITE EXAMINATION

A. Examine the site, tree, plant and soil conditions. Notify the Owner's Representative in writing of any conditions that may impact the successful Tree and Plant Protections that is the intent of this section.

3.02 COORDINATION WITH PROJECT WORK

A. Coordinate with all other work that may impact the completion of the work.

B. Coordinate the relocation of any irrigation lines currently present on the irrigation plan, heads or the conduits of other utility lines or structures that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.03 TREE AND PLANT PROTECTION AREA

A. The Tree and Plant Protection Area is defined as all areas indicated on the tree protection plan. Where no limit of the Tree and Plant Protection area is defined on the drawings, the limit shall be the drip line (outer edge of the branch crown) of each tree.

3.04 PREPARATION

A. Prior to the preconstruction meeting, layout the limits of the Tree and Plant Protection Area and then alignments of required Tree and Plant Protection Fencing and root pruning. Obtain the Owner's Representative's approval of the limits of the protection area and the alignment of all fencing and root pruning.

B. Flag all trees and shrubs to be transplanted / relocated by wrapping pink plastic ribbon around the trunk or major limbs to each shrub. Obtain Owner's Representative's approval of all trees and shrubs to be relocated prior to excavating and removing plants. See Section 32 96 00 (if pesent) – Transplanting for further information.

C. Flag all trees and shrubs to be removed by wrapping orange plastic ribbon around the trunk and obtain the Owner's Representative's approval of all trees and shrubs to be removed prior to the start of tree and shrub removal. After approval, mark all trees and shrubs to be removed with orange paint in a band completely around the base of the tree or shrub 4.5 feet above the ground.

D. Flag all trees and shrubs to remain with white plastic ribbon tied completely around the trunk or each tree and on a prominent branch for each shrub. Obtain the Owner's Representative's approval of all trees and shrubs to be remain prior to the start of tree and shrub removal.

E. Prior to any construction activity at the site including utility work, grading, storage of materials, or installation of temporary construction facilities, install all tree protection fencing, Filter Fabric, silt fence, tree protection signs, Geogrid, Mulch and or Wood Chips as shown on the drawings.

3.05 INSTALLATION OF GEOGRID, FILTER FABRIC, MATTING, WOOD CHIPS AND/OR MULCH (ONLY WHEN APPLICABLE)

A. Install Geogrids, Filter Fabric, matting, Wood Chips and or Mulch in areas and depths shown on the plans and details or as directed by the Owner's representative. In general it is the intent of this specification to provide the following levels of protection:
   1. Areas where foot traffic or storage of lightweight materials is anticipated to be unavoidable provide a layer of Filter Fabric under the 4 inches of Wood Chips or Mulch.
   2. Areas where occasional light vehicle traffic is anticipated to be unavoidable provide a layer of Geogrids under 8 inches of Wood Chips or Mulch.
   3. Areas where heavy vehicle traffic is unavoidable provide a layer of Geogrids under 8 - 12 inches of Wood Chips or Mulch and a layer of matting over the Wood Chips or Mulch.

B. The Owner's Representative shall approve the appropriate level of protection.

C. In the above requirements, light vehicle is defined as a track skid steer with a ground pressure of 5 psi or lighter. A heavy vehicle is any vehicle with a tire or track pressure of greater than 5 psi. Lightweight materials are any packaged materials that can be physically moved by hand into the location. Bulk materials such as soil, or aggregate shall never be stored within the Tree and Plant Protection Area.

3.06 PROTECTION

A. Protect the Tree and Plant Protection Area at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves and roots of all plants; and contamination of the soil, bark or leaves with construction materials, debris, silt, fuels, oils, and any chemicals substance. Notify the Owner’s Representative of any spills, compaction or damage and take corrective action immediately using methods approved by the Owner’s Representative.

3.07 GENERAL REQUIREMENTS: LIMITS FOR OPERATIONS WITHIN PROTECTION AREAS

A. The Contractor shall not engage in any construction activity within the Tree and Plant Protection Area without the approval of the Owner's Representative including: operating, moving or storing equipment; storing supplies or materials; locating temporary facilities including trailers or portable toilets and shall not permit employees to traverse the area to access adjacent areas of the project or use the area for lunch or any other work breaks. Permitted activity, if any, within the Tree and Plant Protection Area maybe indicated on the drawings along with any required remedial activity as listed below.

B. In the event that construction activity is unavoidable within the Tree and Plant Protection Area, notify the Owner’s Representative and submit a detailed written plan of action for approval. The plan shall include: a statement detailing the reason for the activity including why other areas are not suited; a description of the proposed activity; the time period for the activity, and a list of remedial actions that will reduce the impact on the Tree and Plant Protection Area from the activity. Remedial actions shall include but shall not be limited to the following:
   1. In general, demolition and excavation within the drip line of trees and shrubs shall proceed with extreme care either by the use of hand tools, directional boring and or Air Knife excavation where indicated or with other low impact equipment that will not cause damage to the tree, roots or soil.

2. When encountered, exposed roots, 1 inches and larger in diameter shall be worked around in a manner that does not break the outer layer of the root surface (bark). These roots shall be covered in Wood Chips and shall be maintained above permanent wilt point at all times. Roots one inch and larger in diameter shall not be cut without the approval of the owners representative. Excavation shall be tunneled under these roots without cutting them. In the areas where roots are encountered, work shall be performed and scheduled to close excavations as quickly as possible over exposed roots.
3. Tree branches that interfere with the construction may be tied back or pruned to clear only to the point necessary to complete the work. Other branches shall only be removed when specifically indicated by the Owner's Representative. Tying back or trimming of all branches and the cutting of roots shall be in accordance with accepted arboricultural practices (ANSI A300, part 8) and be performed under supervision of the arborist.
4. Matting: Install temporary matting over the Wood Chips or Mulch to the extent indicated. Do not permit foot traffic, scaffolding or the storage of materials within the Tree and Plant Protection Area to occur off of the temporary matting.
5. Trunk Protection: Protect the trunk of each tree to remain by covering it with a ring of 8 foot long 2 inch x 6 - inch planks loosely banded onto the tree with 3 steel bands. Staple the bands to the planks as necessary to hold them securely in place. Trunk protection must by kept in place no longer than 12 months. If construction requires work near a particular tree to continue longer than 12 months, the steel bands shall be inspected every six months and loosened if they are found to have become tight.
6. Air Excavation Tool: If excavation for footings or utilities is required within the Tree and Plant Protection Area, air excavation tool techniques shall be used where practical or as designed on the drawings.
    a. Remove the Wood Chips from an area approximately 18 inches beyond the limits of the hole or trench to be excavated. Cover the Wood Chips for a distance of not less than 15 feet around the limit of the excavation area with Filter Fabric or plastic sheeting to protect the Wood Chips from silt. Mound the Wood Chips so that the plastic slopes towards the excavation.
    b. Using a sprinkler or soaker hose, apply water slowly to the area of the excavation for a period of at least 4 hours, approximately 12 hours prior to the work so that the ground water level is at or near field capacity at the beginning of the work. For excavations that go beyond the damp soil, rewet the soil as necessary to keep soil moisture near field capacity.
    c. Using an air excavation tool specifically designed and manufactured for the intended purpose, and at pressures recommended by the manufacturer of the equipment, fracture the existing soil to the shape and the depths required. Work at rates and using techniques that do not harm tree roots. Air pressure shall be a maximum of 90-100 psi.
        1) The air excavation tool shall be "Air-Spade" as manufactured by Concept Engineering Group, Inc., Verona, PA (412) 826-8800, or Air Knife as manufactured by Easy Use Air Tools, Inc. Allison Park, Pa (866) 328-5723 or approved equal.

d. Using a commercial, high-powered vacuum truck if required, remove the soil from the excavation produced by the Air Knife excavation. The vacuum truck should generally operate simultaneously with the hose operator, such that the soil produced is picked up from the excavation hole, and the exposed roots can be observed and not damaged by the ongoing operation. Do not drive the vacuum truck into the Tree and Plant Protection Area unless the area is protected from compaction as approved in advance by the Owner's Representative.
e. Remove all excavated soil and excavated Wood Chips, and contaminated soil at the end of the excavation.
f. Schedule the work so that foundations or utility work is completed immediately after the excavation. Do not let the roots dry out. Mist the roots several times during the day. If the excavated area must remain open over night, mist the roots and cover the excavation with black plastic.
g. Dispose of all soil in a manner that meets local laws and regulations.
h. Restore soil within the trench as soon as the work is completed. Utilize soil of similar texture to the removed soil and lightly compact with hand tools. Leave soil mounded over the trench to a height of approximately 10% of the trench depth to account for settlement.
i. Restore any Geogrids, Filter Fabric, Wood Chips or Mulch and or matting that was previously required for the area.

3.08 TREE REMOVAL

A. Remove all trees indicated by the drawings and specifications, as requiring removal, in a manner that will not damage adjacent trees or structures or compacts the soil.

B. Remove trees that are adjacent to trees or structures to remain, in sections, to limit the opportunity of damage to adjacent crowns, trunks, ground plane elements and structures.

C. Do not drop trees with a single cut unless the tree will fall in an area not included in the Tree and Plant Protection Area. No tree to be removed within 50 feet of the Tree and Plant Protection Area shall be pushed over or up-rooted using a piece of grading equipment.

D. Protect adjacent paving, soil, trees, shrubs, ground cover plantings and understory plants to remain from damage during all tree removal operations, and from construction operations. Protection shall include the root system, trunk, limbs, and crown from breakage or scarring, and the soil from compaction.

E. Remove stumps and immediate root plate from existing trees to be removed. Grind trunk bases and large buttress roots to a depth of at least 18 inches below the top most roots and over the area of three times the diameter of the trunk (DBH).
1. For trees where the stump will fall under new paved areas, grind roots to a total depth of 18 inches below the existing grade. If the sides of the stump hole still have greater than approximately 20% wood visible, continue grinding operation deeper and or wider until the resulting hole has less than 20% wood. Remove all wood chips produced by the grinding operation and back fill in 6 inch layers with controlled fill of a quality acceptable to the site engineer for fill material under structures, compacted to 95% of the maximum dry density standard proctor. The Owner's Representative shall approve each hole at the end of the grinding operation.

2. In areas where the tree location is to be a planting bed or lawn, remove all woodchips and backfill stump holes with planting soil as defined in Specification Section Planting Soil, in maximum of 12 inch layers and compact to 80 - 85% of the maximum dry density standard proctor.

3.09 GRADING WITHIN SOIL PRESERVATION AND TREE PROTECTION AREAS

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

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

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

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

3.10 PRUNING

A. Implement all pruning recommendations found in the arborist report.

B. Prune any low, hanging branches and vines from existing trees and shrubs that overhang walks, streets and drives, or parking areas as follows:
   1. Walks - within 8 feet vertically of the proposed walk elevation.
   2. Streets and drives - within 14 feet vertically of the proposed driving surface elevation.

C. All pruning shall be done in accordance with ANSI A300 (Part 1), ISA BMP Tree Pruning (latest edition, and the "Structural Pruning: A Guide for the Green Industry", Edward Gilman, Brian Kempf, Nelda Matheny and Jim Clark, 2013 Urban Tree Foundation, Visalia CA.

D. Perform other pruning task as indicated on the drawings or requested by the Owner's Representative.

E. Where tree specific disease vectors require, sterilize all pruning tools between the work in individual trees.

3.11 WEED REMOVAL

A. During the construction period, control any plants that seed in and around the fenced Tree and Plant Protection area at least three times a year.
   1. All plants that are not shown on the planting plan or on the Tree and Plant Protection Plan to remain shall be considered as weeds.

B. At the end of the construction period provide one final weeding of the Tree and Plant Protection Area.

3.12 INSECT AND DISEASE CONTROL

A. Monitor all plants to remain for disease and insect infestations during the entire construction period. Provide all disease and insect control required to keep the plants in a healthy state using the principles of Integrated Plant Management (IPM). All pesticides shall be applied by a certified pesticide applicator.

3.13 CLEAN-UP

A. During tree and plant protection work, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
   1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once tree protection work is complete, wash all soil from pavements and other structures. Ensure that Mulch is confined to planting beds.

C. Make all repairs to grades, ruts, and damage to the work or other work at the site.

D. Remove and dispose of all excess Mulch, Wood Chips, packaging, and other material brought to the site by the Contractor.

3.14 REMOVAL OF FENCING AND OTHER TREE / PLANT PROTECTION

A. At the end of the construction period or when requested by the Owner’s Representative remove all fencing, Wood Chips or Mulch, Geogrids and Filter Fabric, trunk protection and or any other Tree and Plant Protection material.

3.15 DAMAGE OR LOSS TO EXISTING PLANTS TO REMAIN

A. Any trees or plants designated to remain and which are damaged by the Contractor shall be replaced per the HHI LMO code by the Contractor at their own expense. Trees shall be replaced with a tree of similar species per HHI LMO code. Shrubs shall be replaced with a plant of similar species and equal size or the largest size plants reasonably available which ever is less. Where replacement plants are to be less than the size of the plant that is damaged, the Owner’s Representative shall approve the size and quality of the replacement plant.
   1. All trees and plants shall be installed per the requirements of Specification Section Planting.

B. Plants that are damaged shall be considered as requiring replacement or appraisal in the event that the damage affects more than 25% of the crown, 25% of the trunk circumference, or root protection area, or the tree is damaged in such a manner that the tree could develop into a potential hazard. Trees and shrubs to be replaced shall be removed by the Contractor at his own expense.
   1. The Owner's Representative may engage an independent arborist to assess any tree or plant that appears to have been damaged to determine their health or condition.

C. Any tree that is determined to be dead, damaged or potentially hazardous by the Owner's arborist and upon the request of the Owner's Representative shall be immediately removed by the Contractor at no additional expense to the owner. Tree removal shall include all clean up of all wood parts and grinding of the stump to a depth sufficient to plant the replacement tree or plant, removal of all chips from the stump site and filling the resulting hole with topsoil.

D. Any remedial work on damaged existing plants recommended by the consulting arborist shall be completed by the Contractor at no cost to the owner. Remedial work shall include but is not limited to: soil compaction remediation and vertical mulching, pruning and or cabling, insect and disease control including injections, compensatory watering, additional mulching, and could include application tree growth regulators (TGR).

E. Remedial work may extend up to two years following the completion of construction to allow for any requirements of multiple applications or the need to undertake applications at required seasons of the year.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project:
   1. Transportation and Handling of Product
   2. Storage and Protection
   3. Manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 01 23 00 "Alternates" for products selected under an alternate.
   2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
   3. Section 01 40 00 “Quality Requirements”
   4. Section 01 42 00 "References" for applicable industry standards for products specified.
   5. Section 01 73 00 “Execution Requirements.

1.02 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved by Landscape Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.03 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Landscape Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Landscape Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Landscape Architect's Approval of Submittal: As specified in Section 01 33 00 "Submittal Procedures."
      b. Use product specified if Landscape Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Landscape Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
      a. Name of product and manufacturer.
      b. Model and serial number.

c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification sections in Divisions 26 for additional identification requirements.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage products in accordance with manufacturer's instructions.
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

D. Exterior Storage
1. Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious 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 materials.
3. Store foam plastic away from exposure to sunlight, except to extent necessary for period of installation and concealment.

E. Arrange storage in a manner to provide access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage.

1.06 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Landscape Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
      a. Submit additional documentation required by Landscape Architect through Construction Manager in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Landscape Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
    a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
    a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: …"
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
    a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
    a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: …"
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require "match Landscape Architect's sample," provide a product that complies with requirements and matches Landscape Architect's sample. Landscape Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Landscape Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Landscape Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Landscape Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Landscape Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
   2. Evidence that proposed product provides specified warranty.
   3. List of similar installations for completed projects with project names and addresses and names and addresses of Landscape Architects and owners, if requested.
   4. Samples, if requested.

B. Submittal Requirements: Approval by the Landscape Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00 - EXECUTION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

1.02 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Examination
   4. Preparation
   5. Installation of the Work.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Prohibited Methods.

B. Related Requirements:
   1. Section 01 10 00 "Summary" for limits on use of Project site.
   2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
   3. Section 01 45 00 “Quality Control”.
   4. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.03 STANDARDS

A. Standards, codes and regulations published by Manufacturer's Associations, governmental agencies and other regulatory authorities form a part of these Specifications as minimum requirements. Such references include the latest issue and all amendments up to 30 days prior to the Bid Date.

B. "Governing Authority" means all federal, state and local laws and regulations.

C. Where differences occur between the Contract Documents and such standards, the most restrictive requirement shall apply.

D. Supply all materials and perform all work in accordance with the Manufacturer's Specifications and installation procedures, and in conformance with published trade and manufacturer's association standards, unless specifically noted otherwise herein.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

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

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

1.05 QUALITY ASSURANCE

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

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.
   1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Existing Conditions: 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, mechanical and electrical systems, 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; underground electrical services; and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. 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 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Landscape Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

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 Landscape Architect and Construction Manager promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Landscape Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. 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 rim and invert elevations.

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

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

3.04 FIELD ENGINEERING

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

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

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

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

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.

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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

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

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

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

I. Repair or remove and replace damaged, defective, or nonconforming Work.
   1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.06 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
   2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.
   3. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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 the entire work area, as appropriate.

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

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

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

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

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

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

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

3.07 STARTING AND ADJUSTING

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

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

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: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.08 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.

C. Correct damage by repairing or replacing as directed by the Landscape Architect. Repairing will be permitted only where the repair is undetectable and does not cause structural damage or interfere with proper functioning of the part.

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

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

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DISPOSAL OF WASTE

A. General: 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.

B. Related Requirements:
   1. Section 01 73 00 "Execution" for progress cleaning of Project site.
   2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
   3. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   4. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.03 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Landscape Architect. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Landscape Architect's signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Landscape Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Landscape 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 Landscape Architect, that must be completed or corrected before certificate will be issued.

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

1.06 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Landscape Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Landscape Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report.
   5. Submit final completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Landscape Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Landscape 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Landscape Architect and Construction Manager.
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. PDF electronic file. Landscape Architect, through Construction Manager, will return annotated file.
      b. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

1.08 SUBMITTAL OF PROJECT WARRANTIES

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

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

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

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit on digital media acceptable to Landscape Architect.

PART 2 PRODUCTS

2.01 MATERIALS

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

PART 3 EXECUTION

3.01 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Clean exposed exterior 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.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Remove labels that are not permanent.
h. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
i. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
3. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASHRAE Guideline 4 - Preparation of Operations and Maintenance Documentation for HVAC&R Systems; 2019.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Section 01 70 00 "Project Closeout Submittals" for submitting operation and maintenance manuals.
   3. Section 01 78 39 "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.

1.03 DEFINITIONS

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

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

1.04 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Landscape Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. Submit on digital media acceptable to Landscape Architect. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 15 days before commencing demonstration and training. Landscape Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Landscape Architect will return copy with comments.
   1. Correct or revise each manual to comply with Landscape Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Landscape Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.05 FORMAT OF OPERATION AND MAINTENANCE MANUALS

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

1.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

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

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   9. Cross-reference to related systems in other operation and maintenance manuals.

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

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

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

PART 2 PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
   1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
   3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

2.02 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

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

E. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.03 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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

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

2.04 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

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

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
      a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

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

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

END OF SECTION

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Requirements:
   1. Section 01 73 00 "Execution" for final property survey.
   2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
   3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit one paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of scanned record prints and one of file prints.
         3) Landscape Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit record digital data files and three set(s) of record digital data file plots.
         2) Plot each drawing file, whether or not changes and additional information were recorded.

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

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

A. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Landscape Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Annotated PDF electronic file.
   2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

3. Refer instances of uncertainty to Landscape Architect through Construction Manager for resolution.
4. Landscape Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
    a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Landscape Architect's digital data files.
    b. Landscape Architect will provide data file layer information. Record markups in separate layers.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Landscape Architect and Construction Manager.
    e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

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

2.03 RECORD PRODUCT DATA

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

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file.
1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Landscape Architect's and Construction Manager's reference during normal working hours.

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.5 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE (SITE)

PART 1 - GENERAL

1.01 SUMMARY

A. The section includes cast-in-place “structural” concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for:
   1. Site footings.
   2. Pedestrian site lights post bases
   3. Flag pole bases

1.02 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

C. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

H. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

J. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.

K. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2025.

L. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

M. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2026.

N. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2025.

O. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026.

P. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

Q. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2026.

R. AWSD 1.4 - STRUCTURAL WELDING CODE -REINFORCING STEEL (HISTORICAL); 2011.

1.03 DEFINITIONS

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

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site
   1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Concrete Subcontractor.

1.05 ACTION SUBMITTALS

A. Product Data: For each of the following.
   1. Portland cement.
   2. Fly ash.
   3. Slag cement.
   4. Aggregates.
   5. Admixtures:
      a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
   6. Curing materials.
   7. Expansion/Isolation joint filler strips.

B. Design Mixtures: For each concrete mixture, include the following:
   1. Mixture identification.
   2. Minimum 28-day compressive strength.
   3. Durability exposure class (ACI CODE-318).
   4. Maximum w/cm.
   5. Slump limit.
   6. Air content.
   7. Nominal maximum aggregate size.
   8. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:
   1. Installer: Include copies of applicable ACI certificates.
   2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.

2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Bonding agents.
6. Adhesives.
7. Joint-filler strips.
8. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:
a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, incorporating permeability-reducing admixtures.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

D. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

E. Mockups: Cast concrete slab-on-ground panels to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
1. Slab-On-Ground: Build panel approximately 15 feet by 15 feet Insert area in the location indicated or, if not indicated, as directed by Landscape Architect.
a. Divide panel into four equal panels to demonstrate saw joint cutting.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI SPEC-301 and as follows:
1. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.09 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI SPEC-301 and ACI PRC-306 and as follows.
   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI SPEC-301.
   3. Do not use frozen materials or materials containing ice or snow.
   4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
   5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI SPEC-301 and ACI PRC-305, and as follows:
   1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI SPEC-301 unless modified by requirements in the Contract Documents.

2.02 FORM-FACING MATERIALS

A. Form-Facing Panels for As-Cast Finishes: Steel, glass-fiber-reinforced plastic, or other approved non-absorptive panel materials that provide continuous, true, and smooth Architectural concrete surfaces. Furnish in the largest practicable sizes to minimize the number of joints.

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

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.

2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

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

2.05 CONCRETE MATERIALS

A. Source Limitations:
   1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
   2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
   3. Obtain aggregate from single source.
   4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M , Type I/II, gray.
   2. Fly Ash: 618ASTM C618 , Class C or F.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M .

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture:

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.06 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dayton Superior Corporation: Sure Film.
      b. Euclid Chemical Company (The): Eucobar.
      c. L&M Construction Chemicals, Inc.: E-con.
      d. Meadows, W. R., Inc.: Sealtight Evapre.

B. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
   b. Euclid Chemical Company (The); Kurez DR VOX.
   c. L&M Construction Chemicals, Inc.; L&M Cure R.
   d. Meadows, W. R., Inc.; Series 1100.

C. Water: Potable or complying with ASTM C1602/C1602M.

2.07 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

2.08 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI SPEC-301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Slag Cement: 50 percent by mass.
   3. Silica Fume: 10 percent by mass.
   4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
   1. Use water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete,.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
   5. Use permeability-reducing admixture in concrete mixtures where indicated.

2.09 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
   1. ACI CODE-318 Exposure Class F1
   2. Minimum Compressive Strength: 3500 psi or as indicated at 28 days.
   3. Maximum W/C Ratio: 0.55.
   4. Air Content:
      a. 5.0 percent, plus or minus 1.5 percent at point of delivery for 3/4 inch and 1 inch nominal maximum aggregate size.
   5. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

B. ClassC: Normal-weight concrete used for Heavy Duty Slabs.
   1. ACI CODE-318 Exposure Class F3
   2. Minimum Compressive Strength: 4000 psi or as indicated at 28 days.

3. Maximum W/C Ratio: 0.40.
4. Air Content:
   a. 6.0 percent, plus or minus 1.5 percent at point of delivery for 3/4 inch and 1 inch nominal maximum aggregate size.
5. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

C. Earth Fill Concrete (CDF – Controlled Density Fill)
1. Minimum Compressive Strength: 1500 psi, no test

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94 and ASTM C1116, and furnish batch ticket information.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.03 FORMWORK INSTALLATION

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

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

C. Limit concrete surface irregularities, designated by ACI PRC-347 as abrupt or gradual, as follows:
1. Class B, 1/4 inch for rough-formed finished surfaces.

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

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

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

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

H. Chamfer exterior corners and edges of permanently exposed concrete 3/4 inch 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.

3.04 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, CRSI (P1), placing, and supporting reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWSD 1.4, where indicated.

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

E. Install welded-wire reinforcement 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.

3.05 JOINTS

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

3.06 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. Concrete must be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

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

C. 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 Landscape Architect.

3.07 CONCRETE PLACEMENT

A. Before placing concrete and with Landscape Architect present, verify required inspections pertaining to the installation of formwork, form-release agent, reinforcement, and embedded items are complete and in compliance with installation requirements and tolerances and other conditions affecting performance.

B. Notify Landscape Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Landscape Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI SPEC-301 , but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated.
   1. Deposit concrete to avoid segregation.
   2. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   3. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI SPEC-301.
      a. Do not use vibrators to transport concrete inside forms.

b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.08 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
1. ACI SPEC-301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
b. Remove projections larger than 1 inch.
c. Tie holes do not require patching.
d. Surface Tolerance: ACI SPEC-117 ClassD.
e. Apply to concrete surfaces not exposed to public view Insert locations.

3.09 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Minimum Compressive Strength: 5000 psi at 28 days.
3. Install dowel rods to connect concrete base to adjacent concrete slab or structure. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
4. Prior to pouring concrete, place and secure anchorage devices.
a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
b. Cast anchor-bolt insert into bases.
c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI SPEC-301 and ACI PRC-306 for cold weather protection during curing.

2. Comply with ACI SPEC-301 and ACI PRC-305 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI PRC-308 as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
a. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

3.11 TOLERANCES

A. Conform to ACI SPEC-117.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s).

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

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

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

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

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
a. Limit cut depth to 3/4 inch.
b. Make edges of cuts perpendicular to concrete surface.
c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
d. Fill and compact with patching mortar before bonding agent has dried.
e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Landscape Architect.

D. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as slabs, for finish, and verify surface tolerances specified for each surface.
    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including 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.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
    a. Finish repaired areas to blend into adjacent concrete.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

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

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

3.14 FIELD QUALITY CONTROL

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

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
   1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
   2. Testing agency shall immediately report to Landscape Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
   3. Testing agency shall report results of tests and inspections, in writing, to Owner, Landscape Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
      a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M and ACI SPEC-301, including the following as applicable to each test and inspection:
         1) Project name.
         2) Name of testing agency.
         3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
         4) Name of concrete manufacturer.
         5) Date and time of inspection, sampling, and field testing.
         6) Date and time of concrete placement.
         7) Location in Work of concrete represented by samples.
         8) Date and time sample was obtained.
         9) Truck and batch ticket numbers.
         10) Design compressive strength at 28 days.
         11) Concrete mixture designation, proportions, and materials.
         12) Field test results.
         13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
         14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:
   1. Headed bolts and studs.
   2. Verification of use of required design mixture.
   3. Concrete placement, including conveying and depositing.
   4. Curing procedures and maintenance of curing temperature.
   5. Verification of concrete strength before removal of shores and forms from beams and slabs.
   6. Batch Plant Inspections: On a random basis, as determined by Landscape Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance withASTM C172/C172M shall be performed in accordance with the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

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

2. Slump: ASTM C143/C143M:
   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M-21:
   a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M-24 pressure method, for normal-weight concrete; ASTM C173 volumetric method, for structural lightweight concrete.
   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M-23.
   a. One test hourly when air temperature is 40 degrees Fahrenheit and below or 80 degrees Fahrenheit and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M-19 fresh unit weight of structural lightweight concrete.
   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M.
   a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
   b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
   a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. 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.
10. Strength of each concrete mixture 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 if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Landscape Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:

a. 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 Landscape Architect.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M-20 or by other methods as directed by Landscape Architect.
    1) Acceptance criteria for concrete strength shall be in accordance with ACI SPEC-301 section 1.6.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.15 PROTECTION

A. Protect concrete surfaces as follows:
    1. Protect from petroleum stains.
    2. Diaper hydraulic equipment used over concrete surfaces.
    3. Prohibit use of pipe-cutting machinery over concrete surfaces.
    4. Prohibit placement of steel items on concrete surfaces.
    5. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Clay face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Stone trim units in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.
4. Cavity wall insulation.

C. Related Requirements:

1. Section 072100 "Thermal Insulation" for cavity wall insulation.
2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

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

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

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. Exposed CMUs.

2. Clay face brick, in the form of straps of five or more bricks.
3. Colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep holes and cavity vents.
5. Cavity drainage material.
6. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For Installer and testing agency.Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C67.
d. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

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

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. 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 in accordance with TMS 602.

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

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who specializes in masonry construction and has completed similar projects in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1. Submit list including minimum of five similar projects, including Project name, description of project size and scope, and name and contact information for architect, for Installer, superintendent, and crew chiefs. Indicate total years for experience for each.

B. Testing Agency Qualifications: An independent agency acceptable to authorities having jurisdiction and qualified according to ASTM C1093 for testing indicated.

C. Limitations on Aggregates: For concrete masonry units containing recycled materials or post-industrial waste, provide units free of impurities that will cause rusting, staining, or popouts and with a record of successful in-service performance in conditions similar to those expected at Project site.

1. Ferrous material shall be removed by magnetic separation.
2. Aggregates shall contain no combustible materials or coal cinders.
3. Aggregates shall be graded and supplied in consistent gradations from batch to batch.
4. Materials shall be tested according to the following:

a. ASTM C40: Organic Impurities in Fine Aggregates for Concrete.
b. ASTM C136: Sieve Analysis of Fine and Course Aggregate.
c. ASTM C641: Iron Staining Materials in Lightweight Concrete Aggregates.
d. ASTM C151: Autoclave Expansion of Hydraulic Cement (for popouts).
e. ASTM C331: Lightweight Aggregates for Concrete Masonry Units.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

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

1.8 FIELD CONDITIONS

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

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

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

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

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

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

F. Cleaning Masonry Surfaces: Comply with manufacturer's requirements and environmental conditions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

a. For Concrete Masonry Units: f'm = 2000 psi.

2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.2 UNIT MASONRY, GENERAL

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

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.3 CONCRETE MASONRY UNITS

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

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent

manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Euclid Chemical Company (The); Eucon Blocktite.
2) GCP Applied Technologies; Dry-Block Block Admixture.
3) Master Builders Solutions; a Sika company; MasterPel 240.

C. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
2. Density Classification: Lightweight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216.

1. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design indicated or a comparable product by one of the following:

a. Old Carolina Brick Co. (Basis-of-Design).

1) Product: Savannah Grey.

2. Grade: SW.
3. Type: FBS.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
6. Size (Actual Dimensions): Modular; 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
7. Application: Use where brick is exposed unless otherwise indicated.
8. Color and Texture: As indicated and to match Architect's samples.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, 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.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

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

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

a. Amerimix; AMX 400 Series Portland Lime Mortar Mix
b. Amrize; OneCem Portland Limestone Cement
c. Cemex; Portland Limestone Cement (PLC).
d. SPEC MIX, Inc.; Portland Lime & Sand Masonry Mortar.
e. Quickrete; #1125-20.

D. Masonry Cement: Not permitted.

E. Mortar Cement: ASTM C1329/C1329M.

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

a. Sakrete; Mortar Mix
b. SPEC MIX, Inc.; Mortar Cement and Sand Mortar.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

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

a. SPEC MIX, Inc.; Colored Mortar (Basis-of-Design).

1) Color: Light Buff.

b. Amerimix; AMX 405 Colored Portland Cement and Lime Mortar
c. Amrize; Rainbow Mortamix
d. SPEC MIX, Inc.; Colored Mortar.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent of mortar cement by weight.

G. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. White-Mortar Aggregates: Natural white sand or crushed white stone.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Company (The); Accelguard 80.
b. GCP Applied Technologies; Morset.
c. Master Builders Solutions; a Sika company; MasterSet AC 534.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Euclid Chemical Company (The); Eucon Blocktite.
    b. GCP Applied Technologies; Dry-Block Block Admixture.
    c. Master Builders Solutions; a Sika company; MasterPel 240.

K. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

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

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus two side rods at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304.
3. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
5. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

C. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section. Provide gasketed anchor or separate self-adhering tape to seal penetrations in air barrier. Confirm tape is compatible with fluid-applied air barrier.

    a. Products: Subject to compliance with requirements, provide products by one of the following:

        1) 3GEN Masonry Products.
        2) Hohmann & Barnard, Inc.
        3) Heckman Building Products.
        4) Wire-Bond..

5. Contractor's Option: Provide one of the following types:

    a. Anchor Section: Sheet metal plate, 1-1/4- inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Fabricate sheet metal anchor section from 1.05 inch thick steel sheet, galvanized after fabrication. Provide self-healing strip under each clip.

        1) Basis-of-Design: Hohmann & Barnard, Inc.; X-Seal.

    b. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed washer head that covers hole in sheathing.

        1) Basis-of-Design: Heckmann Building Products.; Pos-I-Tie.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
4. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
5. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper core with polymer fabric laminated to copper face on both sides with non-asphaltic adhesive. Use only where flashing is fully concealed in masonry.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) 3GEN Masonry Products; GENFLASH Copper.
        2) STS Coatings; Wall Guardian Copper TWF.
        3) Wire-Bond; Copper Seal.

4) York Manufacturing, Inc.; Multi-Flash 500.

2. Laminated Stainless-Steel Fabric Flashing, Non-Asphaltic: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive. Provide with manufacturer recommended accessory items for a complete compatible system.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) 3GEN Masonry Products; GENFLASH SS.
      2) Hohmann and Barnard, Inc.; Mighty-Flash Stainless Steel Fabric Flashing.
      3) Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
      4) STS Coatings, Inc.; Wall Guardian Stainless TWF.
      5) York Manufacturing, Inc.; Multi-Flash SS

3. Self-Adhering Stainless-Steel Flashing: 2-mil, Type 304 stainless steel core with one uncoated stainless steel face with butyl block copolymer adhesive. Use where flashing is fully concealed in masonry.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) 3GEN Masonry Products; GENFLASH SS SA.
      2) TK Products, Inc.; TK Self-Adhering Stainless Steel TWF.
      3) Vapro Shield, Inc.; Vapro-SS Flashing.
      4) York Manufacturing, Inc.; York 304 SA.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

E. Accessories: Provide preformed inside and outside corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

G. Drip Edges: Stainless-steel, 0.016-inch thick.

H. Termination Bars for Flexible Flashing: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

B. Weep/Cavity 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, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) 3GEN Masonry Products; Cell Vent.
        2) Advanced Building Products Inc.; Mortar Maze.
        3) Heckmann Building Products, Inc.; No. 85 Cell Vent.
        4) Hohmann & Barnard, Inc.; Quadro-Vent.
        5) Wire-Bond; Cell Vent 3601.

C. 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 one of the following:

    a. 3GEN Masonry Products; Mortar Clear.
    b. Advanced Building Products Inc.; Mortar Break DT.
    c. Hohmann & Barnard, Inc.; Mortar Trap.
    d. Mortar Net Solutions; MortarNet.

2. Configuration: Provide one of the following:

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

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

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

    a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2.11 MORTAR AND GROUT MIXES

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

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime ormortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

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

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type S.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints.

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

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

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

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

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

D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

E. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

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

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

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

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

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

3.5 MORTAR BEDDING AND JOINTING

A. General: Prepare mortar in accordance with current Portland Cement Association publications.

B. Prepare fresh mortar at the rate it will be used, in order to maintain consistent color and workability. Do not use mortar that has stiffened because of hydration. Discard when not used within the time recommended by mortar manufacturer or PCA publications, whichever is shorter. Retemper mortar carefully to avoid color changes, no more than twice per batch.

C. Measure mortar materials using cubic foot measuring box or other approved container of known volume, of size appropriate for operation. Use a consistent ratio of water to mortar materials, within the range recommended by the mortar manufacturer's written instructions.

1. Measurement of sand by shovel shall not be permitted.

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

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

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

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide not less than 1 inch of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

A. Install steel lintels where indicated.

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

3.10 FLASHING, WEEP HOLES, AND CAVITY 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. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.

3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

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

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.11 FIELD QUALITY CONTROL

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

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

C. Flashing Inspections: Prior to concealment by closure of wall, coordinate and schedule inspection of through-wall flashing with Architect.

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, where indicated.

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

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

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning or pressurized water cleaning methods described in BIA Technical Notes 20.

3.13 MASONRY WASTE DISPOSAL

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

END OF SECTION 042000

SECTION 047200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trim units (column caps).
2. Mortar materials.
3. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

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.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Verification:

1. For each color and texture of cast stone required, 4 inches square in size.
2. For each trim shape required, 4 inches in length.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1. Masonry Installer: Submit list of minimum of five similar projects, including description of project size and scope, and name and contact information for architect, for Installer, superintendent, and crew chiefs. Indicate total years of experience for each.
2. For testing agency.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364 , including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous six months .

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category A.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated. Retain one of two paragraphs below if mockups are required. First paragraph is for supplying trim units for installation within a masonry wall. Second is for larger or standalone installations.

C. Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

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

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

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.

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

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C1364.

B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast stone textures and colors.

E. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C260/C260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C494/C494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C494/C494M, Type E.

F. Reinforcement:

1. Deformed steel bars complying with ASTM A615/A615M, Grade 40. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

a. Epoxy Coating: ASTM A775/A775M.
b. Galvanized Coating: ASTM A767/A767M.

G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 316.

2.3 CAST STONE UNITS

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

1. Bassco Cast Stone.
2. Advanced Architectural Stone.
3. Cast Stone Systems.
4. Continental Cast Stone, LLC.
5. Custom Cast Stone
6. Miller-Mize Precast, Inc.
7. Stone Legends.

B. Cast Stone Units: Comply with ASTM C1364.

1. Units shall be manufactured using the vibrant dry tamp method.
2. Trim units including items as indicated on Drawings.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.

4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than seven days at mean daily temperature of 50 deg F or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Colors and Textures: As selected by Architect from manufacturer's full range .

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, 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 C207, Type S.

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

D. Masonry Cement: Not permitted.

E. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, sand, and admixtures and complying with ASTM C1714/C1714M.

F. Aggregate for Mortar: ASTM C144.

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

G. Water: Potable.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M.

B. Dowels: 1/2-inch- diameter round bars, fabricated from steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.6 MORTAR MIXES

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

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

B. Comply with ASTM C270, Proportion Specification.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

C. Preblended dry mortar mix complying with ASTM C1714/C1714M and capable of producing mortar strength as indicated in ASTM C270.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.

6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

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

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

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

I. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."

1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

J. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2 inch maximum.

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

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 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.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. 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. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by methods described in Cast Stone Institute Technical Bulletin #39.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead doors and grilles.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 COORDINATION

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

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Shop primers.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Steel framing and supports for overhead doors.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Shelf angles.
4. Loose steel lintels.

1.4 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

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

D. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

G. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

H. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

I. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

C. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

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.

B. Galvanize bearing and leveling plates.

C. Prime plates with zinc-rich primer.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor shelf angles securely to existing construction with expansion anchors.

C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel and iron decorative railings.

1.2 COORDINATION AND SCHEDULING

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

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Stainless steel cable and cable fittings.
3. Fasteners.
4. Post-installed anchors.
5. Nonshrink, nonmetallic grout.
6. Anchoring cement.
7. Metal finishes.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters
2. Fittings, end caps, and brackets.
3. Welded connections.
4. Cable and cable hardware and connections.
5. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and guard infill. Sample need not be full height.

    a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

B. Welding certificates.

C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

D. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build in-place mockups as shown on Drawings and directed by Architect.
2. Build mockups for each form and finish of railing, consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON DECORATIVE RAILINGS

A. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design indicated or a comparable product by one of the following:

1. VIVA Railings, LLC (Basis-of-Design).
    a. Product: CIRCA Railing System.
2. Or approved equal.

B. Source Limitations: Obtain steel decorative railing components from single source from single manufacturer.

C. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

D. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

E. Plates, Shapes, and Bars: ASTM A36/A36M.

F. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

G. Stainless Steel Cable and Cable Fittings:

1. Cable: 1-by-19 wire cable made from wire complying with ASTM A492, Type 316, Insert color.
2. Cable Diameter: 3/16 inch.
3. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.

2.4 FASTENERS

A. Fastener Materials:

1. Hot-Dip Galvanized-Steel Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
2. Dissimilar Metal Railing Components: Type 316 stainless steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.

1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

F. Connections: Fabricate railings with welded or mechanical connections unless otherwise indicated.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

H. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.

1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

I. Form changes in direction as follows:

1. As detailed.
2. By bending.

J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

P. Stainless Steel Cable Guard Infill: Fabricate cable guard infill assemblies in the shop to field-measured dimensions with fittings machine swaged.

1. Minimize amount of turnbuckle take-up used for dimensional adjustment, so maximum amount is available for tensioning cable.
2. Tag cable assemblies and fittings to identify installation locations and orientations for coordinated installation.

Q. Toe Boards: Where indicated on Drawings, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

1. Dull Satin Finish: ASTN A480/A480M, No. 6.

2.9 STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Powder-Coat Finish: AAMA 2603 except when a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, attached to post with setscrews.

D. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends, using nonwelded connections.

C. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.6 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

SECTION 061000 - ROUGH CARPENTRY

1.1 SUMMARY

A. Section Includes:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.

C. Qualification Statements: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. 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 wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent unless otherwise indicated.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
3. After treatment, redry dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. 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. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.

2.3 FIRE-RETARDANT TREATMENT

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 E84, 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 beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. 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 D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
    a. Pressure process treatment is not required for Interior Type A lumber.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

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. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Mixed southern pine or southern pine; SPIB.
2. Spruce-pine-fir; NLGA.
3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
4. Northern species; NLGA.

5. Eastern softwoods; NeLMA.

C. Utility Shelving: Lumber with 15 percent maximum moisture content of any of the following species and grades:

1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Mixed southern pine or southern pine; No. 1 grade; SPIB.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. Concealed Boards: 15 percent maximum moisture content and [**any of**]the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
3. Eastern softwoods; No. 2 Common grade; NeLMA.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
2. For pressure-preservative-treated wood, use stainless steel fasteners.
3. For fire-retardant treated materials:

    a. Interior Applications: Fasteners shall be in accordance with manufacturer's recommendations. In the absence of manufacturer's recommendations, provide fasteners as required for exterior applications.
    b. Exterior Applications: Fasteners shall be hot-dipped zinc-coating galvanized steel, stainless steel, silicone bronze, or copper, in accordance with manufacturer's recommendations.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

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.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 06 10 63 - EXTERIOR ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Site Bridges.
   2. Dumpster Enclosure Doors.

B. Related Requirements:
   1. Section 03 30 00 “Cast In Place” Concrete for foundations

1.02 DEFINITIONS

A. Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.

1.03 ACTION SUBMITTALS

A. Product Data: For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates:
   1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   2. Wood sealer products.

B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

C. Evaluation Reports: For preservative-treated wood products, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Installer Qualifications
   1. Installer with no less than five years’ successful experience with installation of work of the type required by this project.
   2. The installer shall have suitably experienced personnel and management capability sufficient to execute the work shown on the drawings and specified herein.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
   1. Factory mark each item with grade stamp of grading agency.
   2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.
   3. 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 wood products.
   4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:
   1. Boards: 15 percent.
   2. Dimension Lumber: 15 percent.
   3. Timber. 19 percent.

2.02 LUMBER

A. Hand select wood for ____ freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

B. Dimension Lumber: Select Structural grade and any of the following species:
   1. Mixed southern pine; SPIB.

C. Boards: Any of the following species and grades:
   1. Southern pine, B & B finish; SPIB.
   2. Kebony Clear. 5/4x6" (#2226) non-eged grooved boards.

2.03 POSTS

A. Dimension Lumber Posts: No. 2 grade and any of the following species:
   1. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
   2. Mixed southern pine; SPIB.

B. Timber Posts: Southern pine; No. 1; SPIB.

2.04 PRESERVATIVE TREATMENT

A. Pressure treat boards and dimension lumber with waterborne preservative according to AWPA U1; Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

B. Preservative Chemicals: Acceptable to authorities having jurisdiction.

C. Application: Treat all wood unless otherwise indicated.

2.05 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
   1. Use stainless steel unless otherwise indicated.
   2. For pressure-preservative-treated wood, use stainless steel fasteners.

B. Nails: ASTM F1667.

C. Power-Driven Fasteners: ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Carbon-Steel Bolts: ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.

F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with ASTM F594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.

G. Postinstalled Anchors: Stainless steel, chemical anchors 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 according to ASTM E488, conducted by a qualified independent testing and inspecting agency.
   1. Stainless steel bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.06 SEALER

A. Manufacturer: SEAL-ONCE Marine Premium Wood Sealer by U-C Coatings. Proposed substitutions must meet or exceed the performance metrics defined below and receive approval from the Landscape Architect minimum 10 days prior to bidding.

B. Clear Exterior Penetrating Sealer: Water-based nano-particle poly-composite formulation designed to penetrate the wood substrate deeply rather than forming a surface-level film.
   1. Finish/sheen: Clear Satine.
   2. VOC Content: Ultra-low VOC, less than 25 g/l.
   3. Key attributes: Non-toxic, eco-safe, non-film forming, contains advanced UV inhibitors, and resists mold/mildew growth.
   4. Marice grade developed and used for harsh coastal environments.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerances and other condtions affecting performance of the work.

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

3.02 INSTALLATION

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Apply copper naphthenate field treatment to comply with AWPA M4, to cut surfaces of preservative-treated lumber.

D. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. ICC-ES AC70 for power-driven fasteners.
   2. "Fastening Schedule" in ICC's International Building Code.
   3. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.

3.03 USE POST INSTALLATION SEALER APPLICATION

A. Examination and Field Quality Contro
   1. IMoisture Testing: Do not apply finish until the pressure-treated lumber has properly cured. Verify that the wood moisture content is 15% or lower using a calibrated electronic pin-type moisture met.
   2. Absorption (Sprinkle) Test: Conduct a field splash test by sprinkling water onto the surface.
      a. If the water beads up, the wood is too wet or mill glaze is present; postpone application.
      b. If the water absorbs rapidly into the wood fibers, the substrate is ready to accept the sealer.

B. Surface Preparation
   1. Thoroughly clean all surfaces to remove dirt, gray wood fibers, mildew, and factory chemical residues. Use a specialized, biodegradable wood cleaner and brightener (e.g., oxalic or citric acid-based).
   2. Mechanical Prep: Allow the wood to dry for 24–48 hours after cleaning. Lightly sand any fuzzy or rough areas with 80-grit sandpaper to open up the wood pores. Vacuum or blow away all sawdust and debris.
   3. Protection: Mask and protect all adjacent non-wood surfaces, including concrete footings, siding, and landscaping, from overspray and drips.

C. Application Practice
   1. Environmental Constraints: Apply only when ambient and surface temperatures are between 50°F and 90°F (10°C to 32°C). Do not apply if rain or heavy dew is forecasted within 24 hours of application. Avoid application in direct, intense sunlight.
   2. Application Method: Apply using a high-quality synthetic bristle brush, a medium-nap roller, or a low-pressure pump sprayer.
   3. Technique (Wet-on-Wet)
      a. Apply the first coat evenly along the direction of the wood grain, ensuring complete saturation.

b. Back-brush the sealer into the pores to prevent pooling.
c. Apply a second coat wet-on-wet while the first coat is still damp (usually within 15–20 minutes).
d. Immediately wipe off any unabsorbed, pooling, or excess sealer using a dry brush or rag to prevent a glossy, uneven surface finish.

4. Cut Ends: Generously coat all field-cut ends, notches, and drilled holes during construction or assembly to maintain wood preservation.
5. Curing: Protect the treated surface from foot traffic and mechanical loads for a minimum of 24 to 48 hours until fully cured.

END OF SECTION

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof sheathing.
2. Underlayment.
3. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings: For glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer..

B. Product Certificates: From glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

C. Product Test Reports: For each glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of glass-mat gypsum sheathing.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of sheathing assembly.
    a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
    b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
    c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Testing Agency Qualifications:

1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying 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 Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, 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 beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:

1. Roof and wall sheathing within 48 inches of fire walls.
2. Roof sheathing.

2.5 ROOF SHEATHING

A. Plywood Sheathing:, Exterior, Structural I sheathing.

1. Nominal Thickness: Not less than 1/2 inch.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Fasteners for Fire-Retardant-Treated Wood:

a. For Interior Applications: Fasteners shall be in accordance with manufacturer's written recommendations. In the absence of manufacturer's written recommendations, provide as required for exterior applications.
b. For Exterior Applications: Fasteners shall be hot-dipped zinc coated galvanized steel, stainless steel, silicon bronze or copper in accordance with manufacturer's written recommendations.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Roof Sheathing:

a. Screw to cold-formed metal framing.
b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

SECTION 061715 - ENGINEERED STRUCTURAL WOOD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural composite lumber.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with engineered structural wood.
2. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on adhesives, fabrication, and protection.
2. For preservative-treated wood products, include manufacturer's written instructions for handling, storing, installing, and finishing treated material.
3. For connectors, include installation instructions.

B. Shop Drawings:

1. Submit wood floor and roof-framing layouts including dimension lumber, engineered wood products, and plated wood trusses. Include computer-generated design calculations for representative joist and beam types.
2. Identify location and magnitude of design loads on layouts and in member calculations.
3. Include alternate span loading design results in design calculations.
4. Identify metal connectors (joist, beam, post cap, anchors, etc.) by manufacturer and model number. Include a list of accessories required for installation at each connector (blocking, squash blocks, stiffeners, fasteners, etc.). Include allowable design loads for selected metal connectors in design calculation analysis.
5. Identify manufacturer's recommended installation details in layouts.
6. Provide documentation that allowable design stresses comply with allowable design properties of each product indicated.
7. Include large-scale details of connections.
8. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in ASTM D5055 or ASTM D5456, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, stack, and handle engineered wood products to comply with recommendations of APA EWS E705.

1. Store wrapped or banded together until ready for installation, on level well-drained area. Do not store in direct contact with the ground. Use stickers to separate bundles, spaced as recommended in writing by manufacturer.
2. Store I-joists level with the webs vertically.

B. Do not stack other material on top of structural composite lumber or I-joists.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 STRUCTURAL COMPOSITE LUMBER

A. Laminated-Veneer Lumber (LVL): Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Boise Cascade Wood Products, L.L.C.
   b. Louisiana-Pacific Corporation.
   c. RedBuilt.
2. Allowable Stresses:
   a. Extreme Fiber Stress in Bending, Edgewise (Fb): 2600 psi for 12-inch nominal-depth members.
   b. Modulus of Elasticity, Edgewise (E): 2,000,000 psi .

c. Minimum Modulus of Elasticity (Em): 1,500,000 psi .
d. Horizontal Shear (Fv): 285 psi .
e. Tension Parallel to Grain (Ft): 1895 psi .
f. Allowable Compression Stress, Parallel to the Grain (Fc): 2510 psi .

B. Parallel-Strand Lumber (PSL): Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Weyerhaeuser Company.
2. Allowable Stresses:
   a. Extreme Fiber Stress in Bending, Edgewise (Fb): 2400 psi for 12-inch nominal-depth members.
   b. Modulus of Elasticity, Edgewise (E): 1,800,000 psi .
   c. Minimum Modulus of Elasticity (Em): 915,000 psi .
   d. Horizontal Shear (Fv): 190 psi .
   e. Tension Parallel to Grain (Ft): 1995 psi .
   f. Allowable Compression Stress, Parallel to the Grain (Fc): 2500 psi .

2.3 PRESERVATIVE TREATMENT

A. Description: Preservative treatment; AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations must not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

2.4 FASTENERS

A. General: Fasteners are to be of size and type indicated and to comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Carbon Steel Bolts: ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.

F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with ASTM F594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.

G. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that joist flange widths match hanger widths.

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

3.2 PREPARATION

A. Do not install in direct contact with concrete or masonry.

B. Where wood-preservative-treated members are installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use treatment approved in writing by manufacturer.

3.3 INSTALLATION OF STRUCTURAL COMPOSITE LUMBER

A. Install to comply with ESR report, manufacturer's written instructions, and applicable code.

1. Install in dry, covered conditions where average in-service moisture content of lumber is 16 percent or less.
2. Install metal framing connections in accordance with AWC's "National Design Specification (NDS) for Wood Construction." Install fasteners through each fastener hole.
   a. Connections based on NDS or manufacturer's test or code reports.
3. Install lumber plumb and level. Accurately fit, align, securely fasten, and install free from distortion or defects.
4. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

B. Cutting: Confirm size and location of field cutting, notching, and drilling with ESR report, registered design professional, and manufacturer.

3.4 PROTECTION

A. Protect wood that has been treated with SBX from weather. If, despite protection, SBX-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061715

SECTION 064013 - EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior standing and running trim.
2. Wood seating and screen wall.
3. Shop priming of architectural woodwork.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that exterior architectural woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Wood-Preservative Treatment:
    a. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
    b. Indicate type of preservative used and net amount of preservative retained.
    c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.
2. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings:

1. Include dimensioned plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

C. Samples for Verification: For the following:

1. For each species and cut of lumber for Exterior Wood-Stain Finish: Not less than 5 inches wide by 12 inches long, for each species, with one-half of exposed surface finished.
2. For each species and cut of lumber for Interior Wood-Stain Finish: Not less than 5 inches wide by 12 inches long, for each species, with one-half of exposed surface finished.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Evaluation Reports: For preservative-treated and fire-retardant-treated wood materials, from ICC-ES.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

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

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with Architectural Woodwork Standards, Section 2.

B. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation of exterior architectural woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

B. Field Measurements: Where exterior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where exterior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of exterior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

2.2 EXTERIOR STANDING AND RUNNING TRIM

A. Architectural Woodwork Standards Grade: Custom and Economy, paint grade.

B. 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.

C. Wood Species:

1. Southern Pine: For stained finish as indicated on Drawings.
2. Southern Pine: For painted finish as indicated on Drawings.
3. Kebony: For stained finish as indicated on Drawings.
4. Wood Moisture Content: 9 to 15 percent.

2.3 WOOD MATERIALS

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Hardboard: ANSI A135.4.

C. Softwood Plywood: DOC PS 1, exterior, medium-density overlay.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Use stainless steel unless otherwise indicated.

B. Nails: ASTM F 1667.

C. Power-Driven Fasteners: ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

F. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

G. Carbon-Steel Bolts: ASTM A 307 with ASTM A 563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.

H. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2; with ASTM F 594, Alloy Group 1 or 2 hex nuts and, where indicated, flat washers.

I. Postinstalled Anchors: Stainless-steel, chemical or torque-controlled expansion anchors 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 according to ASTM E 488/E 488M conducted by a qualified independent testing and inspecting agency.

2.5 MISCELLANEOUS MATERIALS

A. Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

1. Wood-Preservative Treatment: By pressure process, AWPA U1; Use Category UC3b.

B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

C. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

D. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and applicable requirements in Section 079200 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.

2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate exterior architectural woodwork to dimensions, profiles, and details indicated.

1. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.
2. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

2.7 SHOP PRIMING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing exterior architectural woodwork, as applicable to each unit of work.

B. Exterior Architectural Woodwork for Transparent Finish:

1. Shop seal surfaces to be concealed

2. Shop seal exposed surfaces with stain (if specified), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

2.8 SHOP FINISHING

A. Preparation for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing exterior architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of exterior architectural woodwork. Apply two coats to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition exterior architectural woodwork to average prevailing humidity conditions at Project site.

B. Before installing exterior architectural woodwork, examine shop-fabricated work for completion, and complete work as required, including removing packing and backpriming concealed surfaces.

3.2 INSTALLATION

A. Grade: Install exterior architectural woodwork to comply with same grade as item to be installed.

B. Assemble exterior architectural woodwork, and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install exterior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut exterior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood Materials: Where field cut or drilled, treat cut ends and drilled holes according to AWPA M4.

F. Fire-Retardant-Treated Wood Materials: Install fire-retardant-treated materials to comply with chemical treatment manufacturer's written instructions.

G. Anchor exterior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails for exposed fastening, countersunk and filled flush with exterior architectural woodwork.
3. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.
4. For shop-finished items, use filler matching finish of items being installed.

H. Touch up finishing work specified in this Section after installation of exterior architectural woodwork.

1. Fill nail holes with matching filler where exposed.
2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective exterior architectural woodwork, where possible, to eliminate functional and visual defects and to result in exterior architectural woodwork being in compliance with requirements of the Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

3.5 CLEANING

A. Clean exterior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 064013

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Shop priming of interior architectural woodwork.
3. Shop finishing of interior architectural woodwork.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Shop finishing materials.
2. Wood-Preservative Treatment:
    a. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
    b. Indicate type of preservative used and net amount of preservative retained.
    c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.
3. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings:

1. Include the following:
    a. Dimensioned plans, elevations, and sections.
    b. Attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

C. Samples for Verification: For the following:

1. Lumber and Panel Products with Field-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color.

a. Finish one-half of exposed surface.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTLAS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
2. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Custom.

1. Wood Species: Paint-grade poplar.
2. Wood Moisture Content: 5 to 10 percent.

2.3 WOOD MATERIALS

A. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of ornamental woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, marine-grade; paintable.
2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
3. Softwood Plywood: DOC PS 1, marine-grade; paintable.

2.4 PRESERVATIVE-TREATED-WOOD MATERIALS

A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with a compatible EPA-registered insecticide.
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.

a. Provide where in contact with concrete or masonry.
b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.6 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.7 SHOP PRIMING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 099123 "Interior Painting."

1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.8 SHOP FINISHING

A. Transparent Finish:

1. Finish: System - 10, UV Curable, Water Based.
2. Staining: Match Architect's sample.

B. Opaque Finish:

1. Architectural Woodworking Standards Grade: Custom.
2. Finish: System - 4, Latex Acrylic, Water Based.
3. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

G. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

C. Field Finish: See Section 099123 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.5 CLEANING

A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 064023

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

C. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

D. Test Reports: Provide certified test results for ignition barrier based on full-scale SwRI Test Procedure 99-02 or other test acceptable to Authorities Having Jurisdiction.

E. Evaluation Report: For ignition barrier, indicating acceptance by Code Body for application intended.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

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

    a. BASF Corporation.
    b. Carlisle Spray Foam Insulation.
    c. cfiFOAM, Inc.
    d. Henry Company.
    e. Huntsman Building Solutions; Icynene.
    f. Johns Manville; a Berkshire Hathaway company.
    g. NCFI Polyurethanes.

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.

b. Smoke-Developed Index: 450 or less.

3. Properties:

a. Permeance: 0.97 perms at 1.5 inches; ASTM E96.
b. Air Impermeable: Less than 0.02 at 1 inch; ASTM E-2178.

4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 THERMAL BARRIER

A. Provide thermal barrier approved by manufacturer of spray foam insulation complying with NFPA 286, and validated as Code-compliant alternative thermal barrier by ICC evaluation report.

1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 5 or less.
b. Smoke-Developed Index: 20 or less.

B. Intumescent Thermal Barrier: One part water-based intumescent coating complying with NFPA 286 or UL 1715 over open and closed cell foam.

1. Available products include the following:

a. Huntsman Building Solutions; Blazelock TBX or Blazelock IB4.
b. International Fireproof Technology Inc.; DC 315.
c. Johns Manville; Fireshell TC.

2. Color: As selected by Architect from manufacturer’s full range.

C. Intumescent Thermal Barrier: One part water-based paintable intumescent coating complying with NFPA 286 over open and closed cell foam.

1. Basis of Design: Thermal Product Research Corporation (TPR2); FireShell F10E.
2. Color: As selected by Architect from manufacturer’s full range.

2.3 IGNITION BARRIER

A. Provide ignition barrier approved by manufacturer of spray foam insulation, tested AC-377, appendix X (modified NFPA 286) and acceptable to Authority Having Jurisdiction.

B. Ignition Barrier: Water-based intumescent barrier coating. Available products include the following:

1. Aldo Products Company; Aldocoat 757 or Aldocoat 800.
2. Johns Manville; Ignition Barrier IB.
3. Tiger Foam; Ignition Barrier.

2.4 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

B. Sealants: As recommended by Spray Polyurethane Foam Insulation manufacturer and as specified in Division 7 Section “Joint Sealants.”

C. Foamed-in-place Sealant: One- or two-component foam sealant conforming to ULC S710.1 or ULS S711.1 and the following:

1. Density: 1.5 5o 2.0 pc.
2. Flame Spread: 25 or less per ASTM E84.
3. R-value: Minimum 7.
4. Products: Provide one of the following or comparable product approved by SPF manufacturer.

a. Zerodraft Foam Sealant by BASF.
b. Zerodraft insulating air sealant by BASF.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Cavity Walls: Install into cavities to thickness indicated on Drawings.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 INSTALLATION OF THERMAL AND IGNITION BARRIER

A. Comply with manufacturer's written instructions applicable to products and applications.

B. Spray barrier coating to completely cover entire area of insulation indicated to be protected to achieve thickness required by testing and evaluation reports.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor-permeable, fluid-applied air barriers.

1.2 DEFINITIONS

A. ABAA: Air Barrier Association of America.

B. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

C. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

D. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: Manufacturer to provide job-specific details for air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

1. Include copy of Installer’s ABAA license and verification of manufacturer’s training of installers and supervisors on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Manufacturer's Technical Representative Qualification: An authorized full-time employee representative of manufacturer experienced in the installation and maintenance of the specified system and qualified to determine Installer's compliance with the requirements of this Project.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

C. Installer Limitations: Each type of air barrier system material, fluid-applied and sheet membrane shall be installed by a single installation firm.

D. All associated products used in conjunction with air barrier membranes and forming an integral part of the waterproofing system must be furnished and approved by the air barrier manufacturer and covered by the applicable total system warranties.

E. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in their original undamaged packages, with labels intact and legible.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials from direct sunlight.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

B. Product and system selection shall be coordinated with construction sequence to ensure that manufacturer's exposure limits are adequate for anticipated schedule. Air barrier membrane exposed beyond the manufacturer's exposure limits shall be recoated or removed and reinstalled, per manufacturer's written instructions, re-inspected and reapproved at Contractor's own expense.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

C. Water Resistance: Material shall resist 21.6 in water for 5 hours before and after aging when tested per ICC-ES 212.

D. Nail Sealability: Material shall allow no water found on nail shanks, on underside of sheathing and/or between sheathing and product coating when tested per ASTM D 1970.

E. Flammability**:** Material shall allow a Flame Spread of less than 25 and Smoke Development of less than 450 when tested per ASTM E 84.

F. Adhesion: Material shall exhibit a minimum adhesion of 15 psi when tested per ASTM D 4541.

G. Compatibility: Material shall be compatible with adjacent materials.

H. UV Stability: Material shall survive a minimum of 6 months UV Exposure during construction.

I. System Continuity: Material Manufacturer shall provide materials/system, including flashings, for an interface with windows, door and other penetrations that integrate into a compatible and continuous air barrier assembly.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. High-Build, Vapor-Permeable Air Barrier: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

1. Synthetic Polymer Type:

    a. Products: Subject to compliance with requirements, provide the Basis-of-Design indicated or one of the following:

        1) GCP Applied Technologies Inc.;Perm-A-Barrier VPL
        2) Henry; a Carlisle company; Barritech VP
        3) Henry; a Carlisle company; Air-Bloc 17MR
        4) Meadows, W.R.; Air-Shield LMP
        5) Polyglass; a MAPEI Group company; VertiWrap VPL
        6) Tremco Incorporated; ExoAir 230

2. Physical and Performance Properties:

    a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
    b. Vapor Permeance: Minimum 20 perms; ASTM E96/E96M, Desiccant Method, Procedure B, Water Method.
    c. Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.
    d. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    e. UV Resistance: Can be exposed to sunlight for recommended number of days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

D. Self-Adhering Transition Membrane: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.

1. Products: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle Coatings & Waterproofing.
    b. GCP Applied Technologies.
    c. Henry Company; Blueskin SA.
    d. Meadows, W.R.
    e. Tremco Incorporated.

E. Primer for Transition Membrane: Product recommended by manufacturer of transition membrane for substrate.

F. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation; Pecora XL-Span.
c. The Dow Chemical Company; Dow Corning® 123 Silicone Seal.
d. Tremco Incorporated; Spectrem Simple Seal.

G. Joint and Penetration Treatment Materials: Manufacturer’s recommended materials, such as sealants, mastic, and tape.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar.

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

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air barrier material.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in two or more equal coats.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.

2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports and submit to Architect and Owner.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vertical-rib, snap-joint, standing-seam metal roof panels.
2. Substrate board.
3. Underlayment.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal panels and metal panel accessories.

1. Size: Manufacturers' standard size.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For standing-seam metal roof panels, for tests performed by a qualified testing agency.

B. Qualification Statements: For roof installers.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels.

1.6 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for typical roof area only, including accessories.

a. Size: 12 ft. long by 6 ft..
b. Each type of exposed seam and seam termination.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written installation instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal panel systems 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 metal and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
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 agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E1680 or ASTM E283/E283M at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STANDING-SEAM METAL ROOF PANELS, GENERAL

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed fasteners in side laps. Include all accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

2.3 VERTICAL-RIB, SNAP-JOINT, STANDING-SEAM METAL ROOF PANELS

A. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design indicated or a comparable product by one of the following:

1. Petersen Aluminum Corporation (PAC-CLAD) (Basis-of-Design).
    a. Product: Snap Clad.
2. ATAS International.
3. Berridge Manufacturing Company.
4. Englert, Inc.
5. IMETCO.
6. MBCI, Inc.
7. McElroy Metal.
8. Metal Sale Manufacturing Corp.
9. Morin.

B. Panels: Formed with vertical ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Structural Support: Over open framing.
2. Material: Metallic-coated steel.
3. Finish: Two-coat fluoropolymer.
4. Color: Classic Bronze.
5. Panel Profile: Flat pan.
6. Panel Coverage: 12 inches.
7. Panel Height: 1.75 inches.
8. Clips: One piece, fixed, designed to accommodate thermal movement.
    a. Steel Clips: 0.028-inch- nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
    b. Clip Spacing: As indicated on approved Shop Drawings.

2.4 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. GP Gypsum LLC.
    b. National Gypsum Co.
    c. USG Corporation.
2. Thickness: 1/2 inch.
3. Surface Finish: Unprimed.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions for fastening substrate panel to roof deck.

2.5 UNDERLAYMENT

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface

laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970/D1970M.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle WIP Products.
    b. GCP Applied Technologies.
    c. Henry; a Carlisle company.
    d. Kirsch Building Products.
    e. Polyglass USA; a MAPEI company.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.6 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. Nominal Thickness: 0.028 inch.
2. Surface: Smooth, flat finish.

2.7 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 coating designation. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, fasteners, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal 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- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels 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 panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

1. Profile: 5-inch half-round gutters; aluminum.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10 ft. long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.8 FABRICATION

A. Fabricate and finish metal 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.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to 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 sealant and to comply with manufacturer's recommendations.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not permitted 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 in writing by metal panel manufacturer.

a. Size: As recommended by metal panel manufacturer for application, but not less than thickness of metal being secured.

2.9 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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 same piece are unacceptable. 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. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the 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.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written installation instructions.

3.3 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

    a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board in accordance with roofing system manufacturers' written installation instructions.

3.4 INSTALLATION OF COVER BOARD

A. Install cover board over insulation in accordance with manufacturer's written installation instructions. Install with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

3.5 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.6 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

A. Install metal panels in accordance with manufacturer's written installation instructions and approved Shop Drawings in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Concealed Clip, Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

E. Panel Joints: Fasten panel joints to substrate in accordance with manufacturer's instructions.

1. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
2. Watertight Installation:

a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommended in writing by manufacturer as needed to make panels watertight.
b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: 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 panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. 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 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 achieve 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 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped 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 deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 ft. on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiber-cement siding.

1.2 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Fiber-cement siding.

B. Product Data Submittals: For each type of fiber-cement siding. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- long-by-actual-width Sample of siding.
2. 12-inch- long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement siding.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of fiber-cement siding, including related accessories, to include in maintenance manuals.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockups for fiber-cement siding including accessories.

a. Size: 48 inches long by 60 inches high.
b. Include outside corner on one end of mockup and inside corner on other end.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

A. Fiber-Cement Siding: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.

1. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design indicated or comparable products by one of the following:

a. James Hardie Building Products (Basis-of-Design).

1) Product: Hardie Panel & Hardie Trim Batten.

b. GAF.
c. Nichiha.

B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Nominal Thickness: Not less than 5/16 inch.

D. Vertical Pattern: Boards 9-1/4 to 9-1/2 inches wide in plain style.

1. Texture: Smooth.

E. Panel Texture: 48-inch- wide sheets with smooth texture.

F. Factory Finished: Manufacturer's standard.

1. Color: Cobblestone.

2.3 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
2. Basis-of-Design: James Hardie; Hardie Artisan Trim.

a. Thickness: 1.50 inches.
b. Texture: Smooth.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:

1. Corner posts.
2. Door and window casings.
3. Fasciae.
4. Moldings and trim.

C. Flashing: Provide stainless steel flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: High-performance organic finish.

D. Fasteners:

1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
2. For fastening fiber cement, use hot-dip galvanized fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed steep-slope roof sheet metal fabrications.
2. Formed wall sheet metal fabrications.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of special conditions.
8. Include details of connections to adjoining work.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.

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

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including fascia trim, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

   a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
   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

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

2. Color: As selected by Architect from manufacturer's full range .
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 316, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled).

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet in accordance

with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat.
2. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

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

    a. Carlisle WIP Products.
    b. GCP Applied Technologies.
    c. Henry; a Carlisle company.
    d. Kirsch Building Products.
    e. Polyglass USA; a MAPEI company.

2. Source Limitations: Obtain underlayment from single source from single manufacturer.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:

1. For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

H. Do not use graphite pencils to mark metal surfaces.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Drip Edges: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

B. Ridge Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

B. Install slip sheet, wrinkle free, before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

3.3 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder welds sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel and aluminum sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

a. Fill joint completely.
b. Completely remove flux and spatter from exposed surfaces.

5. Stainless Steel Soldering:

a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
b. Promptly remove acid-flux residue from metal after tinning and soldering.
c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

3.5 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.6 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

B. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

1.9 FIELD CONDITIONS

A. 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.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.10 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace 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.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from 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

2.1 JOINT SEALANTS, 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 joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 890-SL.
b. Pecora Corporation; 300 SL.
c. Sika Corporation; 728 SL.
d. Tremco Incorporated; Spectrem 900 SL.

2. Exterior Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Other exterior horizontal traffic joints.

3. Interior Joint Locations:

a. Control and expansion joints in tile flooring.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Momentive; SilPruf LM SCS2700.
c. Pecora Corporation; 890 NST.
d. Sika Corporation; Sikasil WS-290.
e. Tremco Incorporated; Spectrem 1.

2. Exterior Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints in exterior insulation and finish systems.
c. Metal panels.
d. Joints between different materials listed above.
e. Exterior perimeter joints between materials listed above and frames of doors, windows, and louvers.
f. Control and expansion joints in ceilings and other overhead surfaces.
g. Other vertical or horizontal non-traffic joints.

3. Interior Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Interior perimeter joints of exterior openings.

2.4 URETHANE JOINT SEALANTS

A. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; Dynatrol II.
b. Sika Corporation; Sikaflex -2c NS EZ Mix+.
c. Tremco Incorporated; Dymeric 240FC.

2. Exterior Joint Locations:

a. Control and expansion joints in unit masonry.

3. Interior Joint Locations:

a. Perimeter joints of exterior openings.
b. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
c. Perimeter joints between interior wall surfaces and frames of interior doors.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Neutral Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; Dowsil 786.
b. Pecora Corporation; 898.
c. Sika Corporation; SikaSil N Plus.
d. Tremco Incorporated; Tremsil 600 White.

2. Interior Joint Locations:

a. Tile control and expansion joints.
b. Joints between plumbing fixtures and adjoining walls, floors, and counters.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; BC-158.
b. Tremco Incorporated; General Purpose Butyl Sealant.

2. Exterior Joint Locations: Under door thresholds.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik, Inc.; Chem-Calk 600.
b. Pecora Corporation; AC-20+.
c. Sika Corporation; Sonolac.
d. Tremco Incorporated; Tremflex 834.

2. Interior Joint Locations:

a. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
b. Other non-dynamic interior joints including between interior wall surfaces and casework.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 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 performance of the Work.

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

3.2 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, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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 or primer 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 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 backs of joints.

E. Install sealants using proven techniques that 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 in 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 in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

a. Extent of Testing: Test completed and cured sealant joints as follows:

1) Perform 20 tests at various locations as determined by testing agency.

b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

c. Inspect tested joints and report on the following:

1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 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, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.

C. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Custom Metal Products.
4. Fleming Door Products Ltd.; Assa Abloy Group Company.
5. Karpen Steel Custom Doors & Frames.
6. Mesker Door Inc.
7. Republic Doors and Frames.
8. Steelcraft; an Allegion brand.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A..

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard.

f. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
d. Edge Construction: Model 2, Seamless.
e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.6 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.

4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 LOUVERS

A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.

4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
    1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

3.3 REPAIR

A. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-machining criteria.
6. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Dimensions and locations of blocking for hardware attachment.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory finished and application requirements.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

B. Composite Wood Products: Verify products are made with no added urea formaldehyde.

2.2 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
    a. Forte Opening Solutions.
    b. Lambton Doors.
    c. Oshkosh Door Company.
    d. VT Industries, Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
3. Architectural Woodwork Standards Grade: Custom.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
    a. Species and Cut: As selected by Architect.
    b. Match between Veneer Leaves: As selected by Architect.
5. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
6. Core for Non-Fire-Rated Doors:
    a. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.3 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
    1. Wood Species: Species compatible with door faces.
    2. Profile: Manufacturer's standard shape.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
    1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.
    1. Locate hardware to comply with DHI-WDHS-3.
    2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.

C. Openings: Factory cut and trim openings through doors.
    1. Light Openings: Trim openings with moldings of material and profile indicated.
    2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.5 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
    1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
    2. Finish faces, all four edges, edges of cutouts, and mortises.

3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. Finish: Architectural Woodwork Standards System-10, UV Curable, Water Based.
3. Staining: Match Architect's sample.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. 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.

3.3 ADJUSTING

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

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083613 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:

1. Metal for door sections.
2. Hardware.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

C. Finish warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: Two years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

2.3 SECTIONAL-DOOR ASSEMBLY

A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

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

a. Amarr; an ASSA ABLOY company.
b. Alpine Overhead Doors
c. C.H.I. Overhead Doors
d. Clopay Building Products.
e. Cornell|Cookson LLC.
f. Overhead Door Company.

g. Raynor Garage Doors

B. Operation Cycles: Door components and operators capable of operating for not less than 10,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.

1. Door-Section Thickness: 2 inches.
2. Section Faces:

a. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.

1) Steel Sheet Thickness: 0.0239-inch nominal coated thickness.
2) Surface: Manufacturer's standard, stucco embossed.

3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.

D. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: 2 inches wide.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide intermittent jamb brackets attached to track and wall.
b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

E. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

a. Roller-Tire Material: Manufacturer's standard.

3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

F. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

G. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
    a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
    b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

H. Manual Door Operator:

1. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

I. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. 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.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower.
4. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
5. Operator Type: Manufacturer's standard for door requirements.
6. Motor: Reversible-type for exterior, dusty, wet, or humid motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
    a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
    b. Electrical Characteristics:
        1) Phase: Single phase.
        2) Volts: 115 V.
7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
    a. Unmonitored Entrapment Protection: Pneumatic sensor edge, black, located within weatherseal mounted to bottom bar.
9. Control Station: Surface mounted, two-position (open and close) control.
    a. Operation: Push button interior and key exterior.
    b. Interior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof-type, NEMA ICS 6, Type 4 enclosure.
    c. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4 enclosure.
10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

J. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
    1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
        a. Color and Gloss: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:
    1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
    2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 DEMONSTRATION

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

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples: For each type of exposed finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Installer.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E 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, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, glazed aluminum curtain walls, and aluminum windows, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

D. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

F. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 STOREFRONT SYSTEMS

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

1. YKK AP America Inc. (Basis-of-Design).
    a. Product: YES 45 TU.
2. Kawneer North America.
3. EFCO Corporation
4. Oldcastle BuildingEnvelope

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: Color anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Cap Extension: Manufacturer's standard aluminum extrusion designed to snap-on to aluminum framing for increasing profile depth.

1. Cap Extension Depth: As indicated on Drawings.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
    a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

D. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Sealants: Comply with Section 088000 "Glazing."

2.7 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Sill Pan: Provide high performance flashing by manufacturer. Extruded aluminum, factory fabricated to provide sealed end dams, finished to match storefront; designed to direct water away from building when

installed horizontally at sill. If manufacturer offers a similar sill pan as part of aluminum-framed entrance and storefront system, submit details and product data including finishes, for consideration and approval by Architect. PVC is not acceptable.

D. Sill Extension: Extruded aluminum. Profile as indicated on Drawings.

E. Perimeter Filler: Provide perimeter filler / backer plate to close back of frame and facilitate placement of backer rod and sealant.

1. Back Plates: Furnish jamb and head framing members with manufacturer's standard continuous back plates, unless continuous plates are integral to the design of the framing system.

F. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.

G. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

H. Rigid PVC Filler.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Installation at Sill: Install sill pan system in accordance with manufacturer’s written instructions.

1. Set sill pan in a continuous bed of sealant or apply a nominal 6 inch wide strip of 60 mil self-adhering waterproofing membrane to the bottom of the pan and where a penetration might be required to comply with specified performance requirements.
2. Do not apply sealant between flashing pan and bottom of frame, except as required by manufacturer to comply with specified performance requirements. Set sill members in watertight sill flashing pan. Do not penetrate bottom of flashing pan and/or attach sill members to vertical leg of angle unless required by manufacturer to comply with specified performance requirements.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF WEATHERSEAL SEALANT

A. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.6 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.7 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing shall be conducted by an independent third-party testing agency provided by the Contractor, with prior approval by Owner, Architect, and Commissioning Authority, with the testing being witnessed by the Commissioning Authority to confirm proper testing procedures.
2. Testing shall be in compliance with AAMA 501.2. Testing shall be performed at approximately 10 percent and 50 percent completion. A minimum of 2 test areas to be tested at each phase. Additional testing may be required if installation crew changes of if construction is suspended and

resumed after an extended period of time. Coordinate with Architect's representative for areas to be tested, testing times, and representative's availability to monitor tests.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
2. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 085693 - TRANSACTION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sliding, transaction windows.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, weights and finishes for window units.

B. Shop Drawings: For transaction windows.

1. Include plans, elevations, sections, and attachment details.
2. Full-size section details of track members, including internal armoring, reinforcement, and stiffeners.
3. Hardware for sliding window units.
4. Glazing details.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

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

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Pack transaction windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.

B. Label transaction window packaging with drawing designation.

C. Store crated transaction windows on raised blocks to prevent moisture damage.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 SLIDING, TRANSACTION WINDOWS

A. Provide sliding, transaction windows.

1. Basis-of-Design: Subject to compliance with requirements, provide the following:

a. C.R. Laurence Company; Daisy Model D1041DUXX4848.

B. Configuration: Two horizontal-sliding glazed panels.

C. Operation: Manual open/manual closing.

D. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:

1. Product: C.R. Laurence Company; Model D7 Overhead Track.
2. Profile: Manufacturer's standard, with minimum face dimension indicated.
3. Depth: Manufacturer's standard.
4. Finish: Color anodized.

a. Color: Bronze.

E. Sliding Window Hardware: Provide roller track designed for overhead support of heavy-duty, antilift ball-bearing carrier manufacturer's standard carrier supporting horizontal-sliding glazed panel with manufacturer's standard self-closing mechanism mounted in header. Provide manufacturer's standard pull for each horizontal-sliding glazed panel.

F. Materials:

1. Aluminum Extrusions: ASTM B221. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength.
2. Aluminum Sheet and Plate: ASTM B209.

2.2 FABRICATION

A. General: Fabricate transaction windows to provide a complete system for assembly of components and anchorage of window units.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 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: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.4 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

1. Color: Dark Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of transaction windows.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of transaction window connections before transaction window installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of transaction windows.

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

3.2 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing transaction windows to in-place construction. Include threaded fasteners for inserts, fasteners, and other connectors.

B. Fasteners: Install transaction windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials.

C. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.

D. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose.

3.3 ADJUSTING

A. Adjust horizontal-sliding, transaction windows to provide a tight fit at contact points for smooth operation and a secure enclosure.

B. Remove and replace defective work, including transaction windows that are warped, bowed, or otherwise unacceptable.

3.4 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation of transaction windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.

1. Lubricate sliding transaction window hardware.

B. Clean glass of preglazed transaction windows promptly after installation. Comply with manufacturer’s written instructions for cleaning and maintenance.

C. Provide temporary protection to ensure that transaction windows are without damage at time of Substantial Completion.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Coated glass.
2. Insulating glass.

C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturers of fabricated glass units.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Guardian Industries.
2. Viracon.
3. Vitro Architectural Glass.

B. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.

a. Wind Design Data: As indicated on Drawings.

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer ionoplast interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass withthe following to comply with interlayer manufacturer's written instructions:

1. Construction: Laminate glass with polyvinyl butyral interlayer reinforced with polyethylene terephthalate film to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:

1. Elastomeric with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Elastomeric with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type (G1):

1. Product: As selected by Architect.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Clear heat-strengthened float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Clear heat-strengthened float glass.
7. Low-E Coating: Sputtered on second surface.
8. Safety glazing required.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Sample Warranties: For manufacturer's special warranties.

1.4 QUALITY ASSURANCE

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

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

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

1. Architectural Louvers (Basis-of-Design).
2. Airolite Louvers.
3. Construction Specialties, Inc.
4. Industrial Louvers, Inc.
5. Louvers & Dampers, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Basis-of-Design Product: Architectural Louvers; Model E2DS.
2. Louver Depth: 2 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.063 inch for blades and 0.063 inch for frames.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

a. Free Area: Not less than 8.80 sq. ft. for 48-inch- wide by 48-inch- high louver.
b. Point of Beginning Water Penetration: Not less than [900 fpm.
c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area exhaust velocity.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 BLANK-OFF PANELS

A. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: 2 inches.

2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same finish applied to louvers.
7. Attach blank-off panels with sheet metal screws.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.

F. Provide subsills made of same material as louvers or extended sills for recessed louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Impact-resistant gypsum board.
3. Aluminum trim.
4. Joint treatment materials.
5. Sound-attenuation blankets.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples for Verification: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:
    a. Each level of gypsum board finish indicated for use in exposed locations.
    b. Each texture finish indicated.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

1. CertainTeed Corporation.
2. Georgia-Pacific Gypsum LLC.
3. National Gypsum Company.
4. USG Corporation.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.

2.5 aJOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: 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.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. 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.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.
2. Impact-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular 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 panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. 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.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, in accordance with ASTM C840, and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use at outside corners.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
5. Level 5: Where indicated on Drawings.
    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.
7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

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

1. Build mockup of typical ceiling area as indicated on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 450 or less.

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

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS (ACT-1)

A. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design products as scheduled on Finish Schedule on Drawings.

1. Armstrong World Industries (Basis-of-Design).

a. Product: As indicated on Finish Schedule on Drawings.

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Color: As indicated on Finishes Schedule Drawings.

D. Edge/Joint Detail: As indicated by manufacturer's designation.

E. Thickness: As indicated by manufacturer's designation.

F. Modular Size: As indicated on Finish Schedule on Drawings.

G. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.

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, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Plated with metallic finish indicated by manufacturer's designation.

C. Narrow-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, G30 coating designation; with prefinished 9/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate -duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Plated with metallic finish indicated by manufacturer's designation.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection, Carbon Steel: Components zinc plated in accordance with ASTM B633, Class SC 1 (mild) service condition.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Hold-Down Clips: Manufacturer's standard hold-down.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure 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 the structure to which hangers are attached and the 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 support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

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 o.c. and not more than 3 inches from ends. 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 precise fit.

1. Arrange directionally patterned acoustical panels as follows:
    a. As indicated on reflected ceiling plans.
    b. Install panels in a basket-weave pattern.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. 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.

6. Install hold-down clips in areas indicated; space in accordance with panel manufacturer's written instructions unless otherwise indicated.
    a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.
7. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoset-rubber base.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 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 or more than 90 deg F.

1.4 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE (WB-2)

A. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design products as scheduled on the Finish Schedule on Drawings.

1. Tarkett North America (Basis-of-Design).

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location: As indicated on Drawings.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As indicated on Interior Finish Schedule on Drawings.

2.2 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter corners to minimize open joints.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

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

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE (LVT-1)

A. Basis-of-Design Products: Subject to compliance with requirements, provide the following:

1. Mannington Commercial (Basis-of-Design).

a. Product: As indicated on Finish Schedule on Drawings.

B. Tile Standard: ASTM F1700.

1. Class: Class III, Printed Film Vinyl Tile.
2. Type: B, Embossed Surface.

C. Thickness: 0.098 inch.

D. Size: As indicated on Finish Schedule on Drawings .

E. Colors and Patterns: As indicated on Finish Schedule on Drawings.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor 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 in pattern indicated.

C. Match floor 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 in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. 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 marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere rubber floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply in manufacturer's recommended amount of coat(s).

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resinous flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
2. Review details of integral cove bases.
3. Review manufacturer's written instructions for installing resinous flooring systems.
4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each resinous flooring component.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

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

1. Apply full-thickness mockups on 96-inch- square floor area selected by Architect.
    a. Include 96-inch length of integral cove base with inside and outside corner.
2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Final Acceptance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 RESINOUS FLOORING

A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.

1. Basis-of-Design Products: Subject to compliance with requirements, provide products the Basis-of-Design indicated or comparable products by one of the following:
    a. Stonhard, Inc. (Basis-of-Design).
        1) Product: Stontec ERF.
    b. Dex-O-Tex.
    c. Duraflex, Inc.
    d. MAPEI, Inc.
    e. Neogard; Hempel Group.
    f. Sherwin-Williams High Performance Flooring.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary

materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

C. System Characteristics:

1. Color and Pattern: As indicated on Finish Schedule on Drawings.
2. Wearing Surface: Standard.
3. Overall System Thickness: Manufacturer's recommended thickness for hangar floor applications.

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:

1. Tensile Strength: 5,200 psi minimum in accordance with ASTM D2370.
2. Abrasion Resistance: 0.03 mg maximum weight loss in accordance with ASTM D4060.
3. Hardness: 0.85-0.90, Shore D in accordance with ASTM D2240.

E. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.

1. Basis-of-Design Product: Stonhard Standard Primer.
2. Resin: Epoxy.
3. Formulation Description: High solids.
4. Number of Coats: One coat.
5. Aggregates: Broadcast quartz.

F. Body Coats:

1. Basis-of-Design Product: Stonshield Undercoat.
2. Resin: Epoxy.
3. Formulation: Solvent free epoxy.
4. Number of Coats: One coat.
5. Application Method: Notched squeegee.

G. Broadcast:

1. Basis-of-Design: Stontec Flakes.
2. Formulation: Decorative quartz flakes
3. Finish: Broadcasted.
4. Color: As indicated on Finish Schedule on Drawings.

H. Topcoats: Sealing or finish coats.

1. Basis-of-Design Product: Stonhard; Stonkote CE4.
2. Resin: Epoxy.
3. Formulation Description: High solids.
4. Type: Clear.
5. Number of Coats: Two coats.
6. Finish: Gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.

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

3.2 PREPARATION

A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

   a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
   b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
   b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.

1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

C. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.

D. Integral Cove Base Accessories: Adhesively install precast accessories before applying flooring coats and in accordance with manufacturer's written instructions.

E. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

1. Integral Cove Base: 4 inches high.

F. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.

1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.

G. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.

H. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.

B. Core Sampling: At Owner's direction and at locations designated by Owner, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel and iron.
2. Wood.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
    b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
    a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide products by the Basis-of-Design listed in the Exterior Painting Schedule for the paint category indicated.

1. Sherwin-Williams (Basis-of-Design).
2. Benjamin Moore & Co.
3. Pittsburgh Paints Company.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

C. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.

1. Testing agency will perform tests for compliance with product requirements.
2. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor

will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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 paint finish, color, and appearance.

D. Apply paints 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.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint 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 of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System MPI EXT 5.3J:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) Sherwin-Williams; Pro Industrial DTM Acrylic Primer/Finish, B66W00011 (Basis-of-Design).
2) Benjamin Moore: HP Acrylic Metal Primer HP1100.
3) Pittsburgh Paints Co.: Protective and Marine Coatings; Pitt-Tech Plus EP White Primer, 90-1912.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

1) Sherwin Williams: Pro Industrial, DTM Semi-Gloss, B66W01151 (Basis-of-Design).
2) Benjamin Moore; Ultra Spec HP, DTM 100% Acylic Latex Gloss.
3) Pittsburgh Paints Co.; Protective and Marine Coatings, Pitt-Tech EP DTM Acrylic Semi-Gloss, 90-1610.

B. Wood Substrates:

1. High Performance Architectural Latex System MPI EXT 6.3P:

a. Prime Coat: Primer, alkyd for exterior wood, MPI #6.

1) Sherwin-Williams, PrepRite ProBlock Primer/Sealer, Interior/Exterior Latex, B51W00620 (Basis-of-Design).
2) Benjamin Moore, Multi-Purpose Primer, 067.
3) Pittsburgh Paints Co., Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #315.

1) Sherwin-Williams, Duration, Exterior Acyrlic Satin, K33W00200 (Basis-of-Design).
2) Benjamin Moore, Ultra Spec EXT Exterior Acylic Low Lustre, W455/Y455
3) Pittsburgh Paints Co., Permanizer Exterior 100% Acrylic Latex Satin, 769-10 Series

d. Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #311.

1) Sherwin-Williams, A-100, Exterior Latex Gloss, A08W00116 (Basis-of-Design).
2) Benjamin Moore; Aura, Waterborne Exterior Soft Gloss, N632/F632.
3) Pittsburgh Paints Co., Permanizer Exterior 100% Acrylic Latex Semi-gloss, 749-10 Series

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Floor sealers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Sherwin-Williams Company (The) (Basis-of-Design).
2. Benjamin Moore & Co.
3. Pittsburgh Paints Company.

B. Products: Subject to compliance with requirements, provide the Basis-of-Design products listed in the Interior Painting Schedule for the paint category indicated found at the end of Part 3.

C. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated on Finishes Legend on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

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 to match 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 paint finish, color, and appearance.

D. Apply paints 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. Back-Rolling: Back roll all spray applications on walls and ceilings to allow for touch up.

F. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Hot- and cold-water piping; fire-suppression piping.

2. Paint the following work where exposed in occupied spaces:

a. Hot- and cold-water piping; fire-suppression piping.

3.4 FIRE-RATED ASSEMBLIES

A. By stenciling, permanently identify corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures and fire walls. Above decorative ceiling line and in concealed spaces, on both sides of wall, apply a minimum one-inch wide red line interrupted at maximum 12-ft. spacing with the wording “X HOUR FIRE AND SMOKE BARRIER – PROTECT ALL OPENINGS” in 4-inch high letters with “X” designating the appropriate hourly rating.

3.5 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint 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 of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System (CON-1):

a. First Coat: Matching topcoat.
b. Topcoat: Water-based concrete floor sealer.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; Armorseal 1K (Basis-of-Design).
b) ARDEX Americas; ARDEX CG Concrete Guard.
c) Euclid Chemical; Diamond Clear VOX.
d) Pittsburgh Paints Company; Perma-Crete Plex-Seal WB Int/Ext Clear Sealer, 4-6200.

B. CMU Substrates:

1. (Epoxy System) Water-Based Light-Industrial Coating System (PNT-1, PNT-2):

a. Block Filler: Interior/exterior latex block filler.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; Kem Cati-Coat HS Epoxy Filler/Sealer, B42W00400 (Basis-of-Design).
b) Benjamin Moore: Corotech Epoxy Mastic Coating, V160.
c) Pittsburgh Paints Company: Amerlock 400 BF, AD4008-X.

b. Intermediate Coat: Matching topcoat.
c. Topcoat; Interior Pre-Catalyzed Epoxy, eggshell (Gloss Level 3):

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45W01151 Series (Basis-of-Design).
b) Benjamin Moore; Corotech Pre Catalyzed Waterborne Epoxy Eggshell, V342.
c) Pittsburgh Paints Company; Pitt-Glaze WB1 Int Eggshell Pre-Catalyzed Water-borne Acrylic Epoxy, 16-310 Series.

C. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Water-based rust-inhibitive primer.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer, B66W01310 (Basis-of-Design).
b) Benjamin Moore; Ultra Spec HP Acrylic Metal Primer, HP04.

c) Pittsburgh Paints Company; Pitt-Tech Int/Ext DTM Industrial Primer, 90-712.

b. Intermediate Coat: Matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5).

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series (Basis-of-Design).
b) Benjamin Moore; Ultra Spec Interior Gloss Finish, N540.
c) Pittsburgh Paints Company; Speedhide Zero Interior Zero-VOC Latex Semi Gloss, 6-4510XI.

D. Wood Substrates: Architectural woodwork.

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, latex, for interior wood.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; PrepRite ProBlock Primer Interior Exterior Sealer, B51W00620 (Basis-of-Design).
b) Benjamin Moore; INSL-X Seal Lock Plus 100% Acrylic Primer Sealer, IL-6800.
c) Pittsburgh Paints Company; Seal Grip Int/Ext Acrylic Universal Primer/Sealer 17-921XI Series.

b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5).

a) Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 Series (Basis-of-Design).
b) Benjamin Moore; Ultra Spec Interior Gloss Finish, N540.
c) Pittsburgh Paints Company; Speedhide Zero Interior Zero-VOC Latex Semi Gloss, 6-4510XI.

E. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System (PNT-4):

a. Prime Coat: Interior, institutional low-odor/VOC primer sealer.

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; ProMar 200 Latex Primer, B28W02600 (Basis-of-Design).
b) Benjamin Moore; Ultra Spec 500 Zero VOC Primer, N534.
c) Pittsburgh Paints Company; Speedhide Interior Latex Sealer Quick Drying, 6-2.

b. Intermediate Coat: Matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3).

1) Products: Subject to compliance with requirements, provide one of the following:

a) Sherwin-Williams; ProMar 200 Zero VOC Interior Eg-Shel Latex, B20-2600 Series (Basis-of-Design).
b) Benjamin Moore; Ultra Spec 500 Interior Eggshell, N538.
c) Pittsburgh Paints Company; Speedhide Zero Interior Zero-VOC Eggshell, 6-4310XI.

END OF SECTION 099123

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to overhead structural system.
2. Section 061053 "Miscellaneous Rough Carpentry" for overhead support of floor-and-ceiling-anchored compartments.
3. Section 092216 "Non-Structural Metal Framing" for blocking.
4. Section 102800 "Toilet and Bath Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall and ceiling to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data.

1. Phenolic-core toilet compartments.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

C. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.

1. Size: Manufacturers' standard size.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain phenolic-core toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 200 or less.
2. Smoke-Developed Index: 450 or less.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.3 PHENOLIC-CORE TOILET COMPARTMENTS (TPT-1)

A. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design indicated or a comparable product by one of the following:

1. ASI Global Partitions (Basis-of-Design).
2. Bobrick.
3. Bradley Corporation.
4. Hadrian.
5. PSiSC; a division of CSiSC.

B. Toilet-Enclosure Style: Overhead braced and floor anchored , privacy type.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid phenolic-core material with melamine facing on both sides fused to substrate during manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).

E. No-Sight System: Doors and pilasters to be routed to allow overlapping edges and providing no sight lines into compartment.

F. Urinal-Screen Construction: Matching panel construction.

G. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

H. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe and sleeve (cap) matching that on the pilaster.

I. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design, black anodized aluminum.

J. Phenolic Compartment Finish: One color in each room.

1. Dark-Core Phenolic: Manufacturer's standard dark color core and edge.

a. Facing Sheet Color: As indicated on Interior Finishes Schedule on Drawings.

2.4 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories.

1. Finish: ASI’s black anodized aluminum.
2. Hinges: Manufacturer's continuous, spring-loaded type, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at outswinging doors.
6. Door Pull: Manufacturer's standard pull at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Floor-and-Ceiling-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at tops and bottoms of pilasters.

C. Door Size and Swings: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch.
b. Panels or Screens and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

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

END OF SECTION 102113.17

SECTION 102800 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Hand dryers.
3. Childcare accessories.
4. Custodial accessories.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

D. Delegated Design Submittal: For grab bars.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the Basis-of-Design products or a comparable product by one of the following:

1. American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Toilet Tissue (Roll) Dispenser (TP1):

1. Basis-of-Design Product: ASI; Model #20030 Roval Twin Hide-A-Roll Toilet Tissue Dispenser.
2. Description: Double-roll dispenser.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery.
5. Capacity: Designed for up to 5-1/4-inch diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Waste Receptacle (WS1):

1. Basis-of-Design Product: Bobrick; Model #B-3644.
2. Mounting: Open top, recessed .
3. Minimum Capacity: 12 gal.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Liner: Reusable vinyl liner.

6. Lockset: Tumbler type for waste receptacle.

D. Soap Dispenser (SD1):

1. Basis-of-Design: Bobrick; Model #B-4112.
2. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
3. Mounting: Horizontally oriented, surface mounted.
4. Capacity: 40 fl. oz..
5. Materials: Stainless steel, ASTM A480/A480M No 4 finish (satin).
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

E. Grab Bar (GB1, GB2, GB3):

1. Basis-of-Design Product: Bobrick; Model B-6806 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit (ND1):

1. Basis-of-Design Product: Bradley; Model #4A10; Sanitary Napkin Disposal.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Seat-Cover Dispenser (SC1):

1. Basis-of-Design Product: ASI; Model #20477 Surface-Mounted Toilet-Seat-Cover Dispenser.
2. Mounting: Surface mounted.
3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Lockset: Tumbler type.

H. Mirror Unit (MI1):

1. Basis-of-Design Products: Mirrorlite Glassless Mirror.
2. Size: 48 by 72 inches.

I. Hook (CH1):

1. Basis-of-Design Products: Bradley Corp.; Model #911 Surface-Mounted Robe Hook.
2. Description: Single-prong unit.
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 7 finish (polished).

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Shower Curtain Rod (R1):

1. Basis-of-Design: Bradley Corp.; Model #9539 Curtain Rod.
2. Description: 1-inch- outside diameter, straight rod.
3. Configuration: As indicated on Drawings

4. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 HAND DRYERS

A. Warm-Air Dryer (HD1):

1. Basis-of-Design: Bobrick; Model #B7120 Hand Dryer.
2. Description: Standard-speed, warm-air hand dryer.
3. Mounting: Surface mounted.
    a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.
4. Operation: Infrared-sensor activated with timed power cut-off switch.
    a. Automatic Shutoff: At 90 seconds.
5. Cover Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
6. Electrical Requirements: 115 V, 15 A, 1725 W.

2.6 CHILDCARE ACCESSORIES

A. Diaper-Changing Station(BC1):

1. Basis-of-Design: Bradley Corporation; Model #962.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
    a. Engineered to support minimum of 250-lb static load when opened.
3. Mounting: Recessed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.
6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.7 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder (MOP1):

1. Basis-of-Design Product: Bradley Corp.; Model #9953 Mop and Broom Holders.
2. Length: 24 inches.
3. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
    a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

2.8 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch-minimum nominal thickness.

C. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

E. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.9 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 105133 – CHANGING ROOM BENCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Changing room benches.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Changing room benches.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of bench.

C. Shop Drawings: For changing room benches.

1. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 MATERIALS

A. High Density Polyethylene (HDPE): Provide bench tops fabricated from HDPE.

2.2 CHANGING ROOM BENCHES

A. Pedestal-Leg Benches: Bench top supported by pedestal legs, minimum of two pedestals for each bench, with overall height of 18 inches measured from top of bench to floor, as follows:

1. Basis-of-Design: Subject to compliance with requirements, provide the following:

a. Scranton Products: Tufftec Benches.

2. Metal Pedestal Legs: 1-1/2-inch- diameter, solid aluminum.

a. Pedestal legs to be painted, as indicated on Finish Schedule on Drawings.

3. Bench Tops: 1-1/4 inches deep; fabricated as follows:

a. Width: 9-1/2 inches.
b. Length: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 INSTALLATION

A. Fixed Changing Room Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 PROTECTION

A. Touch up marred finishes, or replace pedestals that cannot be restored to factory-finished appearance.

END OF SECTION 105123

SECTION 107301 – METAL AWNINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal awnings.

1.2 REFERENCES

A. The Aluminum Association (AA):

1. The Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
2. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American Society of Civil Engineers (ASCE):

1. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

D. ASTM International

1. ASTM B209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
2. ASTM B221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. ASTM C150, Specification for Portland Cement.
4. ASTM C404, Specification for Aggregates for Masonry Grout.

E. American Welding Society (AWS):

1. ANSI/AWS D1.2, Structural Welding Code - Aluminum.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s product information, specifications, and installation instructions for canopy components and accessories.

B. Shop Drawings: Include plan dimensions, elevations, and details.

C. Samples:

1. Selection: Manufacturer’s standard range of colors for the finishes selected.
2. Verification: 2-inch-square samples of each finish selected on the substrate specified.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years of experience in the design, fabrication, and erection of extruded aluminum awnings.

B. Installer Qualifications: Have canopy installed by manufacturer, third party installation is not acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Columbus Awning Architectural Metals.
2. Eide Industries, Inc.
3. Peachtree Awnings & Canopies.

2.2 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B221, 6063 alloy, T6 temper.

B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.

C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.

D. Gaskets: Dry seal santoprene pressure type.

E. Aluminum Flashing: ASTM B209, Type 3003 H14, 0.040-inch, minimum.

2.3 FABRICATION

A. General:

1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
2. Welding: In accordance with ANSI/AWS D1.2.
3. Gutter Frame Construction: Factory assemble gutter fascia frames to form a one-piece welded frame. Make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100 percent penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Gutter frames constructed by mechanically fastening components together are not acceptable.
4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each.

B. Beams: Where applicable provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

C. Deck: Extruded self-flashing sections interlocking into a composite unit.

D. Fascia: Where applicable provide manufacturer’s standard fascia in standard sizes.

E. Hanger Assemblies: Provide extruded aluminum in manufacturer's standard shapes and sized to meet the loads seen by canopy.

F. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.

1. High performance Organic Coating 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 manufacturer's written instructions.

a. Fluoropolymer Two-Coat Coating 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 AAMA 2605.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.2 ERECTION

A. Erect canopy true to line, level, and plumb.

B. Provide hairline miters and fitted joints.

3.3 CLEANING

A. Clean all canopy components promptly after installation.

3.4 PROTECTION

A. Protect materials and installed canopies during and after installation.

END OF SECTION 107301

SECTION 107319 - MANUFACTURED METAL CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Manufactured custom metal canopies.

B. Related Sections:

1. Section 033000 “Cast-in-Place Concrete” for requirements for concrete foundations.

1.2 SYSTEM DESCRIPTION

A. General: Provide a complete, integrated set of canopy manufacturer's standard mutually dependent components and assemblies that form a canopy capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal roof panels, and accessories complying with requirements indicated. Provide canopy of size and with spacings, slopes, and spans indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design manufactured canopy, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide canopy capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Design Loads: As indicated on Drawings.
2. Live Loads: As indicated on Drawings.
3. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than the following:

a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
b. Metal Roof Panels: Vertical deflection of 1/240 of the span.

C. Thermal Movements: Provide canopy that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION 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 fabrication and installation details for canopy.

1. Include plans, elevations, and at least 3/4-inch scale sections of typical members and other components. Show anchors, reinforcement, accessories, layout, and installation details.

a. Installation Drawings: Signed, dated, and sealed by a registered architect or professional engineer licensed in jurisdiction in which the project is located.
b. Show locations of electrical service connections.

C. Samples for Verification: For each type of product indicated, of size below:

1. Steel sheet: For each form, finish, and color, on 6-inch- long sections of extrusions and squares of sheet at least 4 by 4 inches.

D. Delegated-Design Submittal: For manufactured canopy indicated to comply with performance requirements, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of canopy manufacturer for installation of units required for this Project.

B. Source Limitations: Obtain canopy components through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of canopies are based on the specific types and models indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
2. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY AND HANDLING

A. Deliver canopies and components in protective covering and crating to protect components and surfaces against damage.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with canopies by field measurements and indicate on Shop Drawings.

1.8 COORDINATION

A. Coordinate installation of anchorages for canopies. Furnish setting drawings, templates, and directions for installing anchorages and other items that are to be embedded in concrete. Deliver such items to Project site in time for installation.

B. Coordinate delivery time so canopies can be installed within 24 hours of receipt at Project site.

1.9 WARRANTY

A. Warranty: Manufacturer’s standard form in which manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.

1. Exposed Metal Roof Finish: Twenty (20) years from date of Substantial Completion.
2. Canopy Frame System: Five (5) years from date of Substantial Completion.

3. Canopy Installation Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design: Subject to compliance with requirements, provide manufactured custom metal canopies by the following:

1. Duo-Gard Industries, Inc.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips inside laps. Include clips, cleats, and accessories required for installation.

1. Material: Zinc-coated (galvanized) steel sheet, 0.024-inch nominal thickness.

a. Exterior Finish: 2-coat fluoropolymer.
b. Color: Match standing-seam metal roofing finish in Section 074113.16 “Standing-Seam Metal Roofing.”

2. Panel Profile: Flat pan.
3. Panel Coverage: 12 inches.
4. Panel Height: 1.75 inches.

2.3 CANOPY FRAMES

A. Steel Frames and Support Columns:

1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Cold-Formed Steel Tubing: ASTM A 500, grade as required by structural loads.
3. Dimensions: As indicated on Structural Drawings.
4. Steel Finish: All exposed steel members, including exposed underside of metal decking at canopy, shall be field-painted.

B. Concealed Drainage: Intermediate troughs pitched to drain to gutters front of canopies and through scuppers.

1. Dimensions of Rain Leader: As indicated on Drawings.

2.4 ACCESSORIES

A. Fasteners: Use concealed fasteners fabricated from metals that are noncorrosive to canopies material and mounting surface.

B. Anchors and Inserts: Use stainless steel or hot-dip galvanized anchors and inserts. Use torque-controlled expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete.

2.5 FABRICATION, GENERAL

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirement. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Frames Preassemble canopy frames in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

2.6 STEEL FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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 same piece are unacceptable. 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. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: Dark bronze.
3. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, installation tolerances, and other conditions affecting performance.

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

3.2 INSTALLATION

A. General: Install canopies in strict accordance with manufacturer's written recommendations and approved Shop Drawings.

B. Set embedded items required for installation of canopies. Use templates furnished by suppliers of items to be attached.

C. Install canopies level, plumb, and at height and slope indicated, with surfaces free from distortion or other defects in appearance.

D. Install concealed gaskets, joint fillers, and sealants, as the Work progresses, to make canopies, gutters and scuppers watertight.

E. Corrosion Protection: Apply bituminous paint, self-adhering underlayment or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with dissimilar metals or substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 CLEANING

A. At completion of installation, clean soiled surfaces of canopies according to manufacturer's written instructions.

1. Remove protective film from members. Clean canopies of dirt, grease, handprints, and other blemishes. Leave area in a neat, clean, and acceptable condition.

B. Protect canopies from damage from other construction operations. Provide temporary barricades where necessary.

END OF SECTION 107319

SECTION 10 75 00 - FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. One 25' height gound-set flagpoles and two 20' height ground-set flagpoles

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 26 05 83 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

D. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's data sheets on pole(s), accessories, and configurations.

B. Shop Drawings: Indicate dimensions, base details, anchor requirements, and imposed loads.

C. Operation and Maintenance Data: Provide manufacturer's recommended maintenance schedule.

D. Executed warranty.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole and foundation under direct supervision of professional engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

C. Protect flagpole and accessories from damage and moisture. Store flagpoles indoors and above ground.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide limited lifetime manufacturer warranty for flagpole shaft and limited manufacturer warranty for other components. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Concord American Flagpole; External - Continental: www.concordamericanflagpole.com/#sle.

2.02 FLAGPOLES

A. Performance Requirements:
   1. Design and size components to accommodate wind pressure in accordance with NAAMM FP 1001.
   2. Wind Pressure Loading on Flagpole with Flag: Resists 130 mph wind speed without permanent deformation when tested in accordance with NAAMM FP 1001 at safety factor of 2.5.

B. Characteristics:
   1. Description: ERS25C6--ABL, 25' heightl and ESR20C61-ABL, 20' height.
   2. Material: Aluminum, 6063-T6, in accordance with ASTM B221 and ASTM B221M.
   3. Type: Cone tapered.
   4. Outside Butt Diameter: 6 inches.
   5. Outside Tip Diameter: 3.5 inches.
   6. Nominal Wall Thickness: .156" inches.
   7. Nominal Height: 25 feet.
   8. Halyard: Internal type; 5/16-inch diameter polyester rope, manual cleat operation.
      a. Cleat: Aluminum, 9 inches, with stainless steel fastenings, one per halyard.
   9. Truck Assembly: TRK-9619-BLK. Cast aluminum, revolving, nonfouling, with stainless steel roller bearings and aluminum spindle for attachment to pole top.
   10. Collar: COL1-A06S-BLK. Spun aluminum, 1-piece, finish matching flagpole.
   11. Finish: Anodized.
      a. Anodized Color: Black.

C. Mounting Components:
   1. Ground Mounted:
      a. Foundation Tube: Galvanized, 16-gauge, 0.0598-inch corrugated steel; size to suit flagpole; with steel centering wedges, 3/16-inch steel bottom plate, and 3/16-inch support plate.
      b. Lightning Ground Spike: Steel, 3/4-inch diameter, 18 inches long.

2.03 ACCESSORIES

A. Flagpole Lighting Unit: Aluminum, consisting of LED lights arranged in circular unit around flagpole.

1. Description: ABES-25FS-GLD-BLK American Beacon Light with external halyard standard.
2. Aluminum Finish: Powder coated.
3. Light Color Temperature: 3000 K.
4. Products:
   a. Concord American Flagpole; PoleLED Basic: www.concordamericanflagpole.com/#sle.

B. Finial Ornament: Aluminum ball.
1. Description: BAL-0612-GLD. HD gold anodized aluminum ball.
2. Finish: Gold powder coat.

2.04 FINISHES

A. Aluminum:
1. Class I Color Anodized Finish: AAMA 611 AA-M32C22A42, minimum 0.7 mil, 0.0007 inch thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify readiness of concrete foundation to receive work. Ensure dimensions comply with shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Concrete Foundation Tube Sleeve: See Section 03 30 00.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices to ensure halyard and flag function smoothly.

END OF SECTION

SECTION 11 68 33 - ATHLETIC FIELD EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes athletic equipment as follows
   1. Permanently installed equipment
   2. Other misc. equipment

B. Pickleball court equipment.

1.02 RELATED REQUIREMENTS AND DOCUMENTS

A. National Federation of State High School Associations, Athletic Field and Cross Country Rules book, 2018.

B. American Sports Builders Association: Pickleball Courts, Construction and Maintenance Manual, Third Edition, 2023.

C. USA Pickleball Association, various publications.

1.03 ABBREVIATIONS

A. NFHS - National Federation of State High School Associations; www.nfhs.com and www.nfhs.org.

B. ASBA: American Sports Builders Association

1.04 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a meeting one week before starting this work to discuss coordination between various installers.
   1. Require attendance by personnel responsible for grading and installers of athletic field equipment, footings, and adjacent work.
   2. Include representatives of Contractor.

1.06 SUBMITTALS

A. Product Data: Provide athletic equipment manufacturer's product data indicating materials of construction, compliance with specified standards, installation procedures, and necessary safety limitations.

B. Shop Drawings: Submit detailed scale drawings showing athletic field equipment and perimeter layout.
   1. Indicate locations and dimensions of footings and anchorage points.

2. Identify mounting elevations in relation to fixed survey point on site, and subgrade elevation.

C. Samples for Verification: Submit color chart for each item that color must be selected showing full range of colors and finishes.
   1. Posts: min. 3" long
   2. Manufacturer's Qualifications

D. Installer's Qualification Statement.

E. Manufacturer's Warranty(ies).

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years of experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least 5 years of experience. A firm whose athletic equipment components have been certified by IAAF third-party product certification service and ASBA for Pickleball.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store equipment on project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, and elevated above grade.

1.09 WARRANTY

A. Manufacturer agrees to repair or replace components of athletic field equipment that fail in materials or workmanship within specified warranty period.

B. Failures include but are not limited to the following:
   1. Structure Failures:
   2. Deterioration of metals and metal finishes and other materials beyond normal weathering and use:

C. Warranty period: As indicated from the manufacturer and began at date of project acceptance.

D. Provide minimum 3-year manufacturer warranty for equipment. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source limitations: Obtain athletic field equipment from single source from single manufacturer.

2.02 APPROVED EQUALS

A. General: Approved Equals are manufacturers and/or fabricators whose products are equal in quality and performance in finish and construction to that of the Basis of Design manufacturer for the equipment.

2.03 PICKLEBALL COURT EQUIPMENT

A. Manufacturers:
   1. Basis of Design Manufacturer/Vendor: Pickleball Central.

B. Pickleball Posts: Single piece heavy-duty uprights, of painted steel and 3 inch with net lacing rods and bottom pin set to 36-inch height with remaining 18 inch of upright mounted in concrete footing.
   1. Provide cast aluminum cap with cable guide pins to close top of uprights.
   2. Provide winch on one side with internal cable length adjustment using removable handle, and internal net attachment in fixed post on other side.
   3. Color and Finish: Black powder coat.

C. Pickleball Net: Polyethylene cord with 0.12 inch thick hollow braid, 36 ounce single layer vinyl headband, 18 ounce coated vinyl side and bottom tapes with brass grommets; vinyl coated galvanized cable at top and 1/2 inch diameter fiberglass dowels at each end.
   1. Center Strap: Heavy-duty polyester webbing with black oxide coated brass slide buckles, nickel-plated double end snap with reinforced ends.
   2. Center Ground Anchor: Galvanized steel tubing, 1-1/2 inch diameter and 9 inch long with stainless steel pin to attach to center strap, and mounted in concrete footing.

2.04 MATERIALS

A. Steel Pipe and Tube: Complying with ASTM A135/A135M, ASTM A500/A500M, or ASTM A513/A513M; hot-dip galvanized and free of excess weld and spatter.
   1. Tensile Strength: 45,000 psi, minimum.
   2. Yield Point: 33,000 psi, minimum.
   3. Galvanizing: Hot-dip metal components in zinc after fabrication, in accordance with ASTM A123/A123M; remove tailings and sharp protrusions and burnish edges.

B. Powder Coating for Steel: See below.

2.05 STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for pretreatment, applying, and baking.

B. PVC Finish: UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on PVC finish, with flame retardant added, and with minimum dry film thickness of 80 mils (2 mm). Comply with coating manufacturer's written instructions for pretreatment and application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading required for placing athletic field equipment and protective surfacing is completed.

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

3.02 PREPARATION

A. Stake location of equipment elements, including necessary athletic field perimeters, surfacing, access and egress points, hard surfaces, walls, fences, and/or structures.

B. Stake layout of equipment perimeter in accordance with approved shop drawings before starting any work.
   1. Verify that athletic field perimeters do not overlap hard surfaces, whether currently installed or not.
   2. Verify that athletic fields are free of obstructions.
   3. If conflicts or obstructions are found, notify Architect.
   4. Do not proceed with this work until revised drawings have been provided, showing corrected layout, and that any obstructions have been removed or corrections to layout have been made.

3.03 INSTALLATION

A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor equipment securely, positioned at locations and elevations indicated.

B. Install equipment in accordance with manufacturer's instructions, and rules and regulations of specified athletic association indicated for this work.

C. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

D. Embedded posts:
   1. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
   2. Finishing Footings: Smooth top, and shape to shed water.

3.04 CLEANING

A. Clean equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

B. Clean courts of excess construction materials, debris, and waste.

C. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as indicated on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Final Acceptance.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS (CTR-1)

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Basis-of-Design: Subject to compliance with requirements, provide the Basis-of-Design indicated or a comparable product by one of the following:

a. Wilsonart.

2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: As indicated on Finish Schedule on Drawings.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.

C. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch- thick, solid surface material.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints:

1. Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

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. Work Included:
   1. Submittals
   2. Electrical Requirements
   3. Excavation & Backfilling
   4. Painting
   5. Cleaning
   6. Testing

1.03 SUBMITTALS

A. The Contractor shall submit for review by the Architect data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable.

B. Refer to the individual sections for identified equipment and materials for which submittals are required.

C. Refer to the SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Section for required procedures.

D. Product Data Preparation: Product submittals shall be made by specification section. All items of a section, requiring submission, shall be submitted together at one time in a tabbed binder. If two or more sections require inter-coordination, they shall be submitted at the same time. Each individual submittal item within a binder shall be marked to show paragraph number which pertains to the item. Binders for mechanical submittals shall be color coded - Green for Plumbing. Binders shall be labeled on outside with project name, contractors name, date of submission, and specification section and number. Binders shall also have a tab indicating submittal number and specification section number. If product submittals for section exceed the capacity of one binder, two or more binders shall be used. In addition to above, a notation cover shall indicate the number of binders for the section and the number of that binder (i.e., 2 of 3). Section binders shall be report cover type with solid cover and 3 metal fasteners or 3-ring type. Report cover binders shall be Duo-Tang Series L2-53558 or approved equal. Electronic submittals are approved.

E. Mechanical Equipment Electrical Data
   1. Prior to submitting data for equipment requiring electrical service, the Contractor shall verify that electrical characteristics of equipment submittals comply with electrical service provided for the specified items of equipment.

2. Upon receipt by the Contractor of reviewed submittals for equipment provided under this Division, the Contractor shall coordinate the electrical service requirements, i.e., motor horsepower and full load amps, electrical service characteristics (voltage and phase), and number of services for each item of equipment requiring electrical connections with the electrical drawings and specifications. The Contractor shall furnish to the Architect a complete typewritten list of electrical requirements for each item of equipment to be installed.

F. Items on or projecting through the ceiling shall be coordinated with other items.

1.04 QUALITY ASSURANCE

A. The mechanical equipment and installation shall conform to the following codes:
1. The International Building Code 2021 Edition with South Carolina Modifications.
2. The International Residential Code 2021 Edition with South Carolina Modifications.
3. The International Plumbing Code, 2021 Edition with South Carolina Modifications.
4. The International Fuel Gas Code, 2021 Edition with South Carolina Modifications
5. The International Energy Conservation Code, 2009 Edition with South Carolina Modifications.
6. National Electrical Code, 2020 Edition with South Carolina Modifications.

B. The mechanical equipment and installation shall conform to the following standards:
1. Associated Air Balance Council (AABC):
   a. National Standard for Total System Balance.
2. National Fire Protection Association (NFPA):
   a. Standard 30, Flammable and Combustible Liquids Code.
   b. Standard 31, Installation of Oil Burning Equipment.
   c. Standard 54, National Fuel Gas Code.
   d. Standard 58, Storage and Handling of Liquefied Petroleum Gases.
   e. Standard 70, National Electric Code.
   f. Standard 99, Health Care Facilities
   g. Standard 101, Code for Safety to Life from Fire in Buildings and Structures.

C. Publication Dates: Where the date of issue of a Reference Standard is not specified, comply with the Standard is effective as of Date of Contract Document.

D. Permits
1. Obtain all permits and inspections for the installation of this work and pay all charges thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

E. Workmanship and Materials
1. The workmanship and materials covered by these specifications shall conform to all ordinances and regulations of the city, county and/or other authorities having jurisdiction.

1.05 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for Detail Requirements.

B. Printed Material: Provide required printed material for binding in operation and maintenance manuals.
1. Refer to the individual sections for identified equipment for which material is to be provided.

2. The Operations and Maintenance Manual shall include a section for certifications and project warranty data. Refer to individual sections for certifications. Warranties for equipment shall be included in the equipment section of the Operation and Maintenance Manual.

C. The Manuals shall be a 3 ring binder with tabs for each item listed in specifications. The manuals shall be submitted to the Architect for approval 30 days prior to instruction of Owner personnel. The manual shall include the following items:
1. Parts list
2. Lubrication requirements
3. Preventative maintenance requirements
4. Name, address, and telephone numbers for supplier of equipment.

D. Instructions of Owner personnel:
1. Before final inspection, at a time designated by the Architect, provide a competent representative to instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems under this division of the specifications. For equipment requiring seasonal operation, perform instructions for other seasons within six months unless requested otherwise.
2. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
3. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

1.06 RECORD DOCUMENTS

A. Refer to Division 1 for record documents and related submittals.

1.07 CONTRACT DRAWINGS

A. Drawings are diagrammatic and indicate general arrangement of systems and work. Provide offsets, transitions, and fittings to coordinate the work of each trade with that of other trades, including HVAC, plumbing, fire protection, electrical, structural, and architectural.

B. Follow drawings in laying out work and check drawings of other disciplines relating to work to verify space conditions. Do not scale drawings.

C. Equipment layout is based on one manufacturer's product. Where equipment selected by the Contractor for use on the job differs from layout, the Contractor shall be responsible for coordinating space requirements and connection arrangements.

1.08 GUARANTY

A. See the General Conditions.

B. The components of the mechanical systems furnished under this division of the Specifications shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship. Upon receipt of notice from the Architect of failure of any part of the equipment during the guaranty period, the affected part or parts shall be replaced promptly which includes removing the defective part or parts, replacing and installing the new part or parts, at the expense of the Contractor.

PART 2 - PRODUCTS

2.01 ELECTRICAL WORK

A. All electrical equipment furnished under this Division of these Specifications shall comply with the electrical system characteristics indicated on the electrical drawings.

B. Motors shall be as specified in the MOTORS Section.

C. Motor control components furnished as an integral part of the mechanical equipment shall conform to requirements of Division 26 - Electrical.

D. For all motors furnished under this Division of these Specifications for which motor controls are not specified to be integral with the equipment, the controls shall be provided under this Division.

E. Power wiring (i.e., feeders to motors, water heaters, and electric heaters and tapes including final connection to equipment) shall be provided under Division 26 - Electrical.

F. Control wiring (i.e. 120 volt and below) including 120 volt control power shall be provided under this division unless shown on the electrical drawings. Power wiring (120V) to control panels shall be provided under Division 26. Power (120V) and control (24V) wiring to application-specific controllers and other control system components shall originate at control panels and be provided under this division.

PART 3 - EXECUTION

3.01 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original color.

B. Steel equipment hangers, threaded rods, bolts, nuts, and supports and uninsulated black steel pipe exposed to sight inside the building which are not provided with a factory applied prime coat shall be cleaned of rust, grease and scale. After cleaning hangers, supports and pipe, a field-applied prime coat shall be provided. In addition, such items in finished spaces shall also be provided with two coats of finish paint in a color to match adjacent surfaces or as noted on the architectural drawings.

C. Steel equipment hangers and supports, uninsulated black steel pipe, and black steel pipe supports exposed to sight outside the building which are not provided with factory prime coat shall be cleaned of rust, grease and scale. After cleaning hangers, supports and pipe, a field-applied prime coat and two coats of bituminous aluminum paint shall be provided. Insulated pipes outside the building shall be cleaned of rust, grease and scale, and shall be provided with a field-applied prime coat before installing insulation.

D. All painting shall conform to the requirements of the PAINTING Section.

3.02 CLEANING AND ADJUSTING

A. All equipment, pipe, valves, and fittings shall be cleaned of grease, oil, paint spots, metal cuttings, sludge, and construction debris.

B. Bearings shall be lubricated as recommended by the equipment manufacturer.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. General: The Contractor shall perform all excavation to install piping herein specified. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid over-loading and to prevent slides and cave-ins. All excavated materials not to be used for back filling shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and excavations, and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling shall be done. Trenches shall not be cut below a plane extending at a 45 degree angle down and away from any footing.

B. Trench Excavation. The bottom of the trenches shall be graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections excavated for sealing of pipe joints. Depressions for joints shall be dug after the trench bottom has been graded. Over depths shall be backfilled with loose, granular, moist earth, tamped. Remove unstable soil that is not capable of supporting the pipe and replace with specified material for a minimum depth of 12” below invert of pipe.

C. Backfilling. The trenches shall not be backfilled until all specified pressure tests are performed. The trenches shall be backfilled with the excavated materials approved for backfilling consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6” layers and rammed until the pipe has a cover of not less than the adjacent existing ground, but not greater than 2” above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious side pressures do not occur. All trenches under pavements and all trenches within the building walls and to 5 ft. outside the building walls shall be compacted in accordance with requirements specified in the EARTH MOVING Section. For all trenches, the compaction of the filled trench shall be at least equal to that of the surrounding undisturbed material, except that trenches occurring in areas to be filled shall be backfilled in 6” maximum layers and each layer compacted to 95% maximum density. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements; or where settlement occurs, refill, compact, and restore the surface to the grade and compaction specified above, mounded over and smoothed off. Under footings and slabs, backfill, fill dewatering and compaction shall, in addition to the above requirements, conform to the requirements of the EARTH MOVING Section.

D. Sheeting and Shoring shall be provided in accordance with the EARTH MOVING Section.

3.04 TESTING PIPE SYSTEMS

A. General: Concealed piping and insulated piping shall be tested in place before concealing or covering. Piping located underground shall be tested before backfilling. Equipment, materials, and instruments for testing shall be furnished by the Contractor without additional cost to the Owner. System components not rated for the respective test pressure shall be isolated from the system during the test.

B. Observation: The contractor shall notify the owner’s representative 3 days prior to a scheduled test. The owner’s representative, at his option, has the right to witness the test.

C. Sanitary, Waste, and Vent System

1. The hydrostatic test shall be performed before installing fixtures. Water tests shall be applied to the system either in its entirety or in sections. If the test is applied to the entire system, all openings in the piping shall be closed except the highest opening, and the system shall be filled with water and tested with at least a 10 ft. (3m) head of water. In testing successive sections, at least the upper 10 ft. (3m) of the next preceding section shall be tested so that each joint or pipe in the building except the uppermost 10 ft. (3m) of the system has been submitted to a test of at least a 10 ft. (3m) head of water. The water shall be kept in the system, or in the portion under test for at least 2 hours before the inspection starts. The system shall be tight at all joints.

D. Domestic Water System
1. The hydrostatic test shall be made upon completion of the roughing-in and before setting fixtures. The entire domestic cold water and hot water, and hot water circulation piping system shall be tested at a hydrostatic pressure of 125 psig (860 kPa) and proved tight at this pressure for a period of not less than [30 minutes] [2 hours] in order to permit inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in a manner described for the entire system.

END OF SECTION

SECTION 22 05 23 - GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Valves For Domestic Water System

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
   1. Valves

PART 2 - PRODUCTS

2.1 GENERAL

A. Valves shall have the name or trademark of the manufacturer and the working pressure stamped or cast on the valve body.

B. All valves in each system, except for special types, shall be the product of a single manufacturer.

C. All valves requiring packing shall be designed and constructed such that they can be repacked under pressure.

D. Valve handwheels shall be malleable iron [except where specified otherwise.]

2.2 VALVES FOR DOMESTIC WATER SYSTEM

A. Gate valves (3" (76 mm) in size and smaller) shall have bronze body, non-rising stem, solid wedge, and solder ends for 200 pound (1375 kPa) W.O.G. Valves shall be:

1.	Crane	No. 1324
2.	Hammond	IB647
3.	Stockham	B-104
4.	Nibco	S-113
5.	Milwalkee Valve	UP115

B. Check valves (3" (76 mm) in size and smaller) shall be horizontal swing type with bronze body, composition disc, and solder ends for 200 pound (1375 kPa) W.O.G. Valves shall be:

1.	Crane	No. 1342
2.	Hammond	IB943

3.	Stockham	B-310-B
4.	Nibco	S-413-W
5.	Milwalkee Valve	UP1509

C. Globe valves (2" (50 mm) in size and smaller) shall have bronze body, rising stem, composition disc, and solder ends for 200 pound (1375 kPa) W.O.G. Valves shall be:

1.	Crane	No. 1310
2.	Hammond	IB423
3.	Stockham	B-14-T
4.	Nibco	S-211-Y
5.	Milwalkee Valve	UP1502

D. Hose end drain valves shall be 3/4" (19 mm) in size with bronze body, non-rising stem, solid wedge, threaded inlet, and hose outlet with cap and chain for 200 pound (1375 kPa) W.O.G. Valves shall be:

1.	Crane	No. 451
2.	Jenkins	372
3.	Nibco	T-113-H

E. Underground Gate Valves and Valve Boxes

1. Gate valves (2" (50 mm) & 3" (76 mm) in size) shall have iron body, bronze trim, non-rising stem, parallel seat double disc, square operating nut, and threaded ends for 200 pound (1375 kPa) W.W.P. Valves shall be:

Mueller Company	A-2380-8
Stockham	G-739-0

2. Valve boxes shall be provided over each underground gate valve. Valve boxes shall be adjustable cast iron roadway type with belled lower section and removable lid at grade. Lid shall be labeled "Water" and boxes not in paved areas shall be set in a 12" (300 mm) x 12" (300 mm) x 6" (150 mm) concrete pad. Valve boxes shall be:

Mueller Company	H-10360
Central Foundry	B-5003
Tyler Pipe Company	6850
Russell Foundry	B-122

3. Provide one T-wrench for each size operating nut.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All valves installed in horizontal lines shall be installed with the stems horizontal or above. Valve handwheels shall be oriented, when installed, to provide maximum accessibility for operation.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Hangers and supporting devices for all mechanical piping.

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
   1. Hangers and supporting devices to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Hangers and support accessories received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Hangers and support accessories shall be stored on wooden rails, wooden pallets, or shipping skids. Under no condition shall the hangers and support accessories be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure, hangers and support accessories may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Hangers and support accessories shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all hangers and rods, turnbuckles, angles, channels and other structural supports to support the piping systems.

B. Pipe hangers, hanger rods, trapeze type hangers, upper attachments and other supports shall be selected based on pipe size (plus insulation of pipes specified to be insulated) and the weight of the medium being transported or the medium used for testing, whichever is heavier. For sprinkler piping, in addition to the pipe and water, allow a minimum of 250 pounds (114 kg) applied at the point of hanging.

C. Rods for pipe hangers shall be carbon steel. Standard hanger rod sizes shall be:

Pipe Size	Diameter
1. 1/2" - 2" (13mm - 50mm)	3/8"(10mm)
2. 2-1/2" - 3" (62mm - 75mm)	1/2"(13mm)

D. All ferrous metal pipe hangers, except copper plated hangers, and concrete inserts shall be provided with a factory applied coat of rust inhibiting paint.

E. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit directly around the pipe:
   1. Domestic cold water piping.
   2. Domestic hot water and hot water circulating piping.
   3. Roof drainage piping.

F. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit around the pipe, pipe insulation and pipe insulation protective shields:
   1. Waste piping from drinking fountains.
   2. Waste piping receiving condensate from air handling units [and fan coil units].

G. All supporting equipment with the exception of springs in spring isolation hangers shall be designed with a minimum factor of safety of five based on the ultimate tensile strength of the material.

2.2 PIPE SUPPORTS FOR SUSPENDED HORIZONTAL PIPING

A. Pipe support for suspended horizontal piping shall be the following:

SYSTEM	PIPE MATERIAL	PIPE SIZE	HANGER NUMBER
1. Domestic Cold & Hot Water	Copper	All Sizes	IV
2. Soil, Waste & Vent	Steel & Cast Iron	All Sizes	I
3. Soil, Waste & Vent	PVC	All Sizes	V
4. Waste & Vent	Glass	All Sizes	V

B. Hanger numbers listed in schedule above shall be the following types:
   1. Hanger Number I: Clevis hanger, steel.
   2. Hanger Number IV: Clevis hanger, copper plated steel.
   3. Hanger Number V: Clevis hanger, plastic coated steel.

C. Hanger numbers listed above shall be:

	I	IV	V
1. B-Line Systems	B3100	B3104CT	B3100C
2. Carpenter & Patterson	100	100CT	100PVC
3. Anvil	260	CT-65	260PLASTIC
4. Erico	400	402	420

D. Upper Attachments
   1. Steel Construction
      a. For suspending pipes from steel beams, upper attachments shall be beam clamps and shall be:
         1) B-Line Systems; Fig. B3055
         2) Carpenter & Paterson; Fig. 268
         3) Anvil Fig. 133
      b. For suspending pipes from bottom chord of steel bar joists, upper attachments shall be C-clamps with retaining clips and shall be:
         1) B-Line Systems; Figs. B351, B3362 and B3363

2) Carpenter & Paterson; Figs. 238 and 22
3) Anvil; Figs. 87 and 89
4) Erico; No. 255 and 255C

c. For suspending pipes from the top chord of steel bar joists, upper attachments shall be top-of-beam C-clamps and shall be:
1) B-Line Systems; Fig. B3034
2) Carpenter & Paterson; Fig. 192
3) Anvil; Fig. 92
4) Erico; No. 300

2. Concrete Construction
a. New Construction
1) For suspending pipe in concrete construction, upper attachments shall be adjustable type concrete inserts. Where weight to be supported by an insert is 300 lbs. (136 kg) or more, install two No. 3 steel reinforcing bars, each 3 ft. (900mm) long, through the yoke of the insert. Concrete inserts shall be:
a) B-Line Systems; Fig. B2500
b) Carpenter & Paterson; Fig. 75
c) Anvil; Fig. 281
d) Erico; No. 355
2) For suspending pipes in concrete construction, upper attachments shall be continuous concrete inserts complete with nuts. Continuous concrete inserts shall be:
a) B-Line Systems; Figs. B22I, B32I, B42I or B52I
b) Carpenter & Paterson; Fig. 650

2.3 PIPE SUPPORTS FOR FLOOR SUPPORTED HORIZONTAL PIPING

A. General
1. Pipe supports for horizontal piping supported on concrete floors and on concrete bases shall be adjustable pipe saddle support with U-bolt and screwed floor flange. Bolt floor flange to floor and bases utilizing all bolt holes. Adjustable pipe saddle supports shall be steel and shall be:
a. B-Line Systems; Fig. B3090 and B3088
b. Carpenter & Paterson; Fig. 125SP
c. Erico; No. 724
2. Pipe supports for horizontal piping in trench below floor level shall be adjustable pipe roller stands. Base shall be bolted to the trench floor utilizing all bolt holes. Adjustable pipe roller stands shall be steel and cast iron and shall be:
a. B-Line Systems; Fig. B3118SL
b. Carpenter & Paterson; Fig. 40
c. Anvil; Fig. 274
d. Erico; No. 619

2.4 PIPE SUPPORTS FOR VERTICAL PIPING

A. Supports for vertical piping shall be riser clamps sized to fit directly around the pipe.
1. Riser clamps shall be steel and shall be:
a. B-Line Systems; Fig. B3373
b. Carpenter & Paterson; Fig. 126
c. Anvil; Fig. 261
d. Erico; No. 510
2. Offset pipe clamps shall be steel and shall be:
a. B-Line Systems; Fig. B3148
b. Carpenter & Paterson; Fig. 179
c. Anvil; Fig. 103

d. Erico; No. 700

3. Clamps for copper tubing shall be copper plated.

2.5 FACTORY FABRICATED FRAMING CHANNELS AND FITTINGS

A. Factory fabricated framing channels and fittings shall be used for:
1. Constructing pipe racks for supporting multiple horizontal pipes where indicated on the drawings.
2. Constructing trapeze type hangers for suspending multiple horizontal pipes where indicated on the drawings.
3. Securing vertical exposed water service drops for hose bibbs and wall hydrants.

B. Framing channels and fittings shall be provided with factory applied baked enamel finish.

C. Galvanized pipe clamps, including bolts and nuts, shall be provided with the framing channels and shall be used for securing pipes to channels. Pipe clamps on insulated pipes shall fit around pipe, pipe insulation and pipe insulation protection shield.

D. Framing channels and fittings shall be:
1. B-Line Systems; Strut System
2. Erico; Strut System
3. Unistrut; Metal Framing System
4. Anvil; Power Strut

PART 3 - EXECUTION

3.1 HORIZONTAL PIPE SUPPORT INSTALLATION

A. Spacing of hangers and supports shall be as follows:
1. Cast iron soil pipe shall be supported at not more than five feet intervals and near each hub or coupling.
2. Copper Tubing:

Nominal Tubing Size	Maximum Spacing of Supports - Feet
a. 3/4" (20mm) & smaller	5 (1600mm)
b. 1 in. through 3 in. (25mm-75mm)	6 (1800mm)
c. 4 in. (100mm) and larger	12 (3600mm)

3. Steel Pipe:

Nominal Pipe Size	Maximum Spacing of Supports - Feet
a. Up thru 1-1/4 in. (32mm)	6 (1800mm)
b. 1-1/2" thru 2-1/2"(37mm-62mm)	8 (2400mm)

4. PVC Pipe: All sizes; 4’-0” (1200mm).

B. Additional hangers shall be provided adjacent to all valves and fittings size 8" (200mm) and larger.

C. Intermediate pipe supports shall be provided between building structural members so as not to exceed maximum support spacing hereinbefore specified.

3.2 UNDERGROUND PIPING

A. Piping in earth shall be laid on a firm bed for its entire length.

3.3 VERTICAL PIPE SUPPORT INSTALLATION

A. Supports for all pipes shall fit directly around the pipe. On insulated pipes, the support shall be insulated and provided with vapor barrier as specified for pipe insulation in Section 220700 - PLUMBING INSULATION.

B. Vertical pipes passing through floors shall be provided with a riser clamp at each floor. Where opening in floor is sleeved, riser clamps shall have steel lugs, 1/4" thick x 2" high x 1-1/2" long (6mm thick x 50mm high x 37mm long), welded to the clamp arms so that clamp does not come in contact with the pipe sleeve; the lugs shall support the clamp from the floor. Where floor opening does not have a sleeve, a 3 inch (75) high concrete curb shall be installed around the opening.

C. Where distance between floors is greater than 15 ft. (4500mm) or where drop within one floor level is more than 15 ft. (4500mm), vertical pipes shall be provided with offset pipe clamps anchored to walls at the approximate midpoint between floors.

D. Exposed to sight vertical service drops to wall hydrants shall be supported with not less than two equally spaced sections of factory fabricated framing channel with standard pipe clamps. Channel sections shall be 8" (200mm) long and shall be fastened to wall with not less than two spring wing toggle bolts.

E. Copper tubing supported by channel framing shall be provided with a lead sleeve to isolate the pipe from the framing channel and the pipe clamp.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Valve Tags
   2. Pipe Bands
   3. Equipment Labels

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS, and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
   1. Valve Tags
   2. Pipe Bands
   3. Equipment Labels

1.4 QUALITY ASSURANCE

A. Standards
   1. American National Standards Institute (ANSI):
      a. Standard A13.1, The Scheme for Identification of Piping Systems.
   2. National Fire Protection Association (NFPA)
      a. Standard 45, Fire Protection for Laboratories Using Chemicals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Tapes, labels, paint received and stored on the job site shall be stored in dry storage spaces, (e.g. building, a storage trailer, or shed). Under no condition shall the units be stored in such a way that metal components are in direct contact with the ground.

B. Tapes, labels, paint shall be covered with 6 mil (.4mm) polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe identification shall comply with ANSI A13.1.

2.2 VALVE TAGS

A. Valve tags shall be 19 gauge (1.2 mm) minimum brass with 1-1/4" (30 mm) minimum height and width. Identification letters 1/4" (6mm) high and numbers 1/2" (12mm) high shall be stamped in tag and shall be filled with black enamel paint. Valve tags shall be:
   1. Emedco; CB/W Series
   2. Seton; Valve Tags
   3. Brady; Valve Tags

4. Marking Services; Valve Tags

B. Valve tag shape and designations shall be:

System	Identification Numbers	Tag Shape
1. Domestic Cold Water	CW - 1, 2, 3, . . .	Round or Square
2. Domestic Hot Water	HW - 1, 2, 3, . . .	Round or Square

2.3 PIPE MARKINGS

A. Pipe identification shall be pressure sensitive tape with banding tape flow arrows.

B. Bands shall be color and background as indicated below.

Pipe	Band Color	Lettering	Lettering Color
1. Dom. Cold Water	Green	DOMESTIC COLD WATER	White
2. Dom. Hot Water	Yellow	DOMESTIC HOT WATER	Black

2.4 EQUIPMENT LABELS

A. Equipment identification labels shall be black plastic laminate with white letters. Labels shall be 2” high with 1/2" minimum letters. Equipment terminology shall be same as shown on equipment schedules, (i.e. AHU-1, CH-1, etc.).

2.5 TAPE

A. Identification tape shall be vinyl pressure sensitive type with adhesive backing. Tape width shall be a minimum of 2"(50 mm). Tape shall be color to match pipe identification band background. Tape shall be:
1. Emedco; T100 Series
2. Seton; PST Series
3. Brady; Tape
4. Marking Services; MS-900

2.6 CABLE TIES

A. Cable ties for valve tag attached shall be self-locking nylon ties. Cable ties shall be:
1. Thomas & Betts; Ty-Rap-Nylon
2. Ideal; Double Lock Cable (Plain Head)
3. Efcor; Sure-Ty Self-Locking Cable Ties

2.7 VALVE CHART

A. Valve chart shall be typed listing of all valve tags. List shall include identification number, valve location in system (e.g., water heater, chilled water pump, etc.) and its function (e.g., shut-off, balancing, drain, etc.). Chart shall be mounted in a aluminum frame with glass or plastic cover. Chart shall be mounted where shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Valve tags shall be installed at all shut-off, balancing, metering, and drain valves. Valve tags shall be attached to the handwheel with cable ties.

B. Pipe identification bands shall be installed on piping at each valve, each piece of equipment, each change of direction, wall penetration, each branch take-off, and at a maximum spacing of 20 feet (6.5M) on straight run piping.

C. Pipe stenciling shall be applied in accordance with Section 099100 - PAINTING. Where pipe material or pipe covering is already black, a white background of stencil ink shall be applied prior to stenciling identification band.

D. Equipment labels shall be attached to equipment using self tapping stainless steel screws or contact-type permanent adhesive.

END OF SECTION

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Pipe Insulation
   2. Roof Drain Insulation

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
   1. Insulation
   2. Field Applied Jacketing

C. Certificates: Certificates shall be submitted on the following:
   1. Certificates of compliance to the specified standards.

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society for Testing and Materials (ASTM):
      a. Standard E84, Surface Burning Characteristics of Building Materials.
      b. Standard C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
      c. Standard C547, Mineral Fiber Performed Pipe Insulation
      d. Standard C534, Preformed Flexible Elastomeric Cellular Thermal Insulation.
      e. Standard C553, Mineral Fiber Blanket and Felt Insulation
      f. Standard C916, Standard Specification for Adhesives for Duct Thermal Insulation
      g. Standard C1071 Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Materials)
      h. Standard C1290 Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
      i. Standard G21, Practice for Determining Resistance of Synthetic Polymeric Material to Fungi
   2. National Fire Protection Association (NFPA):
      a. Standard 255, Test Methods, Surface Burning Characteristics of Building Materials.
   3. Underwriters' Laboratories (UL):
      a. Standard 723, Surface Burning Characteristics of Building Materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Insulation received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Insulation shall be stored on wooden rails, wooden pallets, or shipping skids. Under no condition shall the insulation be stored in such a way that components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure, insulation may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Insulation shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather. UV sensitive material such as PVC and PVDC insulation material shall be protected from sunlight to avoid exposure to UV light from the sun.

PART 2 - PRODUCTS

2.1 FLAME AND SMOKE RATING

A. Insulation material, adhesives, jackets, and tapes specified herein shall comply with ASTM E84, NFPA 255, and UL 723 for:
1. Maximum flame spread rating: 25
2. Maximum smoke developed rating: 50, unless indicated otherwise hereinafter.
3. Compliance shall be for insulation, adhesive, and jacket or facing.

2.2 PIPE INSULATION THICKNESS

A. Size insulation thickness for all insulation types shall be based on the following chart.

Minimum Pipe Insulation Thickness (in inches)							
Fluid Operating Temperature Range and Usage (°F)	Insulation Conductivity		Normal Pipe or Tube Size (inches)				
	Conductivity Btu. In./(h – ft² – F)	Mean Rating Temperature, °F	<1	1 to <1 ½	1 ½ to <4	4 to <8	≥8
>350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 - .030	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	50	0.5	1.0	1.0	1.0	1.5

Chart copied from Table C403.2.10 from the International Energy Conservation Code 2015 edition.

2.3 FOAMED PLASTIC PIPE INSULATION

A. Insulation shall be self sealing, flexible cellular, elastomeric Type conforming to ASTM C 534, designed for use on pipes from -40°F to 220°F (-40°C to 105°C).

B. Insulation shall have a minimum density of 6 lb./cu.ft. (96 Kg/m^3) and a maximum conductivity ('K' value) of 0.28 Btu/In. per sq. ft. per °F per hour (0.00016W/cm^2 °C) at 75°F (24°C) mean temperature, and a maximum permanence of 0.17 LB/sq. ft.

C. Adhesives used for connections shall be manufacturer's standard waterproof vapor retarder.

D. Insulation used outdoors shall be provided with manufacturer's Standard UV-Protection.

E. Insulation shall be:

		Un-cut	Self Sealing
1.	Johns Manville	Aerotube AP	Aerotube AP/SS
2.	Armacell	AP Armaflex	AP/SS Armaflex
3.	Rubatex	R-180-FS	R-180-FS
4.	Halstead	F/R Insutube	F/R Insutube

F. Insulation thickness shall be [1 inch (25mm)] [3/4 inch (19mm)] [1/2 inch (13mm)].

2.4 FIBERGLASS BLANKET INSULATION

A. Insulation shall be flexible fiberglass blanket conforming to ASTM C 553 and ASTM C 1290 designed for use on surfaces up to 250°F (121°C).

B. Insulation shall have a minimum density of 1.0 lb. cu. ft. (16 Kg/m^3) and a maximum conductivity ('K' value) of 0.26 Btu/In. per sq. ft. per °F per hour (0.00015W/cm^2 °C) at 75°F (24°C) mean temperature.

C. Vapor barrier jacket shall be FSK, aluminum foil reinforced with fiberglass yarn and laminated to fire resistant Kraft.

D. Insulation shall be:
1. CertainTeed
2. Knauf; Standard Duct Wrap
3. Ductwrap
4. Johns Manville; Microlite Type 100.
5. Owens Corning; All service faced ductwrap, Type 100.

E. Insulation thickness shall be 2 inches (50mm).

2.5 ADHESIVES

A. Insulation cement shall be:
1. Fibrex; FBX Super Blend
2. ROCKWOOD MFG. CO.; Delta-Maid One Shot

B. Fire Retardant Adhesive for blanket and liner insulation shall be conform to ASTM C 916 and shall be:
1. Childers; CP-56
2. Foster; 85-60
3. King; 11-400
4. Mon-Eco; 22-65
5. Viamsco; 795

2.6 FABRICS

A. Reinforcing fabric shall be 10 by 20 or 10 by 10 white glass on nylon fabric.

2.7 COATINGS

A. Vapor barrier coating (white) shall be:
1. Childers; Chil-Perm CP-30
2. Epolux; Calaler 650
3. Foster; Tite Fit 30-35
4. King ; ---

5. Mon-Eco ; 55-10

B. Breather Coating (white) shall be:
1. Childers; Chil-Seal CP-50A
2. EPOLUX; Cadalag 336
3. Foster; Seal Fas 30-36
4. King ; 11-275
5. Mon-Eco ; 11-07
6. Vimasco; 713

C. Asphalt mastic shall be:
1. Foster; 60-25
2. Lion Oil Co.; Seal-Kote
3. Pittsburgh Corning; Pittcoat 300

D. Fire resistive, vapor barrier, water proof mastic (grey) shall be:
1. Childers; CP-10/11 AF
2. Epolux; Cadolon 500
3. Foster; Monolar 60-39
4. King ; ---
5. Mon-Eco ; 55-50
6. Vimasco; WC-5FR

E. Asphalt based Aluminum paint shall be as recommended by insulation manufacturer.

2.8 FASTENERS AND TAPES

A. Securing wire shall be 16 gauge stainless steel.

B. Metal weld pins shall be 12 gauge galvanized steel.

C. Metal stick pins shall be 12 gauge galvanized steel with perforated base plate.

D. Foil reinforced Kraft tape; 3" (75mm) wide shall be:
1. Compac; 122-2
2. Fasson; 0821
3. Venture; 1525 CW
4. 3M; 898
5. Nashua; FSK

E. Steel bands shall be 1/2" x 0.020" (13mm x 0.5mm) thick stainless steel.

F. Wire mesh shall be 1" (25mm) wide galvanized steel.

2.9 FIELD APPLIED COVERS AND JACKETING

A. Polyvinyl Chloride (PVC)
1. PVC fitting and valve covers shall be factory preformed for the shape used for.
2. PVC jacketing shall be cut and curled and sized for pipe installed on.
3. PVC installed on covers and jacketing shall have a minimum thickness of 20 mil.
4. PVC covers and jacketing shall be:
   a. Speedline Corp.
   b. Johns Manville; Zeston 2000 PVC
   c. Proto; PVC Covers

B. Aluminum
1. Aluminum jacketing shall be 0.016 inch (0.4mm) thick with smooth finish.

2. Aluminum fitting covers shall be 0.024 inch (0.6mm) thick with smooth finish.

C. Stainless Steel
1. Stainless steel jacket and fitting covers shall be 0.10 inch (2.5mm) thick with smooth finish.

D. P-trap, Waste and Lavatory Supplies
1. Covers shall be ADA approved under sink covers designed to fit 1-1/4" (32mm)and 1-1/2" (37mm) cast brass tubular p-traps and waste assemblies and 3/8" (9.5mm) or 1/2" (13mm) angle stop assemblies. Covers shall be molded closed cell vinyl, ASTM D635, with 1/8" (3mm) nominal wall thickness, and smooth antimicrobial white high gloss finish. Covers shall be secured with flush, reusable fasteners; covers on angle stop assemblies shall have locking access door. Assembly shall include covers for offset tailpiece, vertical tail piece, p-trap, waste arm, two stop valves, and two supply risers. Covers shall be:
a. Truebro; Model 103/103K
b. McGuire Mfg; Prowrap
c. Plumberex; Handy-Shield

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Do not apply insulation which has become wet.

B. Do not use staples for securing any insulation.

C. Apply insulation only on clean, dry surfaces.

D. Continue insulation through wall and ceiling openings and sleeves.

E. Provide continuous unbroken vapor seal on all cold surfaces where vapor jackets are used.

F. Insulate and vapor seal supports that are secured to cold surfaces to prevent condensation.

G. Do not insulate unions.

H. Fill pipe insulation protective saddles with same insulation as adjoining pipe insulation.

I. Perform work at ambient and equivalent temperatures as recommended by the adhesive manufacturer.

3.2 FOAMED PLASTIC PIPE INSULATION

A. Insulate the following:
1. All aboveground domestic cold water, hot water, and hot water recirculating lines.

B. Snap insulation around pipe and butt all joints together. Seal butt and longitudinal joints with insulation manufacturer's adhesive.

C. Insulate fittings, with mitered sections of pipe insulation. Seal all butt and longitudinal joints with insulation manufacturer's adhesive.

D. Insulate valves and couplings with oversized sections of pipe insulation. Seal all joints with manufacturer's adhesive.

3.3 FIBERGLAS BLANKET INSULATION

A. Insulate the following:

1. Underbodies of roof drains.

B. Wrap portions of roof drains described above with insulation. Overlap ends of insulation 2"(50mm) minimum. Overlap bottom of insulation at pipe connection to roof drain 3" (75mm) minimum. Adhere insulation to underbody of roof drain with 100% coverage of fire retardant adhesive. Tape all joints with pressure sensitive tape.

3.4 FIBERGLAS BOARD INSULATION TYPE 'D'

A. Insulate the following:
1. Domestic hot water generators

B. Cut insulation to fit contour of equipment. Secure in place with stainless steel bands.

C. Fill voids with insulating cement.

D. Provide welded pins and clips as anchors for wire mesh.

E. Over insulation, apply wire mesh. Stretch in place and secure by wiring anchors. Wire the edges together.

F. Finish surface with one coat of insulating cement.

3.5 P-TRAP WASTE AND SUPPLY COVERS

A. Covers shall be installed on handicapped lavatories in accordance with manufacturer’s instructions.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
1. Domestic Water Piping
2. Water Hammer Arrestors
3. Hydrants
4. Vacuum Breakers
5. Disinfecting

B. Description
1. Provide systems of domestic water piping and accessories so that every fixture and piece of water using equipment in the building will be furnished with a water supply.
2. Extend the domestic cold water service to point shown on the drawings.

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
1. Pipe standard compliance certificates.
2. Backflow preventers.

C. Operation and Maintenance Instructions: Data shall be provided for the following items:
1. Hose Bibbs
2. Hydrants
3. Vacuum Breakers
4. Backflow Preventers
5. Water Hammer Arrestors

1.4 QUALITY ASSURANCE

A. Standards
1. American National Standards Institute (ANSI):
   a. Standard B16.18, Cast Copper Alloy Solder-Joint Pressure Fittings.
   b. Standard B16.21, Non-Metallic Gaskets for Pipe Flanges.
   c. Standard B16.22, Wrought Copper and Bronze Solder-Joint Pressure Fittings.
   d. Standard B16.24, Bronze Flanges and Flanged Fittings, 150 and 300 Pound.
   e. Standard B31.1, Power Piping and Addendum.
2. American Society for Testing and Materials (ASTM):

a. Standard A307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
b. Standard B88, Specification for Seamless Copper Water Tube.

3. American Water Works Association (AWWA):
   a. Standard C104, Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water.
   b. Standard C110, Grey-Iron and Ductile-Iron Fittings, 3 inc. through 48 inc., for Water and Other Liquids.
   c. Standard C111, Rubber-Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings.
   d. Standard C151, Ductile-Iron Pipe, Centrifugally Cast In Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
4. Federal Specifications (Fed. Spec.):
   a. Specification BB-C-120B, Chlorine, Technical: Liquid.
   b. Specification WW-U-516C, Unions, Brass or Bronze, Threaded Pipe Connections, and Solder Joint Tube Connections.
5. Plumbing and Drainage Institute (PDI):
   a. Standard WH-201, Water Hammer Arrestors.

B. Qualifications of Manufacturer
   1. Pipe and fittings shall be manufactured in the United States.

C. Qualifications of Installers
   1. All welders employed for the work shall be qualified under the requirements of ANSI B31.1.0, Section 127.5. Certification of welders qualifications shall be submitted to the Engineer before any welds are made.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Pipe and fittings shall be as listed herein and shall be used on the services indicated.

B. Type "K" hard drawn copper tubing, ASTM B88, with soldered joints and wrought copper, ANSI B16.22, or cast bronze, ANSI B16.18, socket fittings for:
   1. Underground water service piping 3" (80 mm) in size and smaller to a point 1'-"0 above the finished floor.

C. Type "L" hard drawn copper tubing, ASTM B88, with soldered joints and wrought copper, ANSI B16.22, or cast bronze, ANSI B16.18, socket fittings for:
   1. Above-ground water piping.

2.2 WATER HAMMER ARRESTORS & AIR CHAMBERS

A. Water Hammer Arrestors:
   1. Arrestors shall have a stainless steel casing, flexible mechanical bellows, pressurized inert gas chamber, and certification stamp as conforming to PDI WH-201. Water hammer arrestors shall be:

J. R. Smith	"Hydrotrol" Series
Josam	"Absorbotron" Series

Wade	"Shokstop" Series
Zurn	"Shoktrol" Series
Amtrol	"Diatrol" Series
Watts	“SS” Series

B. Air Chambers
1. Air chambers shall be Type "L" copper tubing, 12" (305 mm) in length and one pipe size larger than the pipe on which it is installed.

2.3 DIELECTRIC ADAPTERS

A. Dielectric adapters shall be provided between copper and iron pipe connections and between ferrous and non-ferrous piping or equipment. Refer to Section 221119 DOMESTIC WATER PIPING SPECIALTIES.

2.4 UNIONS

A. Unions in copper tubing shall be cast bronze, Fed. Spec. WW-U-516C, with threaded or solder joint ends to match pipe connections.

B. Unions between ferrous and non-ferrous piping shall be dielectric type as specified hereinbefore under Dielectric Adapters.

2.5 NON-FREEZE WALL HYDRANTS (NFWH)

A. NFWH shall be 3/4" (20 mm) non-freeze type with bronze casing and body, nickel bronze face, and loose key. The box shall be deep enough to accommodate a vacuum breaker. Hydrants shall be:

	Non-Freeze
J. R. Smith	5509, QT-VB
Josam	71150
Wade	W-8606-1
Zurn	Z-1305
Watts	HY-725

2.6 VACUUM BREAKERS

A. Vacuum breakers shall be the screw on vandal proof type with finish to match outlet finish - (i.e. chrome plated vacuum breakers on chrome plated hose outlets). Vacuum breakers shall be:

Watts	8A
A. W. Cash	VB101
Nidel	34HD

PART 3 - EXECUTION

3.1 INSTALLATION

A. A union or flange shall be provided at all piping connections to equipment.

B. Faucets, flush valves, and shower heads shall be cleaned or dirt and debris.

C. Changes in pipe size shall be made with reducing fittings. No bushings will be allowed.

D. Underground water piping shall have a minimum cover of 3'- 0" to the top of the pipe.

E. Install water hammer arrestors on the hot and cold water branch lines serving a battery of fixtures; on the cold water branch lines serving individual flush valve water closets and urinals; and elsewhere as indicated on the drawings. All water hammer arrestors shall have a wall access panel adjacent to the shock absorber for repair purposes. See architectural drawings and specifications for access panels.

F. Install air chambers on the hot and cold water branch lines to all fixtures not provided with water hammer arrestors. Individual fixtures in a battery of fixtures with a water hammer arrestors on the supply line will not require an air chamber.

G. Vacuum breakers shall be provided on all hose outlets unless the drawings indicate that a backflow preventer is to be provided on the piping serving the outlet.

H. The atmospheric relief from backflow preventers shall be piped through a fixed air gap to [a floor drain] [6" (150 mm) above the floor].

I. Underground piping from trap primer to floor drains shall be installed without fittings.

3.2 JOINTS

A. Threaded joints shall be made up with a mixture of graphite and oil applied to male threads only. After cutting but prior to threading, pipe shall be reamed and shall have burrs removed.

B. Solder joints shall be made using a 95-5 tin-antimony solder with a compatible flux.

C. Flanged joints shall be made with ring type non-metallic gaskets, bolts, and nuts.

D. At contractors option, tee branches in aboveground copper tubing may be made using the T-drill method. Joint between main and branch tubing shall be sealed using a BCup-5 brazing alloy with a compatible flux.

E. ProPress Fittings and joints are an approved system.

3.3 ADJUSTING

A. Adjust and balance all water systems to obtain operating flows at all fixtures and water using equipment.

3.4 DISINFECTION

A. All domestic water service and supply piping installed under this DIVISION shall be disinfected with chlorine before it is placed into operation. The chlorinating material shall be liquid chlorine conforming to Fed. Spec. BB-C-120 and shall be introduced to the system by experienced operators only. The chlorine solution applied to the piping sections or system shall contain at least fifty parts per million of available chlorine and shall remain in the sections or system for a period of not less than sixteen (16) hours. During the disinfection period all valves shall be opened and closed at least four times. After the disinfection period the chlorinated water shall be flushed from the system with clear water until the residual chlorine content is not greater than two-tenths - (0.2) - parts per million. The Contractor shall submit to the Architect written certification that the system was disinfected. Certification shall include name of project, name of owner, name of operators, date of disinfection, times of disinfection period, maximum chlorine level, and residual chlorine level.

END OF SECTION

SECTION 22 13 16 - SANITARY, WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Work Included
   1. Piping

B. Description
   1. Provide a system of sanitary, waste, and vent piping including extension from the building to point shown on the drawings.

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

1.4 QUALITY ASSURANCE

A. Standards
   1. American National Standards Institute (ANSI):
      a. Standard B16.3, Malleable Iron Threaded Fittings.
      b. Standard B16.5, Steel Pipe Flanges and Flanged Fittings.
      c. Standard B16.12, Cast-Iron Threaded Drainage Fittings.
      d. Standard B16.18, Cast Copper and Bronze Solder-Joint Pressure Fittings.
      e. Standard B16.21, Non-Metallic Gaskets for Pipe Flanges.
      f. Standard B16.22, Wrought Copper and Bronze Solder-Joint Pressure Fittings.
   2. American Society for Testing and Materials (ASTM):
      a. Standard A74, Cast Iron Soil Pipe and Fittings.
      b. Standard A120, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
      c. Standard A234, Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
      d. Standard A307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
      e. Standard B43, Specification for Seamless Red Brass Pipe, Standard Sizes.
      f. Standard B88, Specification for Seamless Copper Water Tube.
      g. Standard B306, Specification for Copper Drainage Tube.
      h. Standard C444, Specification for Perforated Concrete Pipe.
      i. Standard C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
      j. Standard C599, Specification for Process Glass Pipe and Fittings.

k. Standard D1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
l. Standard D2146, Specification for Propylene Plastic Molding and Extrusion Materials.

B. Qualifications of Manufacturer
1. Pipe and fittings shall be of domestic manufacturer.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe and fittings shall be as listed herein and shall be used for the services indicated.

B. Schedule 40 PVC pipe with solvent glue on joints for underground piping.

C. Service weight cast iron soil pipe and fittings, ASTM A74, with gasketed modified hub and spigot joints, ASTM C564, for:
1. Aboveground sanitary, waste, and vent piping 6" (150 mm) in size and larger.

D. Service weight cast iron soil pipe and fittings, ASTM A74, with no-hub coupling joints for:
1. Aboveground sanitary, waste, and vent piping 2" (50 mm) to 5" (127 mm) in size.

E. Type 'L' hard drawn copper tubing, ASTM B88, with soldered joints and wrought copper, ANSI B16.22, or cast bronze, ANSI B16.18, socket fittings for:
1. All waste piping 1" (25 mm) in size and smaller.

2.2 NO-HUB COUPLINGS

A. Couplings shall consist of a type 304 stainless steel housing with multiple draw bands and screw clamps plus an elastomeric neoprene gasket conforming to ASTM C-564. Housings shall be three-inch wide for pipe sizes 4-inch and smaller and four-inch wide for pipe sizes larger than 4 inches (100 mm). Housings 0.016-inch thick shall have four screw clamps on pipe sizes 4-inch (100 mm) and smaller and six screw clamps on pipe sizes larger than 4 inches (100 mm). Housings 0.024 inch (0.6 mm) thick shall have two screw clamps on pipe sizes 4-inch (100 mm) and smaller and four screw clamps on pipe sizes larger than 4 inches (100 mm). Couplings shall be:

Aneheim Foundry	Husky HD-4000
Clamp-All Corporation	Clamp-All]

2.3 FLANGES

A. Flanges in steel pipe shall be 150 pound (1035 kPa) steel, ANSI B16.5, slip-on type welding flange with raised or flat face to mate with adjacent flanges, valve, fitting, or piece of equipment.

B. Flange gaskets shall be 1/16-inch (1.6 mm) non-metallic, ring type, ANSI B16.21.

C. Flange bolts shall be carbon steel, all threaded type. Nuts shall be carbon steel hexagon type. Steel for bolts and nuts shall conform to ASTM A307, Grade A.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Horizontal soil and waste piping 2-1/2 inches (65 mm) in size and smaller shall be sloped at a minimum of 1/4 inch per foot (1mm per 48 mm). Horizontal soil and waste piping 3 inches (76 mm) in size and larger shall be sloped at a minimum of 1/8 inch per foot (1 mm per 96mm)

B. Horizontal vent branches shall be kept above the highest fixture served by the vent branch in order to preclude the possibility of vents being used as waste pipes. Horizontal vent branches shall be sloped to prevent the accumulation of water or scale therein.

C. On soil, waste and vent piping changes in pipe size shall be made with reducing fittings and changes in pipe direction shall be made with fittings. No bushings will be allowed.

D. During construction all pipe openings, not being worked on, shall be plugged or capped to prevent foreign objects from entering system.

3.2 JOINTS

A. Solvent glued joints in PVC pipe shall be made with solvent primer and glue according to the manufacturer’s requirements.

B. Gasketed joints for cast iron pipe shall be made with lubricated neoprene compression gaskets.

C. Clamped joints for hubless cast iron pipe shall be made with bolted stainless steel clamps and neoprene gasket. Clamps shall be tightened by alternately tightening screws to 60 in. lb. torque.

D. Soldered joints for type 'L' copper tubing and cast DMV bronze pipe shall be made with 50-50 tin-lead solder and a compatible flux.

3.3 FLASHING

A. Vent pipes (in metal roofs) shall be flashed and made watertight at the roof with the same metal as the roof itself. The flashing shall extend not less than 8 inches (200 mm) from the vent pipe in all directions and soldered to the roof. The flashing shall be turned down into the vent pipe a minimum of 1 inch. (25 mm)

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALITIES

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 DESCRIPTION

A. Work Included
   1. Drains
   2. Cleanouts
   3. Traps

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
   1. Drains
   2. Interceptors
   3. Neutralization Basins

1.4 QUALITY ASSURANCE

A. Standards
   1. American National Standards Institute (ANSI):
      a. Standard B16.3, Malleable Iron Threaded Fittings.
      b. Standard B16.5, Steel Pipe Flanges and Flanged Fittings.
      c. Standard B16.12, Cast-Iron Threaded Drainage Fittings.
      d. Standard B16.18, Cast Copper and Bronze Solder-Joint Pressure Fittings.
      e. Standard B16.21, Non-Metallic Gaskets for Pipe Flanges.
      f. Standard B16.22, Wrought Copper and Bronze Solder-Joint Pressure Fittings.
   2. American Society for Testing and Materials (ASTM):
      a. Standard A74, Cast Iron Soil Pipe and Fittings.
      b. Standard A120, Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
      c. Standard A234, Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
      d. Standard A307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
      e. Standard B43, Specification for Seamless Red Brass Pipe, Standard Sizes.
      f. Standard B88, Specification for Seamless Copper Water Tube.
      g. Standard B306, Specification for Copper Drainage Tube.

h. Standard C444, Specification for Perforated Concrete Pipe.
i. Standard C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
j. Standard C599, Specification for Process Glass Pipe and Fittings.
k. Standard D1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
l. Standard D2146, Specification for Propylene Plastic Molding and Extrusion Materials.

B. Qualifications of Manufacturer
1. Pipe and fittings shall be of domestic manufacturer.

PART 2 - PRODUCTS

2.1 DRAINS

A. Drains marked "A" on the drawings (for toilets and general use) shall have a cast iron body with adjustable 5" (127 mm) square nickel bronze strainer and flashing flange. Drains shall be:

	Hub & Spigot	No-Hub
J. R. Smith	2110	2005-B
Josam	30000-S	30000-Z-S
Wade	W-1100-G-IC	W-1100-G-NH
Zurn	ZN-415-Y	ZN-415-Y
Watts	FD-100-M5	

2.2 CLEANOUTS

A. Cleanouts shall be provided where shown on the drawings and shall be the same size as the pipe on which installed except cleanouts on underground piping shall be a maximum of 4"(100 mm).

B. Cleanouts in waterproofed floors shall have flashing clamp.

C. For masonry walls: Cleanout shall be countersunk bronze plug tapped for machine screw, tapered threads, shallow stainless steel face-of-wall access cover, and vandalproof securing screw. Cleanout shall be inserted into tapped cast iron cleanout tee. Cleanout shall be:

	Hub & Spigot	No-Hub
J. R. Smith	4472	4472
Josam	58890	58890
Wade	W-8470-R-75	W-8470-R-75
Zurn	Z-1460-8	Z-1460-8
Watts	CO-590-RA	

D. For concrete floors: Cleanouts shall have cast iron body, adjustable round scoriated nickel bronze cover and rim, vandalproof securing screw, and countersunk bronze plug with taper threads. Cleanout shall be:

	Hub & Spigot	No-Hub

J. R. Smith	4028-U	4023
Josam	56000	56010
Wade	W-6010/W-7040	W-6000/W-7030
Zurn	ZN-1405-2	ZN-1400-2
Watts	CO-200-R	

E. For cleanouts to grade: Cleanout shall have cast iron ferrule and countersunk bronze plug with taper threads. Where not in paved areas, cleanouts shall be set in a 12" (305 mm) x 12" (305 mm) x 6" (152 mm) deep poured concrete pad set flush with grade. Cleanout shall be:

J. R. Smith	4400
Josam	58500
Wade	WL-8550-S
Zurn	Z-1440
Watts	CO-380

2.3 TRAPS

A. Traps other than those furnished as a part of the plumbing fixture, shall be of the same material and size as the pipe into which they discharge, unless specified otherwise hereinafter. Where not underground, traps shall be provided with cleanout plugs on the bottom.

PART 3 - EXECUTION

3.1 INSTALLATION

A. During construction all pipe openings, not being worked on, shall be plugged or capped to prevent foreign objects from entering system.

B. Floor drains shall be set flush with the floor at the low points designated on the architectural drawings.

C. Cleanouts on underground drainage shall have piping extended to the floor and finished with cleanout plug and removable floor plate.

D. Cleanouts in vertical piping shall be roughed with centerline not more than 1'-6" (460 mm) above the finished floor, but high enough to clear the baseboard.

END OF SECTION

SECTION 22 33 00 -ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Water Heaters
   2. Circulating Pumps
   3. Temperature Control Valves

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
   1. Water Heaters
   2. Circulating Pumps

C. Operation and Maintenance Instructions: Data shall be provided for the following items:
   1. Water Heaters
   2. Circulating Pumps

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society of Heating, Refrigeration, Air Conditioning Engineers (ASHRAE):
      a. Standard 90A, Energy Conservation in New Building Design, 1980 Edition.
   2. American Society of Mechanical Engineers (ASME):
      a. Boiler and Pressure Vessel Code, Section IV Low-Pressure, Heating Boilers.
      b. Boiler and Pressure Vessel Code, Section VIII - Unfired Pressure Vessels.
   3. Military Specifications (Mil. Spec.):
      a. Specification T-12295E, Tanks, Potable Hot Water Storage.

PART 2 - PRODUCTS

2.1 WATER HEATERS

A. Type 'I' water heater shall be the vertical electric design with factory insulated steel tank, enameled steel jacket, two immersion elements, anode rod, thermostats, high temperature

cut-off, and dip tube. The tank shall be glass lined and designed for at least 150 psi (1034 kPa) working pressure. Insulation between tank and jacket shall be polyurethane foam or high density fiberglass blanket. The heating elements shall be tin coated, copper sheath type with a maximum of 80 watts per square inch at the voltage indicated on the drawings. Elements shall be wired for non-simultaneous operation. The water heater shall be Underwriters' Laboratories listed and shall meet the requirements of ASHRAE 90 for energy conservation. The water heater shall be 'lowboy' type. The water heaters shall carry a [three year commercial] [ten year residential] warranty. Water heater shall be:

A. O. Smith DEL Series

B. Refer to the drawings for capacities and electrical characteristics of water heaters.

C. Water heaters shall be provided with all openings for specified and detailed accessories.

D. Where heater storage volume is 120 gallons (454 Liters) or greater, tank shall be constructed in accordance with ASME Code Section IV for 125 psig (860 kPa) working pressure.

2.2 TEMPERATURE AND PRESSURE RELIEF VALVES

A. Temperature, pressure, and combination relief valves, if not factory installed, shall be automatic type with bronze body, threaded ends and manual test level. The temperature relief setting shall be 210°F (99°C) and the pressure relief setting shall be equal to the water heater tank working pressure. Relief valves shall be:

Watts
A. W. Cash
Robert Shaw

2.3 HOT WATER TEMPERATURE MAINTENANCE SYSTEM

A. Furnish and install a complete UL listed system of a single electric self-regulating heating cable and components for maintaining domestic hot temperatures at a selected temperatures of 115 ° F (46°C) and 140 °F (60°C).
   1. The self-regulating heater shall consist of
      a. two (2) 16 AWG nickel-coated copper bus wires embedded in
      b. a radiation cross-linked semi-conductive polymer core covered by (NON-CROSSLINKED CORES WILL NOT BE ACCEPTED)
      c. a radiation cross-linked modified polyolefin dielectric jacket which is covered by (NON-CROSS-LINKED JACKETS WILL NOT BE ACCEPTED)
      d. a polymer-coated aluminum wrap, and enclosed in a tinned copper braid of 14 AWG equivalent wire size. The braid shall be covered with a (nominal) 40-mil polyolefin outer jacket, color coded for easy identification.
   2. Operating temperatures: The systems shall maintain a nominal temperature of 115 °F (46°C) or 140 °F (60°C), at 208 volts, without the use of thermostats or transformers.
   3. Power control: The power of the heating cable shall increase with decreasing temperature at a rate of more than .05 watts/ft- °F. over the temperature control range.
   4. Long term thermal stability (as determined by accelerated testing): The power retention of the heating cable shall be at least 90% after 300 cycles between 50 °F (10 °C) and 212 ° F (100°C).
   5. High temperature ignition: The heater shall not overheat and burn when powered at 208 volts and exposed to 400 °F (204°C). in an oven for 30 minutes.

6. The system shall be installed according to the Contract Documents and the manufacturer's instructions.

B. Testing
1. Procedure: Measure the insulation resistance between the braid and either bus wire of each circuit with a 2500 volt d.c. megohmeter (megger).
2. Timing: The tests should be performed after the pipe insulation has been installed and prior to installation of wall or ceiling panels, and shall be witnessed by the Architect and the manufacturer's representative.
3. Acceptable results: The megger readings should be at least 20 megohms regardless of heater length. Circuits yielding unacceptable readings must be repaired or replaced.
4. Submittal of results: Submit records of the test data to the Architect.

C. Manufacturer
1. The manufacturer shall have five years experience with self-regulating heaters in the domestic hot water temperature maintenance application.
2. The manufacturer shall submit the names, locations, and telephone numbers of five projects that have used their products for domestic hot water temperature maintenance for five years or more. Each project shall involve at least 2000 feet (610 m) of heating.
3. The products shall be [Raychem HWAT-G2(115°F. (46°C))] or [HWAT-R2(140°F. (60° C))] or as manufactured by Thermon.
4. The manufactured shall after a ten year extended warranty of the heating cable system.

D. System Design Procedure
1. The design procedure submitted by the manufacturer must be the standard design procedure for the products submitted. This design procedure must have been in use for three years or more.
2. Each hot water system shall be temperature maintained using only one product. A chart which indicates the product for each temperature and the acceptable pipe sizes and insulation thicknesses will be submitted by the manufacturer (CALCULATION OF THE PIPE HEAT LOSS BY THE USER FOLLOWED BY PRODUCT SELECTION IS NOT AN ACCEPTABLE DESIGN PROCEDURE).
3. Temperatures must be maintained with straight runs of heating cable on the pipe. Spiralling will not be accepted.

E. Installation Responsibilities
1. The contractor shall insure that the hot water piping has been installed and pressure tested or checked for leaks before installing the heating cable.
2. Installer shall provide shop drawing diagrams of the tracing installation which shall include locations of all power connections, end seals, access test points, splices, tee splices, identification of heater circuits and risers, and identification of circuit breakers.
3. All power connections, access test points, and end seals shall be accessible and shall be clearly and permanently labeled with the circuit number.
4. The installer shall be responsible for affixing an "Electric Traced" label to the outside of the pipe's thermal insulation on alternating sides at intervals of five to fifteen feet immediately after the piping has been insulated.
5. The installing contractor shall be responsible for providing instruction to all those under his direction on installation of tracing in accordance with the manufacturer's recommendations.
6. Assembly of all splices, tees, power connections, and end seals, shall be performed in strict accordance with the manufacturer's recommendations using only components supplied by the heating cable manufacturer. Failure to adhere to the above may void the warranty and/or the UL listing of the heater.

7. If modification or other work on the hot water piping is required after the heating cable has been installed, the contractor shall remove the heating cable from the pipe in this area as indicated in the installation instructions before proceeding. The contractor is responsible for instructing all those under his direction in the proper work procedures involving previously traced piping.
8. Contractor shall coordinate start-up of completed system with the manufacturer's representative.
9. Contractor shall complete warranty card, return to manufacturer and provide a copy of the Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water heaters shall be installed on a holdrite water heater wall support and piped as indicated on the drawings.

B. Temperature control valves shall be installed in accordance with manufacturers requirements.

C. Temperature, pressure, and combination relief valves shall have discharge piped full size to drain.

END OF SECTION

SECTION 22 40 00-PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1. Plumbing Fixtures
2. Fixture Trim
3. Chair Carriers

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 220500 COMMON WORK RESULTS FOR PLUMBING.

B. Product Data: Data shall be submitted on the following items:
1. Plumbing Fixtures
2. Fixture Trim
3. Chair Carriers

C. Operation and Maintenance Instructions: Data shall be provided for the following items:
1. Flush Valves

1.4 QUALITY ASSURANCE

A. Standards
1. Air-Conditioning and Refrigeration Institute (ARI):
a. Standard 1010, Standard for Drinking Fountains and Self-Contained, Mechanically-Refrigerated Drinking Water Coolers, Annual Edition.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless specified otherwise hereinafter, furnish, set, and connect all fixtures and supports.

B. All fixtures, except for special types, shall be the product of the same manufacturer.

C. All vitreous china fixtures shall be white.

D. The nipple connecting the cold water supply to the exposed flush valves shall be chrome plated IPS brass pipe.

E. All exposed waste and supply piping shall be chrome plated.

2.2 FIXTURES

A. Water Closets

1. Water Closed 'P-1': shall be a floor mounted, floor outlet, vitreous china, siphon jet water closet with elongated bowl (designed for a 1.28 GPM flush cycle), 1-1/2" [op spud, floor bolts, bolt caps, and outlet gasket. The water closet shall be fitted with an open front seat without cover and 1-1/2" (40 mm) (11-1/2" (292 mm) roughing) flush valve with wall brace. Water closet shall be:

	AM. STD.	KOHLER	SLOAN	ZURN
[top]	Madera	Wellcomme		
	2221.018*	K-4250-ET*	ST-2009	Z-5654

2. Water Closet 'P-1A': shall be a floor mounted, floor outlet, vitreous china, siphon jet water closet with elongated bowl (designed for a 1.28 GPM flush cycle), 1-1/2" (40 mm) top spud, floor bolts, bolt caps and outlet gasket. The water closet shall be fitted with an open front seat without cover and a 1-1/2" (40 mm) (11-1/2" (292 mm) roughing) flush valve. Water closet shall be:

AM. STD.	KOHLER	SLOAN	ZURN
Cadet	Highcliff		
3043001	K-96057	ST-2029	Z-5665

B. URINALS

1. Urinal 'P-2 & P-2A': shall be a wall hung, vitreous china, siphon jet urinal with extended basin (minimum 13" (330 mm) to wall), 2" (51 mm) outlet, 1-1/2" (40 mm) top spud, and wall hangers. The urinal shall be fitted with a 1-1/2" (40 mm) (11-1/2" (292 mm) roughing) flush valve and backplate. Urinal shall be:

AM. STD.	KOHLER	SLOAN	ZURN
Allbrook	Dexter		
6550.001	K-5016ET .5/1GPM K5452/.125 GPF		Z-5730

C. Lavatories

1. Lavatory 'P-3': shall be a countertop, nominal 20" x 17" (432 mm) oval vitreous china, self rimming lavatory punched for 4" (100 mm) centers. The lavatory shall be fitted with centerset faucet with wrist handles, perforated grid drain, 1-1/4" (32 mm) cast brass P-trap, and loose key angle supplies. Lavatory shall be:

	AM. STD.	KOHLER	SLOAN	ZURN
	Aqualyn	Pennington		
(4")	0476.028	K-2196-4	SS-3002	Z-5114

D. Service Sinks

1. Mop Basin 'P-4': shall be a 24" (610 mm) x 24" (610 mm) precast terrazzo mop basin with 12 inch high sides, integral 3 inch (80 mm) chrome plated dome drain, and integral stainless steel bumper guards. The mop basin shall be fitted with a chrome plated faucet with vacuum breaker, hose, and hose bracket. Mop basin shall be:

FIAT	STERN-WILLIAMS

Basin	TSB	SB
Faucet	830-AA	T-15-VB
Hose & Bracket	832-AA	T-35

E. Electric Water Coolers
1. Electric Water Cooler 'P-5': Shall be an outdoor wall mount, ADA, freeze-resistant and vandal-resistant water cooler. The water cooler shall be a HAWS 1109FR model water cooler.
2. Electric Water Cooler 'P-5A': Shall be an outdoor wall mount, ADA, freeze-resistant and vandal-resistant water cooler with bottle filler. The water cooler shall be a HAWS 1109FRP model water cooler.

2.3 FIXTURE TRIM

A. Water Closet Seats
1. Seat for fixture(s) 'P-1 & P-1A': shall be open front type without cover for elongated bowl. Seat shall be solid molded plastic with self-sustaining check hinge. The hinge shall be stainless steel with molded plastic casing. Water closet seat shall be:

CHURCH	BENEKE	SPERZEL	BEMIS
5320.536	527 SS/CH-HPSS	150 W/CH	1655-SS/C

B. Flush Valves
1. Flush valve for fixture(s) 'P-1, P-1A, P-2 & P-2A': shall be exposed diaphragm actuated type with chrome plated exterior, screwdriver angle stop, protective cap on stop, nonhold open handle, vacuum breaker, adjustable tailpiece [, flow control as indicated], and cast brass escutcheon with setscrew. Flush valve shall be:

	AM STD	SLOAN Royal	ZURN
For 1-1/2" (40 mm) top spud:			
		1.28GPF	
11-1/2" (292 mm) roughing	6147.121.002	111-1.28	Z60000 AV-HET
24" (610 mm) roughing	6147.122.002	115-1.28	Z6017 AV-HET
For 1-1/2" (40 mm) back spud:			
11-1/2" (292 mm) roughing 24" (610 mm) roughing		120-1.28	Z6010-AV-HET
For 1-1/4" (32 mm) top spud: 1GPF		122-1.6	
11-1/2" (292 mm) roughing		180-1.0	X6003-AV
For ¾" (20 mm) top spud:			
.125	6145.013.00L		-ULF
.50	6145.051.002	186-.05	-EWS
1GPM	6145.101.002	186-.0125	-WS1

11-1/2" (292 mm) roughing

C. Faucets
1. Lavatory Faucets:
a. Faucet for fixture(s) 'P-3 ': shall be centerset type with chrome plated brass body, 4" (100 mm) wrist handles, 2.5 GPM flow restricting aerator, and 1-1/4" (32 mm) [perforated grid] [pop-up] drain. Faucet shall be:

	AM. STD.	KOHLER
1.5GPM grid	5500.170	K-7404-5A
pop-up		7401-5A
.5GPM		

	CHICAGO	SPEAKMAN	T & S BRASS
grid	802-VE2805-317		B-0890-F05
pop-up			B-0891-F05
grid			
pop-up			

D. Drains
1. Lavatory Drains:
a. Perforated grid drain shall be chrome plated brass with integral grid and 1-1/4 inch (32 mm) tailpiece. Drain shall be:

AM. STD.	KOHLER	CRANE	ELJER
2411.015	K-7715	C-1065-G	803-0552

b. Perforated grid off-set drain (for handicapped lavatory) shall be chrome plated brass with integral grid and 1-1/4 inch (32 mm) off-set tailpiece. Drain shall be:

AM. STD.	KOHLER	CRANE	ELJER
7723.018	K-13885	CH8053	803-0530

2. Service Sink Drains:
a. Perforated grid drain (for service sink) shall be as specified hereinafter under traps.
b. Perforated grid drain (wash sink) shall be chrome plated brass with integral grid and 1-1/2" (40 mm) tailpiece. Drain shall be:

	AM. STD.	KOHLER	ELJER
3-1/2" (89 mm)	4311.023	K-8807	803-0570
2" (50 mm)		4362.026	

E. Traps
1. P-traps shall be chrome plated cast brass with adjustable outlet, slip joints, cleanout plug, extension to wall, and [cast brass] escutcheon [with setscrew]. P-trap shall be:

McGUIRE	KOHLER	CRANE	ELJER

cast esc.	1-1/4" (32 mm) 8872 w/127	K-9000 mod.	8-5260 mod.	804-1180 mod.
	1-1/4" (32 mm) 8872	K-9000	8-5260	804-1180
cast esc.	1-1/2" (40 mm) 8912 w/127	K-9000 mod.	8-5260 mod.	804-1190 mod.
	1-1/2" (40 mm) 8912	K-9000	8-5260	804-1190

2. P-trap (for electric water coolers and drinking foutains) shall be chrome plated cast brass with adjustable outlet, slip joints, and cleanout plug. P-trap shall be:

	McGUIRE	KOHLER	CRANE	ELJER
1-1/4"	8088	K-9004	8-5272	804-1100
1-1/2"	8089	K-9004	8-5272	804-1110

3. P-trap standard shall be cast iron with acid resisting enameled interior, exterior painted black, chrome plated brass strainer, 3" (80 mm) outlet, cleanout plug, and adjustable floor stanchion. Trap standard shall be:

AM. STD.	KOHLER	CRANE	ELJER
7798.176	K-6673	7-620	804-1060

F. Continuous Wastes

1. Continuous waste shall be chrome plated brass with slip joints. Continuous waste shall be:

	JUST	ELKAY
2 comp.	J53S	LK-53
3 comp.	J60S	----

G. Supplies

1. Loose key angle supply shall be chrome plated brass with 3/8 inch (9.5 mm) angle stop, flexible riser, extension to wall, and cast brass escutcheon with setscrew. Supply shall be:

BRASS				
	CRAFT	KOHLER	CRANE	ELJER
rigid/cast	S3601/CE	K-7601 mod.	8-5001 mod.	802-0315 mod.
rigid	S3601	K-7601	8-5001	802-0315
flex/cast	S1512A/CE	K-7607 mod.	8-5003 mod.	802-0325 mod.
flex.	S1512A	K-7607	8-5003	802-0325

2. Loose key angle supply (for water closet) shall be chrome plated brass with 3/8 inch (9.5 mm) angle stop, flexible riser, extension to wall, and cast brass escutcheon with setscrew. Supply shall be:

BRASS				
	CRAFT	KOHLER	CRANE	ELJER
rigid cast	S3561W/CE	K-7630	----	802-0215 mod.
rigid	S3651	K-7630	----	802-0215
flex. cast	S1512DL/CE	K-7639 mod.	8-5426 mod.	802-0235 mod.
flex.	S1512DL	K-7639	8-5426	802-0235

3. Provide three keys for each size and type of loose key stop.

2.4 CHAIR CARRIER SUPPORTS

A. All fixtures specified to have chair carriers shall be provided with floor mounted fixture carriers.

B. Carriers shall be the commercial type and shall be the standard manufacturers catalogued carrier for the make and model of the plumbing fixture being furnished. All materials, unless otherwise specified herein, shall be manufacturer's standard material. All concealed portions shall have the manufacturers standard finish. Wherever supporting arms of brackets are exposed, they shall have a porcelain enameled baked on finish in a color to match the fixture.

C. Carriers shall have block feet. No support, unless otherwise specified herein or on drawings, shall depend on the wall construction or piping to prevent movement.

D. All adjustments on carriers shall have set screws or some other type locking device to secure carrier when it is positioned.

E. Carriers for urinals shall have vertical uprights with cross tie bar at the bottom and upper and lower bearing plates, both vertically adjustable.

F. Carriers shall be J. R. Smith, Josam, Wade or Zurn manufacturer.

G. Carriers for water coolers shall be manufacturer’s recommendation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All spaces between fixtures and walls or floors shall be sealed with a white non-hardening caulking compound.

B. Chrome plated piping, valves, and fittings shall be installed using padded wrenches. An application of petroleum jelly shall be applied to all exposed surfaces after installation.

C. All fixtures and trim shall be set level and straight. Waste traps and supplies shall be installed perpendicular to walls.

D. After flush valves have been connected and fixtures tested, adjust valves to provide the minimum water flow required to clean the fixture.

E. Concealed support brackets, hangers, and plates, if not factory prime painted, shall have a field applied prime coat of paint before concealing.

F. Fixture mounting height shall be as indicated on the drawings.

G. Surfaces and structures to, and on, which plumbing fixtures will be mounted shall be inspected by the contractor before installation of fixtures begins, surfaces and structures shall be capable of supporting the fixtures. Surfaces which will be concealed by plumbing fixtures shall be finished before fixtures are installed.

H. Chair carriers shall be bolted to floor slab with concrete anchors. All bolt holes shall be used.

END OF SECTION

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
1. Submittals
2. Electrical Requirements
3. Excavation & Backfilling
4. Painting
5. Cleaning
6. Testing

1.3 SUBMITTALS

A. The Contractor shall submit for review by the Architect data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, catalogs, cuts, diagrams, performance curves, and charts published by the manufacturer to show conformance to specification and drawing requirements; model numbers alone will not be acceptable.

B. Refer to the individual sections for identified equipment and materials for which submittals are required.

C. Refer to the SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Section for required procedures.

D. Product Data Preparation: Product submittals shall be made by specification section. All items of a section, requiring submission, shall be submitted together at one time in a tabbed binder. If two or more sections require inter-coordination, (e.g. Air Handling Unit and Vibration Isolation or Air Handling Unit and Condensing Unit) they shall be submitted at the same time. Each individual submittal item within a binder shall be marked to show paragraph number which pertains to the item. Binders for mechanical submittals shall be color coded - Black for HVAC. Binders shall be labeled on outside with project name, contractors name, date of submission, and specification section and number. Binders shall also have a tab indicating submittal number and specification section number. If product submittals for section exceed the capacity of one binder, two or more binders shall be used. In addition to above, a notation cover shall indicate the number of binders for the section and the number of that binder (i.e., 2 of 3). Section binders shall be report cover type with solid cover and 3 metal fasteners or 3-ring type. Report cover binders shall be Duo-Tang Series L2-53558 or approved equal. Electronic submittals shall also be acceptable.

E. Mechanical Equipment Electrical Data
1. Prior to submitting data for equipment requiring electrical service, the Contractor shall verify that electrical characteristics of equipment submittals comply with electrical service provided for the specified items of equipment.
2. Upon receipt by the Contractor of reviewed submittals for equipment provided under this Division, the Contractor shall coordinate the electrical service requirements, i.e., motor horsepower and full load amps, electrical service characteristics (voltage and phase), and number of services for each item of equipment requiring electrical connections with the electrical drawings and specifications. The Contractor shall furnish to the Architect a

complete typewritten list of electrical requirements for each item of equipment to be installed.

F. Items on or projecting through the ceiling shall be coordinated with other items.

1.4 QUALITY ASSURANCE

A. The mechanical equipment and installation shall conform to the following codes:
   1. The International Building Code 2021 Edition with South Carolina Modifications.
   2. The International Residential Code 2021 Edition with South Carolina Modifications.
   3. The International Mechanical Code 2021 Edition with South Carolina Modifications.
   4. The International Gas Code, 2021 Edition with South Carolina Modifications.
   5. The International Energy Conservation Code, 2009 Edition with South Carolina Modifications.
   6. National Electrical Code, 2020 Edition with South Carolina Modifications.

B. The mechanical equipment and installation shall conform to the following standards:
   1. Associated Air Balance Council (AABC):
      a. National Standard for Total System Balance.
   2. National Fire Protection Association (NFPA):
      a. Standard 70, National Electric Code.
      b. Standard 90A, Installation of Air Conditioning and Ventilating Systems.
      c. Standard 101, Life Safety Code.

C. Publication Dates: Where the date of issue of a Reference Standard is not specified, comply with the Standard is effective as of Date of Contract Document.

D. Permits
   1. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

E. Workmanship and Materials
   1. The workmanship and materials covered by these specifications shall conform to all ordinances and regulations of the city, county and/or other authorities having jurisdiction.

1.5 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for Detail Requirements.

B. Printed Material: Provide required printed material for binding in operation and maintenance manuals.
   1. Refer to the individual sections for identified equipment for which material is to be provided.
   2. The Operations and Maintenance Manual shall include a section for certifications and project warranty data. Refer to individual sections for certifications. Warranties for equipment shall be included in the equipment section of the Operation and Maintenance Manual.

C. The Manuals shall be a 3 ring binder with tabs for each item listed in specifications. The manuals shall be submitted to the Architect for approval 30 days prior to instruction of Owner personnel. The manual shall include the following items:
   1. Parts list
   2. Lubrication requirements
   3. Preventative maintenance requirements
   4. Name, address, and telephone numbers for supplier of equipment.

D. Instructions of Owner personnel:
   1. Before final inspection, at a time designated by the Architect, provide a competent representative to instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems under this division of the specifications. For equipment requiring seasonal operation, perform instructions for other seasons within six months unless requested otherwise.
   2. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
   3. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.
   4. [The instructional demo shall be video taped. The tape shall list project, time, date, Contractor and personnel involved.]

1.6 SPARE PARTS

A. The Contractor shall prepare a typed written list of spare parts or equipment to be turned over to the Owner. The list shall indicate the equipment the parts are for, model numbers and quantity of parts. Refer to individual sections for the spare parts or equipment required by these specifications.

1.7 RECORD DOCUMENTS

A. Refer to Division 1 for record documents and related submittals.

1.8 CONTRACT DRAWINGS

A. Drawings are diagrammatic and indicate general arrangement of systems and work. Provide offsets, transitions, and fittings to coordinate the work of each trade with that of other trades, including HVAC, plumbing, fire protection, electrical, structural, and architectural.

B. Follow drawings in laying out work and check drawings of other disciplines relating to work to verify space conditions. Do not scale drawings.

C. Equipment layout is based on one manufacturer's product. Where equipment selected by the Contractor for use on the job differs from layout, the Contractor shall be responsible for coordinating space requirements and connection arrangements.

1.9 GUARANTY

A. The components of the mechanical systems furnished under this division of the Specifications shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or final acceptance, whichever is earlier, against defective materials, design, and workmanship. Upon receipt of notice from the Architect of failure of any part of the equipment during the guaranty period, the affected part or parts shall be replaced promptly which includes removing the defective part or parts, replacing and installing the new part or parts, at the expense of the Contractor. In addition to the one year guaranty required, each air conditioning compressor shall have an additional four year guaranty on the compressor which shall include parts only.

PART 2 - PRODUCTS

2.1 ELECTRICAL WORK

A. All electrical equipment furnished under this Division of these Specifications shall comply with the electrical system characteristics indicated on the electrical drawings.

B. Motors shall be as specified in the MOTORS Section.

C. Motor control components furnished as an integral part of the mechanical equipment shall conform to requirements of Division 26 - Electrical.

D. For all motors furnished under this Division of these Specifications for which motor controls are not specified to be integral with the equipment, the controls shall be provided under this Division.

E. Power wiring (i.e., feeders to motors, water heaters, and electric heaters and tapes including final connection to equipment) shall be provided under Division 26 - Electrical.

F. Control wiring (i.e. 120 volt and below) including 120 volt control power to motor operated dampers valves, and variable volume boxes shall be provided under this division unless shown on the electrical drawings. Power wiring (120V) to control panels shall be provided under Division 26. Power (120V) and control (24V) wiring to application-specific controllers and other control system components shall originate at control panels and be provided under this division.

PART 3 - EXECUTION

3.1 PAINTING

A. Factory painted equipment that has been scratched or marred shall be repainted to match original color.

B. Steel equipment hangers, threaded rods, bolts, nuts, and supports and uninsulated black steel pipe exposed to sight inside the building which are not provided with a factory applied prime coat shall be cleaned of rust, grease and scale. After cleaning hangers, supports and pipe, a field-applied prime coat shall be provided. In addition, such items in finished spaces shall also be provided with two coats of finish paint in a color to match adjacent surfaces or as noted on the architectural drawings.

C. Steel equipment hangers and supports, uninsulated black steel pipe, and black steel pipe supports exposed to sight outside the building which are not provided with factory prime coat shall be cleaned of rust, grease and scale. After cleaning hangers, supports and pipe, a field-applied prime coat and two coats of bituminous aluminum paint shall be provided. Insulated pipes outside the building shall be cleaned of rust, grease and scale, and shall be provided with a field-applied prime coat before installing insulation.

D. All painting shall conform to the requirements of the PAINTING Section.

3.2 CLEANING AND ADJUSTING

A. All equipment, pipe, valves, and fittings shall be cleaned of grease, oil, paint spots, metal cuttings, sludge, and construction debris.

B. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.

C. Bearings shall be lubricated as recommended by the equipment manufacturer.

D. Temporary filters shall be provided for fans that are used during construction. Where supply, exhaust, or return fans (whether alone or part of mechanical equipment), are used, all return/exhaust inlets shall be covered with roll filter media. Media shall be taped in place to face of air inlet device or opening. At the time of starting the balancing of the air distribution system, new filters shall be installed.

3.3 TESTING PIPE AND DUCT SYSTEMS

A. General: Concealed piping and duct work and insulated piping and ductwork shall be tested in place before concealing or covering. Piping and ductwork located underground shall be tested before backfilling. Equipment, materials, and instruments for testing shall be furnished by the Contractor without additional cost to the Owner. System components not rated for the respective test pressure shall be isolated from the system during the test.

B. Observation: The contractor shall notify the owner's representative 7 days prior to a scheduled test. The owner's representative, at his option, has the right to witness the test.

C. Heating & Air Conditioning Piping System
   1. All condensate drain piping shall be tested hydrostatically and proved tight at a pressure of not less than 100 psi (690 kPa) for a period of not less than 2 hours.
   2. Field erected refrigerant piping shall be tested with a halide leak detector.
   3. No loss in pressure will be permitted. Leaks detected shall be repaired by tightening, rewelding joints, or replacing pipe and fittings. Caulking of joints will not be permitted.

D. Air Distribution Systems
   1. Ductwork in pressure classes less than $\pm$3" W.G. shall be made airtight prior to covering or concealing to the point that no leakage can be detected by the senses of hearing or feeling at all duct joints and seams.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Motors (except hermetic refrigeration machine motors) for mechanical equipment.
   2. Variable Frequency Drives

B. Description
   1. All motors shall be provided with equipment for which they serve as prime mover.

1.3 SUBMITTALS

A. General: All submittals shall conform to the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. High efficiency motors, including certification of rating and power factor at full, three quarter, and half load.
   2. Variable Frequency Drives

C. Operation and Maintenance Data: Data shall be provided on the following:
   1. Variable Frequency Drives

1.4 QUALITY ASSURANCE

A. Standards
   1. Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA):
      a. Standard 9, Load Ratings and Fatigue Life for Ball Bearings
   2. National Electrical Manufacturer's Association (NEMA):
      a. Publication MG - 1, Motors and Generators
   3. The Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. Standard 112, Test Procedure for Polyphase Induction Motors and Generators.
   4. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. Standard 90.1 – 1999 Energy Standard for Buildings Except Low Rise Residential Buildings

1.5 DELIVERY, STORAGE, AND HANDLING

A. Motors received and stored on the job site shall be stored in dry storage spaces, (e.g. building, a storage trailer, or shed). Under no condition shall the units be stored in such a way that metal components are in direct contact with the ground.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless indicated otherwise hereinafter or on the drawings, motors shall be 1800 RPM open drip proof (ODP) type.

B. Motors shall operate within plus or minus 10% of nameplate voltage without reduction of performance or life.

C. Motors shall have continuous duty classification based on 40 degree C. ambient temperature. Motor service factor shall not be less than 15% unless indicated other wise herein.

D. Motors shall be sized for the duty to be performed and shall not be operated in the service factor when the driven equipment is operating at specified capacity.

E. Motors shall comply with NEMA MG – 1-2003, Section I, parts 1, 2, 3, 4, Section II, parts 10, 11, 12, 14.

F. Motors operating on 120 volt systems shall be rated at 115 volts; motors operating on 208 volt system shall be rated at 200 volts; motors operating on 240 volt system shall be rated at 230 volts; motors operating on 277 volt system shall be rated at 265 volts; motors operating on 480 volt system shall be rated at 460 volts.

G. Motor voltage and phase shall be as indicated on the Electrical drawings.

H. Motors used with variable frequency drives shall be inverter duty designed to operate with variable frequency drives. Motors shall be approved by the variable frequency drive manufacturer and the motor manufacturer to provide quiet and stable operation over the entire speed range.

2.2 STANDARD MOTORS

A. Fractional Horsepower Motors
   1. Fractional horsepower motors rated 3/4 HP, 1/2 HP, 1/3 HP, or 1/4 HP (550 W, 400 W, 250 W, or 200 W) shall be capacitor start type motors.
   2. Drip-proof enclosure motors shall have Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, pre-lubricated sleeve or ball bearings.
   3. Enclosed Motors shall have Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, pre-lubricated ball bearings.

B. Integral Horsepower Motors
   1. Integral horsepower motors, i.e., one horsepower (750 W) and larger, shall be polyphase, squirrel-cage induction motors, NEMA design B, normal starting torque and low starting current unless other operational characteristics are required for the duty to be performed.
   2. Bearings shall be grease lubricated anti-friction ball bearings rated for minimum AFBMA 9, L - 10 life of 20,000 hours. Bearing housings shall be equipped with plugged provision for relubrication. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
   3. Insulation shall be NEMA Class B.
   4. Sound power levels shall comply with NEMA MG 1.

2.3 TOTALLY ENCLOSED MOTORS

A. Motors indicated to be totally enclosed shall be as specified above for standard motors. In addition, motors shall have coated windings and fan cooled enclosure.

2.4 MOTOR EFFICIENCY

A. Motors shall be standard efficiency as defined by the Energy Policy Act of 1992.

B. All general purpose motors shall have nominal full load power factor and efficiency ratings not less than those listed in Table I & II below. Data listed is for 3 phase 230/460 volts NEMA design B, Class B insulation, 40 degree C. ambient, continuous duty motor. Motors of other ratings and characteristics shall conform to their respective efficiency standards for efficiency and power factor.

C. High efficiency motors nameplate data shall indicate rated efficiency and power factor in addition to standard nameplate data.

D. Efficiency and power factor shall be tested in accordance with IEEE 112.

Open Drip-Proof (ODP)									
HP (kW)	1200 RPM			1800 RPM			3600 RPM		
	Power Factor %	Standard Eff. %	High Eff. %	Power Factor %	Standard Eff. %	High Eff. %	Power Factor %	Standard Eff. %	High Eff. %
1 (0.75)	72	80	82.5	84	82.5	85.5	85	N/A	77
1.5 (1.1)	73	84	86.5	85	84	86.5	85	82.5	84
2 (1.5)	75	85.5	87.5	85	84	86.5	87	84	85.5
3 (2.3)	60	87.5	88.5	86	86.5	89.5	85	84	85.5
5 (3.8)	65	88.5	89.5	87	87.5	89.5	86	85.5	86.5
7.5 (5.6)	73	90.2	90.2	86	88.5	91	88	87.5	88.5
10 (7.5)	74	90.2	91.7	85	89.5	91.7	86	88.5	89.5
15 (12)	77	91	91.7	85	91	93	89	89.5	90.2
20 (15)	78	91.7	92.4	86	91	93	89	90.2	91
25 (19)	74	92.4	93	85	91.7	93.6	92	91	91.7
30 (22)	78	93	93.6	88	92.4	94.1	91	91	91.7
40 (30)	77	93	94.1	83	93	94.1	92	91.7	92.4
50 (37)	79	93.6	94.1	85	93	94.5	89	92.4	93
60 (45)	82	93.6	94.5	88	93.6	95	91	93	93.6
75 (56)	80	94.1	94.5	88	94.1	95	88	93	93.6
100 (75)	80	94.1	95	83	94.1	95.4	88	93	93.6
125 (94)	84	94.5	95	86	94.5	95.4	91	93.6	94.1
150 (113)	83	94.5	95.4	85	95	95.8	91	93.6	94.1
200 (150)	83	94.5	95.4	85	95	95.8	90	94.5	95

Totally Enclosed Fan-Cooled (TEFC)									
HP	1200 RPM			1800 RPM			3600 RPM		
	Power Factor %	Standard Eff. %	High Eff. %	Power Factor %	Standard Eff. %	High Eff. %	Power Factor %	Standard Eff. %	High Eff. %
1 (0.75)	72	80	82.5		82.5	85.5		75.5	77
1.5 (1.1)	65	85.5	87.5	84	84	86.5	85	82.5	84
2 (1.5)	68	86.5	88.5	85	84	86.5	87	84	85.5
3 (2.3)	63	87.5	89.5	85	87.5	89.5	87	85.5	86.5
5 (3.8)	66	87.5	89.5	83	87.5	89.5	88	87.5	88.5
7.5 (5.6)	68	89.5	91	83	89.5	91.7	86	88.5	89.5
10 (7.5)	75	89.5	91	85	89.5	91.7	86	89.5	90.2
15 (12)	72	90.2	91.7	84	91	92.4	91	90.2	91
20 (15)	76	90.2	91.7	86	91	93	89	90.2	91
25 (19)	71	91.7	93	85	92.4	93.6	92	91	91.7
30 (22)	79	91.7	93	84	92.4	93.6	92	91	91.7
40 (30)	78	93	94.1	86	93	94.1	91	91.7	92.4
50 (37)	81	93	94.1	83	93	94.5	92	92.4	93
60 (45)	83	93.6	94.5	85	93.6	95	93	93	93.6
75 (56)	80	93.6	94.5	87	94.1	95.4	91	93	93.6
100 (75)	83	94.1	95	87	94.5	95.4	92	93.6	94.1
125 (94)	85	94.1	95	87	94.5	95.4	91	94.5	95
150 (113)	85	95	95.8	88	95	95.8	91	94.5	95
200 (150)	81	95	95.8	87	95	96.2	87	95	95.4

PART 3 - EXECUTION

3.1 INSTALLATION

A. Motors shall be installed and aligned with equipment for which they serve as prime mover.

B. Motors located indoors shall be open drip proof unless indicated otherwise hereinafter.

C. Motors located outdoors shall be weatherproof type unless indicated otherwise hereinafter.

END OF SECTION

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Hangers and supporting devices for all mechanical piping.

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Hangers and supporting devices to be used.

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society for Testing Materials (ASTM):
      a. Standard E84, Surface Burning Characteristics of Building Materials.
      b. Standard A446, Specification for steel sheet, zinc coated (galvanized) by the hot dip process, structural (physical quality), edited.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Hangers and support accessories and equipment curbs and rails received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Hangers and support accessories shall be stored on wooden rails, wooden pallets, or shipping skids. Under no condition shall the hangers and support accessories be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure, hangers and support accessories may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Hangers and support accessories and equipment curbs and rails shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all hangers and rods, turnbuckles, angles, channels and other structural supports to support the piping systems.

B. Pipe hangers, hanger rods, trapeze type hangers, upper attachments and other supports shall be selected based on pipe size (plus insulation of pipes specified to be insulated) and the weight of the medium being transported or the medium used for testing, whichever is heavier.

C. Rods for pipe hangers shall be carbon steel. Standard hanger rod sizes shall be:

Pipe Size	Diameter
1. 1/2” - 2" (13mm - 50mm)	3/8"(10mm)

D. All ferrous metal pipe hangers, except copper plated hangers, and concrete inserts shall be provided with a factory applied coat of rust inhibiting paint.

E. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit directly around the pipe:
1. Piping 2 inches (50mm) and smaller for refrigerant.

F. Pipe hangers for suspending the following horizontal insulated piping shall be sized to fit around the pipe, pipe insulation and pipe insulation protective shields:
1. Refrigerant suction piping.
2. Condensate drain piping from air handling units.

G. All supporting equipment with the exception of springs in spring isolation hangers shall be designed with a minimum factor of safety of five based on the ultimate tensile strength of the material.

2.2 PIPE SUPPORTS FOR SUSPENDED HORIZONTAL PIPING

A. Pipe support for suspended horizontal piping shall be the following:

SYSTEM	PIPE MATERIAL	PIPE SIZE	HANGER NUMBER
1. Refrigerant (Uninsulated)	Copper	All Sizes	IV
2. Condensate Drains	Steel	All Sizes	I

B. Hanger numbers listed in schedule above shall be the following types:
1. Hanger Number I: Clevis hanger, steel.
2. Hanger Number IV: Clevis hanger, copper plated steel.

C. Hanger numbers listed above shall be:

	I	IV
1. B-Line Systems	B3100	B3104CT
2. Carpenter & Patterson	100	100CT
3. Anvil	260	CT-65
4. Erico	400	402

D. Upper Attachments
1. Steel Construction
   a. For suspending pipes from steel beams, upper attachments shall be beam clamps and shall be:
      1) B-Line Systems; Fig. B3055
      2) Carpenter & Paterson; Fig. 268
      3) Anvil Fig. 133
   b. For suspending pipes from bottom chord of steel bar joists, upper attachments shall be C-clamps with retaining clips and shall be:
      1) B-Line Systems; Figs. B351, B3362 and B3363
      2) Carpenter & Paterson; Figs. 238 and 22
      3) Anvil; Figs. 87 and 89
      4) Erico; No. 255 and 255C

c. For suspending pipes from the top chord of steel bar joists, upper attachments shall be top-of-beam C-clamps and shall be:
   1) B-Line Systems; Fig. B3034
   2) Carpenter & Paterson; Fig. 192
   3) Anvil; Fig. 92
   4) Erico; No. 300

2. Concrete Construction
   a. New Construction
      1) For suspending pipe in concrete construction, upper attachments shall be adjustable type concrete inserts. Where weight to be supported by an insert is 300 lbs. (136 kg) or more, install two No. 3 steel reinforcing bars, each 3 ft. (900mm) long, through the yoke of the insert. Concrete inserts shall be:
         a) B-Line Systems; Fig. B2500
         b) Carpenter & Paterson; Fig. 75
         c) Anvil; Fig. 281
         d) Erico; No. 355
      2) For suspending pipes in concrete construction, upper attachments shall be continuous concrete inserts complete with nuts. Continuous concrete inserts shall be:
         a) B-Line Systems; Figs. B22I, B32I, B42I or B52I
         b) Carpenter & Paterson; Fig. 650

2.3 PIPE SUPPORTS FOR FLOOR SUPPORTED HORIZONTAL PIPING

A. General
1. Pipe supports for horizontal piping supported on concrete floors and on concrete bases shall be adjustable pipe saddle support with U-bolt and screwed floor flange. Bolt floor flange to floor and bases utilizing all bolt holes. Adjustable pipe saddle supports shall be steel and shall be:
   a. B-Line Systems; Fig. B3090 and B3088
   b. Carpenter & Paterson; Fig. 125SP
   c. Erico; No. 724
2. Pipe supports for horizontal piping in trench below floor level shall be adjustable pipe roller stands. Base shall be bolted to the trench floor utilizing all bolt holes. Adjustable pipe roller stands shall be steel and cast iron and shall be:
   a. B-Line Systems; Fig. B3118SL
   b. Carpenter & Paterson; Fig. 40
   c. Anvil; Fig. 274
   d. Erico; No. 619

2.4 PIPE SUPPORTS FOR VERTICAL PIPING

A. Supports for vertical piping shall be riser clamps sized to fit directly around the pipe.
1. Riser clamps shall be steel and shall be:
   a. B-Line Systems; Fig. B3373
   b. Carpenter & Paterson; Fig. 126
   c. Anvil; Fig. 261
   d. Erico; No. 510
2. Offset pipe clamps shall be steel and shall be:
   a. B-Line Systems; Fig. B3148
   b. Carpenter & Paterson; Fig. 179
   c. Anvil; Fig. 103
   d. Erico; No. 700
3. Clamps for copper tubing shall be copper plated.

2.5 PIPE INSULATION PROTECTIVE SHIELDS AND SADDLES FOR HORIZONTAL PIPING

A. Shields shall be galvanized sheet metal type. Shields shall be 180 degrees type at all pipe hangers. Shields shall be 360 degrees type on trapeze hangers, pipe racks, and on floor supported horizontal pipes. Shields sizes shall be:
   1. Pipes 2 in. (50mm) and smaller -- 18 gage x 12" long (1.3 mm x 300mm long)
   2. Pipes 2-1/2 in. thru 6” (150mm) 16 gage x 18" long(1.5mm x 450mm long)
   3. Pipes 8 in. (200mm) and larger -- 14 gage x 24" long(2.0mm x 600mm long)

B. Saddles shall be steel and shall be:

		Insulation Thickness					
		1” (25mm)	1-1/2” (37mm)	2” (50mm)	2-1/2” (63mm)	3” (75mm)	4” (100mm)
1.	B-Line Systems	B3160	B3161	B3162	B3163	B3164	B3165
2.	Carpenter & Patterson	351	352	353	354	355	356
3.	Anvil	160	161	162	163	164	165
4.	Erico	630	631	632	633	634	635

2.6 FACTORY FABRICATED FRAMING CHANNELS AND FITTINGS

A. Factory fabricated framing channels and fittings shall be used for:
   1. Constructing pipe racks for supporting multiple horizontal pipes where indicated on the drawings.
   2. Constructing trapeze type hangers for suspending multiple horizontal pipes where indicated on the drawings.
   3. Securing vertical exposed gas service drops for gas outlets and equipment.

B. Framing channels and fittings shall be provided with factory applied baked enamel finish.

C. Galvanized pipe clamps, including bolts and nuts, shall be provided with the framing channels and shall be used for securing pipes to channels. Pipe roller type supports shall be provided for pipes 2-1/2 inches (63mm) and larger for [hot water heating,] [steam,] [condensate return,] [boiler feedwater] and [steam trap return]. Pipe roller supports shall include rollers, 1/2 inch (13mm) diameter axle, nuts and angle brackets. Pipe clamps on insulated pipes shall fit around pipe, pipe insulation and pipe insulation protection shield. Pipe roller supports on insulated pipes shall be sized to fit around pipe saddles.

D. Framing channels and fittings shall be:
   1. B-Line Systems; Strut System
   2. Erico; Strut System
   3. Unistrut; Metal Framing System
   4. Anvil; Power Strut

PART 3 - EXECUTION

3.1 HORIZONTAL PIPE SUPPORT INSTALLATION

A. Spacing of hangers and supports shall be as follows:
   1. Cast iron soil pipe shall be supported at not more than five feet intervals and near each hub or coupling.
   2. Copper Tubing:

Maximum Spacing of

Nominal Tubing Size	Supports - Feet
a. 3/4" (20mm) & smaller	5 (1600mm)
b. 1 in. through 3 in. (25mm-75mm)	6 (1800mm)

3. Steel Pipe:

Nominal Pipe Size	Maximum Spacing of Supports - Feet
a. Up thru 1-1/4 in. (32mm)	6 (1800mm)

4. PVC Pipe: All sizes; 4'-0" (1200mm).

B. Additional hangers shall be provided adjacent to all valves and fittings size 8" (200mm) and larger.

C. Intermediate pipe supports shall be provided between building structural members so as not to exceed maximum support spacing hereinbefore specified.
1. In steel construction, intermediate supports shall be welded to steel beams and to steel joists. In no case shall supports be attached to roof purlins, roof decks, or permanent metal forms.

3.2 VERTICAL PIPE SUPPORT INSTALLATION

A. Supports for all pipes shall fit directly around the pipe. On insulated pipes, the support shall be insulated and provided with vapor barrier as specified for pipe insulation in Section 230700 HVAC INSULATION.

B. Vertical pipes passing through floors shall be provided with a riser clamp at each floor. Where opening in floor is sleeved, riser clamps shall have steel lugs, 1/4" thick x 2" high x 1-1/2" long (6mm thick x 50mm high x 37mm long), welded to the clamp arms so that clamp does not come in contact with the pipe sleeve; the lugs shall support the clamp from the floor. Where floor opening does not have a sleeve, a 3 inch (75) high concrete curb shall be installed around the opening.

C. Where distance between floors is greater than 15 ft. (4500mm) or where drop within one floor level is more than 15 ft. (4500mm), vertical pipes shall be provided with offset pipe clamps anchored to walls at the approximate midpoint between floors.

D. Exposed to sight vertical service drops to gas outlets shall be supported with not less than two equally spaced sections of factory fabricated framing channel with standard pipe clamps. Channel sections shall be 8" (200mm) long and shall be fastened to wall with not less than two spring wing toggle bolts.

E. Copper tubing supported by channel framing shall be provided with a lead sleeve to isolate the pipe from the framing channel and the pipe clamp.

3.3 CONCRETE INSERTS AND ANCHORS

A. In filler type concrete construction, inserts and anchors shall be installed in joists or beams only. Install inserts in sides of joists or beams.

B. In framed type concrete construction, inserts and anchors shall be installed no closer than 6 inches (150mm) to edge of slab.

3.4 SHIELD AND SADDLE INSTALLATION

A. Shields shall be installed at all pipe hangers in horizontal insulated condensate drain and refrigerant suction piping.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Pipe Bands
   2. Equipment Labels

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS, and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Pipe Bands
   2. Equipment Labels

1.4 QUALITY ASSURANCE

A. Standards
   1. American National Standards Institute (ANSI):
      a. Standard A13.1, The Scheme for Identification of Piping Systems.
   2. National Fire Protection Association (NFPA)
      a. Standard 45, Fire Protection for Laboratories Using Chemicals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Tapes, labels, paint received and stored on the job site shall be stored in dry storage spaces, (e.g. building, a storage trailer, or shed). Under no condition shall the units be stored in such a way that metal components are in direct contact with the ground.

B. Tapes, labels, paint shall be covered with 6 mil (.4mm) polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Pipe identification shall comply with ANSI A13.1.

2.2 PIPE MARKINGS

A. Pipe identification bands shall be snap-on type with clear polyester exterior surface. Bands shall include directional flow arrows and legends. Identification bands on pipe or coverings 5-1/2" (138mm) or less in diameter shall be sized to fit around pipe and overlap self. Identification bands on pipe or covering 6" (150 mm) or more in diameter shall have stainless steel spring fasteners. Pipe identification bands shall be:
   1. Seton/Setmark; SNA/STR Series

2. Brady; Snap-on Series
3. Brimar Industries; System #1
4. Marking Services; MS-970 Series

C. Pipe identification shall be pressure sensitive tape with banding tape flow arrows.

D. Bands shall be color and background as indicated below.

Pipe	Band Color	Lettering	Lettering Color
1. Condensate Drain	Yellow	CONDENSATE DRAIN	Black
2. Refrigerant Suction	Yellow	REFRIGERANT. SUCTION	Black
3. Refrigerant Liquid	Yellow	REFRIGERANT. LIQUID	Black

E. Band width and lettering size shall be as follows:

Pipe or Pipe Covering Diameter (inches)(mm)	Band Width (inches)(mm)	Lettering Size (inches)(mm)
1. 3/4 to 2 (20 mm to 50 mm)	8 (200 mm)	3/4 (20 mm)

2.3 EQUIPMENT LABELS

A. Equipment identification labels shall be black plastic laminate with white letters. Labels shall be 2” high with ½” minimum letters. Equipment terminology shall be same as shown on equipment schedules, (i.e. AHU-1, CH-1, etc.).

2.4 TAPE

A. Identification tape shall be vinyl pressure sensitive type with adhesive backing. Tape width shall be a minimum of 2"(50 mm). Tape shall be color to match pipe identification band background. Tape shall be:
1. Emedco; T100 Series
2. Seton; PST Series
3. Brady; Tape
4. Marking Services; MS-900

2.5 CABLE TIES

A. Cable ties for valve tag attached shall be self-locking nylon ties. Cable ties shall be:
1. Thomas & Betts; Ty-Rap-Nylon
2. Ideal; Double Lock Cable (Plain Head)
3. Efcor; Sure-Ty Self-Locking Cable Ties

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipe identification bands shall be installed on piping at each valve, each piece of equipment, each change of direction, wall penetration, each branch take-off, and at a maximum spacing of 20 feet (6.5M) on straight run piping.

B. Plastic pipe bands shall be wrapped around pipe or pipe covering under pressure so that no gaps or wrinkles occur. Bands on pipe or pipe covering 6" (150 mm) or smaller shall overlap

and adhere to themselves. Bands on pipe or pipe covering larger than 6" (150 mm) shall be further secured at both ends with tape. Tape shall overlap and adhere to itself.

C. Equipment labels shall be attached to equipment using self tapping stainless steel screws or contact-type permanent adhesive.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Performance Testing
   2. Balancing

B. Description
   1. The Contractor shall performance test and balance the following systems:
      a. All air distribution (i.e., supply, return, exhaust)

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following:
   1. Balance procedure
   2. Balance forms

C. Certificates: Certificates shall be submitted on the following:
   1. Test equipment calibration including date of last calibration.
   2. Certificate of membership in AABC or NEBB.

D. Reports: Reports shall be submitted on the following:

E. Field balance report.

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE):
      a. Fundamentals.
   2. Associated Air Balance Council (AABC):
      a. National Standards for Field Measurements and Instrumentation, Total System Balance, Air Distribution - Hydronic Systems - Air Pollution - Sound Vibration.
   3. National Environmental Balancing Bureau (NEBB):
      a. Procedural Standards for Testing - Balancing - Adjusting of Environmental Systems.

B. Qualification of Testers:
   1. The balancing personnel shall be familiar with and perform the balancing in accordance with AABC MN-1-1989 or NEBB-1998 procedures using forms of appropriate organization.
   2. The balancing firm shall be a certified member of AABC or NEBB.

3. The independent test and balance company shall have a minimum of five years experience as an independent test and balance company.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Instruments used for balancing shall have been calibrated within 6 months prior to the balancing of the systems.

B. All instruments required to balance the system shall be provided at the Contractor's expense.

PART 3 - EXECUTION

3.1 GENERAL BALANCING

A. Air
1. Adjust and balance air systems indicated hereinbefore to obtain design flow rates for systems as a whole and for each inlet and outlet. Use balancing dampers and/or flow setting devices for inlet, outlet and branch adjustments. Use fan speed adjustment for belt drive fans. When balancing air devices in rooms, doors to room shall be closed.
2. Pitot tube traverses shall be performed in accordance with ASHRAE Fundamentals.

B. Final readings shall be set with -5% to +10% of design conditions.

3.2 REPORT

A. The report of performance testing and balancing shall include data listed below:
1. Name and address of project, name and address of Contractor, dates of all tests, name and telephone number of test engineer.
2. Grilles, registers and diffusers:
    a. Fan System and/or zone number.
    b. Room number.
    c. Size of inlet or outlet.
    d. Manufacturer's effective data.
    e. Required flow and velocity.
    f. Initial flow and velocity.
    g. Final flow and velocity.
3. Fans (including fans which are part of air conditioning equipment):
    a. System and/or fan number.
    b. Fan manufacturer, serial number and model number.
    c. Motor manufacturer, horsepower, voltage, phase, RPM, type and service factor, amperage nameplate rating.
    d. Scheduled data on drawings or in specifications.
    e. Final air flow.
    f. Final RPM.
    g. Final total static pressure.
    h. Final suction static pressure.
    i. Final motor amperage.
    j. Final brake horsepower.

B. Any deviations from design data shall be explained in the report - possible reasons for and solutions to.

C. Report shall be signed and dated by balance engineer.

D. Test and balance shall not be performed until system installation is complete.

E. Permanently mark the settings of all valves, dampers and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Pipe Insulation
   2. Ductwork Insulation

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC .

B. Product Data: Data shall be submitted on the following items:
   1. Insulation
   2. Field Applied Jacketing

C. Certificates: Certificates shall be submitted on the following:
   1. Certificates of compliance to the specified standards.

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society for Testing and Materials (ASTM):
      a. Standard E84, Surface Burning Characteristics of Building Materials.
      b. Standard C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
      c. Standard C547, Mineral Fiber Performed Pipe Insulation
      d. Standard C534, Preformed Flexible Elastomeric Cellular Thermal Insulation.
      e. Standard C553, Mineral Fiber Blanket and Felt Insulation
      f. Standard C916, Standard Specification for Adhesives for Duct Thermal Insulation
      g. Standard C1071 Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Materials)
      h. Standard C1290 Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
      i. Standard G21, Practice for Determining Resistance of Synthetic Polymeric Material to Fungi
   2. National Fire Protection Association (NFPA):
      a. Standard 255, Test Methods, Surface Burning Characteristics of Building Materials.
   3. Underwriters' Laboratories (UL):
      a. Standard 723, Surface Burning Characteristics of Building Materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Insulation received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Insulation shall be stored on wooden rails, wooden pallets, or shipping skids. Under no condition shall the insulation be stored in such a way that components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure, insulation may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Insulation shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather. UV sensitive material such as PVC and PVDC insulation material shall be protected from sunlight to avoid exposure to UV light from the sun.

PART 2 - PRODUCTS

2.1 FLAME AND SMOKE RATING

A. Insulation material, adhesives, jackets, and tapes specified herein shall comply with ASTM E84, NFPA 255, and UL 723 for:
   1. Maximum flame spread rating: 25
   2. Maximum smoke developed rating: 50, unless indicated otherwise hereinafter.
   3. Compliance shall be for insulation, adhesive, and jacket or facing.

2.2 PIPE INSULATION THICKNESS

A. Pipe insulation thickness and conductivity for all insulation types shall be based on the following chart, unless otherwise noted:

Minimum Pipe Insulation Thickness (in inches)							
Fluid Operating Temperature Range and Usage (°F)	Insulation Conductivity		Normal Pipe or Tube Size (inches)				
	Conductivity Btu. In./(h – ft^2 – F)	Mean Rating Temperature, °F	<1	1 to <1 ½	1 ½ to <4	4 to <8	≥8
>350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 - .030	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	50	0.5	1.0	1.0	1.0	1.5

Chart copied from Table C403.2.10 from the International Energy Conservation Code 2015 edition.

2.3 FOAMED PLASTIC PIPE INSULATION

A. Insulation shall be self sealing, flexible cellular, elastomeric Type conforming to ASTM C 534, designed for use on pipes from -40°F to 220°F (-40°C to 105°C).

B. Adhesives used for connections shall be manufacturer's standard waterproof vapor retarder.

C. Insulation used outdoors shall be provided with manufacturer's Standard UV-Protection.

D. Insulation thickness shall be 1-1/2".

E. Insulation shall be:

		Self Sealing
1.	Johns Manville	Aerotube AP/SS
2.	Armacell	AP/SS Armaflex
3.	Rubatex	R-180-FS
4.	Halstead	F/R Insutube

2.4 FIBERGLASS BLANKET INSULATION

A. Insulation shall be flexible fiberglass blanket conforming to ASTM C 553 and ASTM C 1290 designed for use on surfaces up to 250°F (121°C).

B. Insulation shall have a minimum insulation value of R-6 when located in interior of building, R-8 when located on exterior of building.

C. Vapor barrier jacket shall be FSK, aluminum foil reinforced with fiberglass yarn and laminated to fire resistant Kraft.

D. Insulation shall be:
1. CertainTeed
2. Knauf; Standard Duct Wrap
3. Ductwrap
4. Johns Manville; Microlite Type 100.
5. Owens Corning; All service faced ductwrap, Type 100.

E. Insulation thickness shall be 2 inches (50mm).

2.5 ADHESIVES

A. Insulation cement shall be:
1. Fibrex; FBX Super Blend
2. ROCKWOOD MFG. CO.; Delta-Maid One Shot

B. Fire Retardant Adhesive for blanket and liner insulation shall be conform to ASTM C 916 and shall be:
1. Childers; CP-56
2. Foster; 85-60
3. King; 11-400
4. Mon-Eco; 22-65
5. Viamsco; 795

2.6 FABRICS

A. Reinforcing fabric shall be 10 by 20 or 10 by 10 white glass on nylon fabric.

2.7 COATINGS

A. Vapor barrier coating (white) shall be:
   1. Childers; Chil-Perm CP-30
   2. Epolux; Calaler 650
   3. Foster; Tite Fit 30-35
   4. King; ---
   5. Mon-Eco; 55-10

B. Breather Coating (white) shall be:
   1. Childers; Chil-Seal CP-50A
   2. EPOLUX; Cadalag 336
   3. Foster; Seal Fas 30-36
   4. King; 11-275
   5. Mon-Eco; 11-07
   6. Vimasco; 713

C. Asphalt mastic shall be:
   1. Foster; 60-25
   2. Lion Oil Co.; Seal-Kote
   3. Pittsburgh Corning; Pittcoat 300

D. Fire resistive, vapor barrier, water proof mastic (grey) shall be:
   1. Childers; CP-10/11 AF
   2. Epolux; Cadolon 500
   3. Foster; Monolar 60-39
   4. King; ---
   5. Mon-Eco; 55-50
   6. Vimasco; WC-5FR

E. Asphalt based Aluminum paint shall be as recommended by insulation manufacturer.

2.8 FASTENERS AND TAPES

A. Securing wire shall be 16 gauge stainless steel.

B. Metal weld pins shall be 12 gauge galvanized steel.

C. Metal stick pins shall be 12 gauge galvanized steel with perforated base plate.

D. Foil reinforced Kraft tape; 3" (75mm) wide shall be:
   1. Compac; 122-2
   2. Fasson; 0821
   3. Venture; 1525 CW
   4. 3M; 898
   5. Nashua; FSK

E. Steel bands shall be 1/2" x 0.020" (13mm x 0.5mm) thick stainless steel.

F. Wire mesh shall be 1" (25mm) wide galvanized steel.

2.9 FIELD APPLIED COVERS AND JACKETING

A. Polyvinyl Chloride (PVC)
   1. PVC fitting and valve covers shall be factory preformed for the shape used for.
   2. PVC jacketing shall be cut and curled and sized for pipe installed on.

3. PVC installed on covers and jacketing shall have a minimum thickness of 20 mil.
4. PVC covers and jacketing shall be:
   a. Speedline Corp.
   b. Johns Manville; Zeston 2000 PVC
   c. Proto; PVC Covers

B. Aluminum
1. Aluminum jacketing shall be 0.016 inch (0.4mm) thick with smooth finish.
2. Aluminum fitting covers shall be 0.024 inch (0.6mm) thick with smooth finish.

C. Stainless Steel
1. Stainless steel jacket and fitting covers shall be 0.10 inch (2.5mm) thick with smooth finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Do not apply insulation which has become wet.

B. Do not use staples for securing any insulation.

C. Apply insulation only on clean, dry surfaces.

D. Continue insulation through wall and ceiling openings and sleeves, except terminate duct insulation at fire dampers and at flexible duct connections at air handling units.

E. Provide continuous unbroken vapor seal on all cold surfaces where vapor jackets are used.

F. Insulate and vapor seal supports that are secured to cold surfaces to prevent condensation.

G. Do not insulate unions, except in chilled water lines.

H. Fill pipe insulation protective saddles with same insulation as adjoining pipe insulation.

I. Perform work at ambient and equivalent temperatures as recommended by the adhesive manufacturer.

3.2 FOAMED PLASTIC PIPE INSULATION

A. Insulate the following:
1. All refrigerant suction and hot gas piping.
2. All condensate drain piping.

B. Snap insulation around pipe and butt all joints together. Seal butt and longitudinal joints with insulation manufacturer's adhesive.

C. Insulate fittings, with mitered sections of pipe insulation. Seal all butt and longitudinal joints with insulation manufacturer's adhesive.

D. Insulate valves and couplings with oversized sections of pipe insulation. Seal all joints with manufacturer's adhesive.

3.3 FIBERGLAS BLANKET INSULATION

A. Insulate the following:

1. All galvanized steel supply air ductwork including duct silencers unless indicated otherwise herin.
2. That portion of ceiling diffusers which are exposed above ceilings in non-return air plenums.

B. Wrap insulation around ducts. Butt all circumferential joints. Overlap longitudinal joints 2"(50mm) minimum. Secure insulation with wire spirally wrapped at 12" (300mm) on center intervals.

C. For ducts over 24" (600mm) wide, adhere insulation to bottom of duct with 100% coverage of fire retardant adhesive. In addition impale insulation on the bottom of ducts on metal stick pins maximum 18" (450mm) on center adhered to duct. Secure insulation on pins with speed washers and seal with white vapor barrier coating.

D. Seal circumferential joints at fire dampers, flexible connections, and ends of ducts with pressure sensitive tape.

E. Tape longitudinal joints with pressure sensitive tape for duct insulation.

F. Seal penetrations and punctures with pressure sensitive tape and apply white vapor barrier coating.

G. Wrap portions of ceiling diffusers described above with insulation. Overlap ends of insulation 2"(50mm) minimum. Tape all joints with pressure sensitive tape.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. All direct expansion refrigerant system piping, valves, accessories and refrigerant.

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Piping
   2. Refrigerant Accessories
   3. Refrigerant

C. Certificates: Certificates shall be submitted on the following items:
   1. Technician’s Certificate.

1.4 QUALITY ASSURANCE

A. Standards
   1. American National Standards Institute (ANSI):
      a. Standard B16.3, Malleable Iron Screwed Fittings, 150 and 300 pound.
      b. Standard B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
      c. Standard B31.5, Refrigerant Piping.
   2. American Society for Testing and Materials (ASTM):
      a. Standard A53, Pipe, Steel, Black and Hot - Dipped Zinc - Coated, Welded and Seamless.
      b. Standard B280, Specification for Seamless Copper Tubes for Air Conditioning and Refrigeration Field Service.
   3. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
      a. Standard 15, Safety Code for Mechanical Refrigeration.
   4. Air Conditioning and Refrigeration Institute (ARI):
      a. Standard 710, Liquid Line Driers
      b. Standard 730, Flow - Capacity Rating and Application of Suction - Line Filters and Filter - Driers.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Refrigerant piping shall be hard drawn Type ACR seamless copper tubing, ASTM B280. Fittings shall be wrought, ANSI B16.22, copper with a working pressure of not less than 300 psig.

B. Condensate drain piping and fittings shall be schedule 40 galvanized steel pipe, ASTM A53, with threaded 150 pound iron fittings, ANSI B16.3.

2.2 REFRIGERANT ACCESSORIES

A. Refrigerant accessories shall be provided as recommended by the unit manufacturer.

B. Refrigerant Stop Valves shall be designed for use with the refrigerant used and for system working pressures of not less than 300 psig. Valves shall be all brass, hand-wheel operated, diaphragm, packless type globe and angle valves in sizes up to and including 5/8 inch. In sizes over 5/8 inch, valves shall be bronze globe and angle type, wrench operated with ground-finish stems, packed especially for fluorocarbon refrigerant service, back-seated, and equipped with seal caps.

C. Solenoid valves shall be bronze body, packless type, with stainless steel trim, rated for continuous duty service. Valves shall have manual lift stem and shall be designed for use with type refrigerant used. Valves shall have a safe working pressure of 400 psig and a maximum operating pressure differential of at least 200 psig at 85% rated voltage. Valves shall have an operating pressure differential based on the refrigerant used. The solenoid coil shall have moisture proof insulation and shall be approved by the Underwriters' Laboratories.

D. Filter - Dryers shall conform to ARI Standard 710. Sizes 1/2 inch and larger shall be the full flow, replaceable core type. Sizes smaller than 1/2 inch shall be the sealed type. Cores shall be of desiccant that will not plug, cake, dust, channel or break down, and shall remove water, acid, and foreign material from the refrigerant. The drier shall be constructed so that none of the desiccant will pass into the refrigerant lines. Provide filter - drier in liquid line to each evaporator, installed with 3-value bypass for servicing.

E. Moisture Indicator Glasses shall be located in the liquid line preceding each expansion valve. The sight glass and moisture indicating element shall be removable. The moisture indicator shall have a reversible color indicator which has an easily distinguished color change. The sight glass shall be equipped with a protective cover.

F. Refrigeration access valves for testing, pressure checking, purging and charging shall be bronze body, Schraeder type, solder end with removable brass valve core, and brass, finger tightening quick seal cap.

2.3 REFRIGERANT

A. Refrigerant shall be as recommended by the unit manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipes shall have all burrs removed by reaming and shall be cut square.

B. Open ends of pipe shall be plugged during installation to keep dirt and other foreign material out of the system.

C. Both inside and outside of piping shall be cleaned with dry, lintless cloth followed by refrigerant oil soaked swab before brazing. All joints shall be brazed with silver solder having a minimum melting point of 1100°F.

D. Changes in direction shall be made with fittings.

E. Remove access valve cores prior to soldering and replace when cooled.

F. Installation of refrigerant piping and refrigerant handling equipment shall comply with ASHRAE 15.

G. Refrigerant piping shall be sized and installed in accordance with the equipment manufacturers' recommendations.

3.2 REFRIGERANT CHARGING

A. Upon completion of refrigerant piping including testing, between condensing unit and direct expansion coil, the system shall be evacuated with a high vacuum pump to a 27" vacuum. Maintain vacuum for a minimum of 5 hours after closing valve between vacuum pump and system. Break vacuum with refrigerant gas and allow pressure build up to 2 psi. Complete charging of system using new filter-dryer cone in charging line.

B. All refrigerant piping shall be installed and systems charged by a certified technician. All work shall be in accordance with the clean air act. No venting of refrigerant to the atmosphere is acceptable.

END OF SECTION

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Ductwork

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Ductwork including coordinated layout drawings indicating locations of equipment of all other trades above ceilings as well as ductwork.

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society for Testing and Materials (ASTM):
      a. Standard E84, Surface Burning Characteristics of Building Materials.
   2. National Fire Protection Association (NFPA):
      a. Standard 90A, Installation of Air Conditioning and Ventilating Systems.
      b. Standard 90B, Installation of Warm Air Heating and Air Conditioning Systems.
      c. Standard 255, Test Methods, Surface Burning Characteristics of Building Materials.
   3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
      a. HVAC Duct Construction Standards, Metal and Flexible.
      b. Duct Cleanliness for New Construction Guidelines
   4. Underwriter's Laboratories (UL):
      a. Standard 181, Factory-Made Air Duct Materials and Duct Connectors.
   5. American Conference of Governmental Industrial Hygienists
      a. Industrial Ventilation, 24th Edition, 2001, a Manual of Recommended Practice.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Air distribution system components received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Air distribution system components shall be stored on wooden rails or wooden pallets. Under no condition shall the air distribution system components be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure air distribution system components may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Air distribution system components shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 DUCTWORK

A. General
1. Ductwork shall be constructed of lock forming quality galvanized steel sheets.
2. Galvanized coating shall be not less than 0.9 ounces total for both sides per square foot of sheet metal.
3. Ductwork shall be square, rectangular, round, or flat oval, as indicated on the drawings.
4. Turning vanes shall be installed in all 90 degree square and rectangular elbows and at other locations shown on the drawings. In any supply, return or exhaust air ductwork with velocities of 1800 FPM (9 m/s) or higher, the turning vanes shall be the double thickness type, with vanes welded to the runners and runners welded to the duct.
5. Ductwork shall be classified and constructed in the following SMACNA pressure classes, or 150% of the scheduled fan S.P., whichever is greater:

System or Zone	Pressure Class
a. Supply air ductwork from air handling units to air distribution devices.	+ 2
b. Return air ductwork	- 2
c. Exhaust ductwork (general building)	- 2

B. Galvanized Steel Ductwork
1. Except where indicated otherwise, herein or on the drawings, duct construction shall conform to the recommendations of the SMACNA HVAC Duct Construction Manual for pressure classes specified hereinbefore.
2. All galvanized areas damaged by welding shall be coated with rust inhibitive aluminum paint.
3. Round and flat oval ductwork shall be spiral lock-seam construction, except as follows:
   a. Concealed round duct up to 22” (550mm) in diameter in pressure class 2" shall be longitudinal seam construction.
   b. Round ducts 61” (25mm) and larger in diameter shall be longitudinal seam construction with fusion welded butt seams. Sections supplied in lengths greater than four feet shall have angle iron rings welded to the duct on four foot centers (maximum). Welding of the angle ring to duct shall apply not less than one inch of weld for each foot of angle ring.
   c. Flat oval duct sizes not available in spiral lock seam construction shall be longitudinal seam construction with fusion welded butt seams.
      1) Round and flat oval ductwork shall be the products of the same manufacturer:
         a) Monroe Manufacturing Company
         b) Semco Manufacturing Company
         c) United McGill Sheet Metal Corporation
         d) Eastern Sheet Metal
         e) Spiraline
         f) Lindlab
4. Round and flat oval fittings shall be fusion welded butt seam type with all welds continuous along seams. All divided flow fittings shall be manufactured as separate fittings - tap collars welded into spiral duct sections will not be permitted. All divided flow fittings 12” (300mm) and smaller shall have radiused entrance produced by machine or press forming; all divided flow fittings 14"(355mm) and larger shall have conical entrance produced by machine or press forming. All divided flow entrances shall be free of weld build-up, burrs, and irregularities. Fittings shall be the same manufacturer as ductwork.

5. Pre-insulated round and flat oval ductwork shall be as specified above. In addition, ductwork shall have 2” (50mm) of fiberglass duct insulation sandwiched between outer casing and solid inner galvanized steel liner.
6. Duct sealant shall be a U.L. listed synthetic latex base mastic or mineral impregnated woven fiber tape with adhesive. Duct sealing compounds shall be low VOC type with a maximum VOC emission of 250 grams per liter
   a. Sealant shall have fire hazard classification per ASTM E84 of flame spread-5 and smoke development-0. Sealant shall be:
      1) Kingco
      2) United McGill
   b. Fiber tape and adhesive shall be:
      1) Uni-cast
      2) United McGill
   c. Tape width in inches, shall be:
      1) Duct Diameter, 0 to 10 Inches: 2.
      2) Duct Diameter, 11 to 20: 3.
      3) Duct Diameter, 22 and Larger: 4.

2.2 BRANCH TAPS

A. Taps shall be galvanized steel for use with rectangular or square sheet metal ductwork. Taps shall have 45° air scoop and damper. Taps for sheet metal shall be:

		Scoop & Damper
1.	Crown	714
2.	Jer-Air	---
3.	Flexmaster	---

PART 3 - EXECUTION

3.1 INSTALLATION

A. Galvanized Steel Ductwork
   1. Ductwork shall be installed in accordance with recommendations of SMACNA HVAC Duct Construction Standards Manual.
   2. Duct-to-duct joints in round duct up to and including 60" (1500mm) in diameter and in equivalent size flat oval ducts shall be made by using sleeve couplings, reinforced by rolled beads. Duct-to-fitting joints in round duct up to and including 60" (1500mm) in diameter and in equivalent size flat oval ducts shall be made by slip-fit of the projecting collar on the fitting into the duct. Sleeve shall be the same gauge galvanized steel as the duct; insertion length of sleeve coupling and fitting collar shall be not less than 2” (50mm). After the joint is slipped together, sheet metal screws shall be installed for mechanical strength; screws shall be equally spaced, no more than 12” (300mm) on centers and with a minimum of 3 screws in each joint. Screws shall be placed at 1/2” (12mm) from the joint bead. Duct-to-duct joints in ducts up to and including 12” (300mm) in diameter for pressure class 2” (50mm) and below may be the beaded-crimp type and each joint shall be fastened with sheet metal screws, equally spaced, not more than 12” (300mm) on centers and with a minimum of 3 screws in each joint. The beaded-crimp joint shall provide at least a 1” (25mm) lap to accommodate the sheet metal screws.
   3. Duct-to-duct and duct-to-fitting joints in round ducts larger than 60"(1500mm) in diameter, and in equivalent size flat oval ducts, shall be the loose flange type. The ends of ducts and fittings shall have 5/8"(16mm) flanges to form a gasketing surface for sealing. Bolting flanges shall be 2" x 2" x 3/16” (50mm x 50mm x 5mm) ring type steel angles attached to the duct and fitting by continuous weld; bolt spacing on flanges shall not

exceed 6" (150mm) on centers. Flanged joints shall be sealed with neoprene rubber gaskets.

4. All duct joints (longitudinal, transverse) and duct penetrations shall be sealed using methods outlined in SMACNA HVAC Air Duct Leakage Test Manual.

3.2 DUCT SUPPORT SPACING

A. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards except:
   1. Hangers shall be spaced not over 8'-0" (2400mm) on centers.
   2. For rectangular ducts; with longest dimensions up through 60" (1500mm), hangers shall be the galvanized steel strap type; with longest dimension 61” (1525mm) and larger, hangers shall be trapeze type constructed of galvanized steel angles with round hanger rods. Sizes for strap hangers and trapeze angles and rods shall be based on duct size as scheduled in the SMACNA HVAC Duct Construction Standard.
   3. For round ducts, hangers shall be galvanized steel strap hangers. Sizes and number for strap hangers shall be based on duct size as scheduled in the SMACNA HVAC Duct Construction Standard.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Dampers

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Dampers

1.4 QUALITY ASSURANCE

A. Standards
   1. American Society for Testing and Materials (ASTM):
      a. Standard E84, Surface Burning Characteristics of Building Materials.
   2. National Fire Protection Association (NFPA):
      a. Standard 90A, Installation of Air Conditioning and Ventilating Systems.
      b. Standard 90B, Installation of Warm Air Heating and Air Conditioning Systems.
      c. Standard 255, Test Methods, Surface Burning Characteristics of Building Materials.
   3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
      a. HVAC Duct Construction Standards, Metal and Flexible.
      b. Duct Cleanliness for New Construction Guidelines
   4. Underwriter's Laboratories (UL):
      a. Standard 181, Factory-Made Air Duct Materials and Duct Connectors.
      b. Standard 555, Fire Dampers and Ceiling Dampers.
      c. Standard 555S, Leakage Rated Dampers for Use in Smoke Control Systems.
   5. American Conference of Governmental Industrial Hygienists
      a. Industrial Ventilation, 24th Edition, 2001, a Manual of Recommended Practice.
   6. Air Movement and Control Association International Inc. (AMCA)
      a. Standard 500-L-99, Laboratory Methods for Testing Louvers for Ratings

1.5 DELIVERY, STORAGE, AND HANDLING

A. Air distribution system components received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Air distribution system components shall be stored on wooden rails or wooden pallets. Under no condition shall the air distribution system components be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure air distribution system components may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Air distribution system components shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 MANUAL DAMPERS AND DAMPER HARDWARE

A. Splitter Dampers shall be constructed of not less than 20 gauge (1mm) galvanized steel sheet. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall the blade length be less than 12 inches (300mm).

B. Butterfly and Multi-Louver Dampers
1. Dampers shall be single blade butterfly type in ducts up to and including 18" x 12" (450mm x 300mm) size; for ducts larger than 18" x 12"(450mm x 300mm), in either or both dimensions, the dampers shall be the multi-louver type.
2. Single blade butterfly dampers shall be constructed of not less than 16 gauge (1.6mm) galvanized steel blade mounted in a galvanized steel frame. For rectangular dampers, the top and bottom edges of the blade shall be crimped to stiffen the blade. Damper shall be provided with an extended rod to permit installation of a damper regulator. Dampers shall be:

	Manufacturer	Rectangular Model	Round Model
a.	Air Balance, Inc.	AC-115	----
b.	American Warming & Ventilating	VC-21	VC-22
c.	Arrow United Ind., Inc.	1700	----
d.	Louvers & Dampers, Inc.	CD-500	CD-600
e.	Ruskin	CD-35	CDR-25
f.	Safe Air/Dowco Corp.	611	BDR
g.	Leader	BS-1	BR4

3. Multi-louver dampers shall be the opposed blade type, constructed of not less than 16 gauge (1.6mm) galvanized steel blade mounted in galvanized steel channel frame. Blade spacing shall not exceed 6 inches (150mm) and the top and bottom edges of the blades shall be crimped to stiffen the blades. Damper blades shall be interconnected by rods and linkages to provide simultaneous operation of all blades. Damper shall be provided with an extended rod to permit installation of a damper regulator. Rectangular dampers shall be:
   a. Air Balance, Inc.; AC-116.
   b. American Warming & Ventilating, Inc.; VC-21.
   c. Arrow United Ind., Inc.; 1770.
   d. Louvers & Dampers, Inc.; CD-400.
   e. Ruskin; CD-35.
   f. Safe Air/Dowco Corp.; 610.
   g. Leader; DO3.

C. Damper Hardware
1. Splitter Damper Hardware. When neither dimension of a damper exceeds 18 inches, the damper shall be provided with a ball joint bracket attached to the outside of the duct. The bracket shall have a set screw for securing damper rod in position. The damper operating rod shall be not less than 1/4" (6mm) diameter steel rod and shall be secured to the damper blade with a clip. When either dimension of a damper exceeds 18 inches (450mm), the damper shall be provided with 2 ball joint brackets and rods. The rods shall be located at quarter points on the damper.
2. Butterfly and Multi-Louver Hardware

a. Duct mounted dial regulators with operating handle shall be provided on dampers which are located above non-fire rated, lift out acoustical tile ceilings supported on an exposed grid system.
b. Concealed ceiling mounted dial regulators shall be provided on volume control dampers which are located above the following type ceilings:
    1) Gypsum board ceilings.
    2) Plastered ceilings
    3) Acoustical tile ceilings with concealed grid system.
    4) Fire rated acoustical tile ceilings secured with clips on an exposed grid system.
c. Concealed regulators shall be provided with plain, off white covers. The Contractor shall provide steel channel blocking above the ceiling to support and anchor the regulators. Dampers with operating rods parallel to the line of the ceiling shall be provided with miter gears for connecting the regulator operating rod to the damper operator rod.
d. Damper hardware shall be:
    1) Duro-Dyne
    2) Vent Fabrics
    3) Young Regulator

2.2 GRAVITY VENTILATORS

A. Ventilators shall be the stationary, round type, constructed of galvanized steel, with curb base and with galvanized birdscreen. Ventilator shall be rainproof regardless of wind direction. Ventilator shall be provided with a ceiling mounted exhaust register and interconnecting ductwork between the register and the ventilator base. Gravity ventilators shall be:
    1. Airstream Products Co.; Pul-Air Round Series.
    2. Greenheck; Stationary Ventilator Series.
    3. Penn Ventilator Co.; Pul-Air Series.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Fans

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items;
   1. Fans

C. Operation and Maintenance Instructions: Data shall be provided for the following items:
   1. Fans

1.4 QUALITY ASSURANCE

A. Standards:
   1. Air Moving and Conditioning Association (AMCA):
      a. Publication 99-401, Classification for Spark Resistant Construction.
      b. Publication 210, Laboratory Methods of Testing Fans for Rating.
   2. American Society for Testing Materials (ASTM):
      a. Standard E84, Surface Burning Characteristics of Building Materials.
   3. National Fire Protection Association (NFPA):
      a. Standard 255, Test Methods, Surface Burning Characteristics of Building Materials.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Fans received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Fans shall be stored on wooden rails or wooden pallets. Under no condition shall the fans be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure fans may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Fans shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Testing and Ratings

1. Fans shall be tested and rated in accordance with AMCA 210.

B. Drives
1. V-Belt drives shall be designed for not less than 150% of connected driving capacity and motor sheaves shall be adjustable to provide not less than 20% speed variation. Sheaves shall be selected to drive the fan at a speed to produce the scheduled capacity indicated on the drawings when set at the approximate midpoint of the sheave adjustment. Motors with V-belt drives shall be provided with adjustable bases.

C. Balancing
1. Centrifugal fan wheels shall be statically and dynamically balanced.

D. Disconnects
1. Safety disconnect switches shall conform to requirements of Division 26 - ELECTRICAL.

2.2 CEILING CENTRIFUGAL FANS

A. Fans shall be the ceiling centrifugal type with insulated metal housing, back draft damper, and integral exhaust grille.

B. Housing shall be galvanized steel with 1/2" thick (minimum) coated Fiberglas insulation. Insulation shall comply with ASTM E84 and NFPA 255 for maximum ratings of flame - 25 and smoke - 50.

C. Fan wheel shall be forward curved centrifugal type with direct drive.

D. Fan motor shall comply with Section 230513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT. Motor and drive shall be mounted on vibration isolators.

E. Fans shall be:
1. Acme; Model V.
2. Breidert; Model FF/FFC.
3. Carnes; Model VCD
4. Cook; Model GC (Gemini)
5. Greenheck; Model SP.
6. PennBarry; Model Z (Zephyr)

F. Roof caps for ceiling centrifugal exhaust fans shall be aluminum or steel with birdscreen and a curb base or curb mounting. Steel caps shall have baked enamel finish. Roof caps shall be:

		Flat Roof	Slopped Roof
1.	Acme	Model 611 Series	Model 636 (4”) - Model 634 (8”)
2.	Breidert	Model 611 Series	Model 636 (4”) - Model 634 (8”)
3.	Carnes	Model VXCAF	Model VXCAR
4.	Cook	Model PR	Model RJ
5.	Greenheck	Model RC/GR	Model RJ
6.	PennBarry	Model DR	Model SL

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ceiling centrifugal exhaust fans shall be supported by 1" x 6" gauge galvanized steel straps secured to each corner of the fan housing and to overhead building structure members. Straps shall be attached to fan housing with not less than 2 sheet metal screws per strap. In steel bar

joist construction, straps shall be looped around the bottom chord of joists and fastened with not less than 2 sheet metal screws through the strap to secure the loop.

B. Roof caps shall be secured to curb with cadmium plated steel screws.

END OF SECTION

SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included
   1. Grilles
   2. Registers
   3. Diffusers

B. SUBMITTALS
   1. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

C. Product Data: Data shall be submitted on the following items:
   1. Grilles
   2. Registers
   3. Diffusers

D. Equipment to Owner
   1. Two special tools for security screws and attachments.

1.3 QUALITY ASSURANCE

A. Standards
   1. National Fire Protection Association (NFPA):
      a. Standard 255, Test Methods for Surface Burning Characteristics of Building Materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Air distribution devices received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Air distribution devices shall be stored on wooden rails or wooden pallets. Under no condition shall the air distribution devices be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure air distribution devices may be stored on wooden rails, wooden pallets, or shipping skids outside.

C. Air distribution devices shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Finish
1. Steel grilles, registers, and diffusers shall be provided with a factory applied white baked enamel finish unless indicated otherwise, herein or on the drawings.
2. Aluminum grilles, registers, and diffusers which are ceiling mounted shall be provided with a factory applied white baked enamel finish unless indicated otherwise, herein or on the drawings.
3. Aluminum grilles and registers which are wall or floor mounted shall be factory etched to a satin finish and coated with a clear lacquer.
4. Security grilles and registers installed before the building is dried in shall be protected from rusting. After installation in the walls, all scratches and welds shall be reprimed and refinished to match the new undamaged product.

B. Mounting
1. Model numbers indicated herein are for surface mounting in exposed tee-bar grids or for integral mounting in exposed tee-bar grids. Where grilles, registers or diffusers are to be installed in concealed spine ceilings or plaster ceilings the mounting frame shall be adjusted to match the ceiling requirements. In plaster ceilings, provide plaster frames.

2.2 GRILLES & REGISTERS

A. Type 'D' supply air registers shall be aluminum with double deflecting individually adjustable horizontal and vertical vanes and flat margin with gasket. Vertical vanes shall be in rear; vane spacing shall be 3/4” (20mm) on center. Registers shall be provided with steel opposed blade damper key operated from face of register. Type 'D' registers shall be:

Manufacturer	Register (SR-A)
Carnes	RWDAV Series
Tuttle & Bailey	A64 Series
Krueger	5880 V Series
Titus	300-F Series
Anemostat	X2V Series
E. H. Price	620 Series
J & J Register	990V Series
Millaire	110V Series
Metal Aire	VH Series (2/3"center)

B. Type 'C' return, exhaust, and transfer air grilles and registers shall be aluminum with fixed horizontal vanes, 35 degrees setting (minimum) and flat margin with gasket. Vane spacing shall be 3/4” (20mm) (maximum) on center. Registers shall be provided with steel opposed blade dampers key operated from face of register. Type 'C' grilles and registers shall be:

Manufacturer	
Carnes	RALAH Series
Tuttle & Bailey	A70D Series
Krueger	80/80H Series
Titus	350-F Series
Anemostat	X3HD Series
E.H. Price	630 Series
J & J Register	S90H Series

Millaire	1100H Series
Metal Aire	RH Series (2/3"center)

C. Type 'B' return, exhaust, and transfer air grilles and registers shall be aluminum with perforated face panel. Register shall be provided with steel opposed blade damper. Panel shall be sized to fit 24”x24” (600mm x600mm) exposed tee-bar ceiling system. Type 'B' registers shall be:

Manufacturer	
Carnes	SPRB Series
Krueger	6690 Series
Tuttle & Bailey	PR Series
Titus	PAR Series
Anemostat	PR3P Series
E. H. Price	PDDR Series
J & J Register	1290 Series
Millaire	SPRTB Series
Metal Aire	7500 Series

2.3 CEILING DIFFUSERS

A. Type ‘A’ ceiling diffusers shall be aluminum with square plaque face, removable core, opposed blade damper, round neck or round neck adapter and flat panel to fit a 24” X 24” exposed tee-bar ceiling system. Throw pattern shall be four way unless otherwise indicated on the drawings. Type ‘A’ ceiling diffusers shall be:

Manufacturer	
Carnes	----
Krueger	ASDP
Tuttle & Bailey	----
Titus	OMNI-AA

2.4 LINEAR DIFFUSERS

A. Type 'E' linear diffusers shall be extruded aluminum. Diffuser face shall be white aluminum with suspended ceiling border. Interior air pattern controller shall be painted flat black. Diffusers shall be furnished in one piece up to a maximum of six feet; where diffuser exceeds six feet (2 meters), multiple sections shall be butted with hairline joints and provided with alignment spines. Diffusers shall have concealed fastening. Linear diffusers shall be furnished in lengths, number of slots, size of slot width, and direction of blow as indicated on the drawings. Type 'E’ linear diffusers shall be:

Manufacturer	
Carnes	---
Tuttle & Bailey	---
Krueger	---
Titus	Model FL
Anemostat	---
Barber Colman	---
J & J Register	---
Millaire	---
Metal Aire	---
E. H. Price	---

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grilles and registers mounted in walls shall be secured to ductwork with sheet metal screws.

B. Grilles, registers, and ceiling diffusers not sized to fit ceiling grid systems shall be secured to ductwork with sheet metal screws. Where diffuser is attached to duct system with flexible duct, diffusers shall be supported from structures with two galvanized steel wire hangers.

C. Slot diffusers shall be supported from ceiling grid system. Where installed in plaster or gypsum board ceiling, slot diffuser boot shall be supported from structure with four galvanized steel wire or strap hangers.

D. Linear diffusers shall have a field installed supply boot. Boot shall be 22 gauge (0.8mm) minimum galvanized sheet metal internally lined with 1/2” (12mm) thick, 3 PCF fiberglass mat coated duct liner. Where duct connects to side of boot, boot shall be 12” (300mm) high with width and length 1” (25mm) wider and longer than diffuser inlet. Where duct connects to top of boot, boot shall be 2" (50mm) wider than duct and length 1” (25mm) longer than diffuser inlet. Factory supplied boot shall be acceptable.

END OF SECTION

SECTION 23 81 26 - SPLIT SYSTEM HEAT PUMP UNITS (TO 5 TONS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1.3 Work Included:

1. Indoor Units
2. Outdoor Units

1.4 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Indoor Units
   2. Outdoor Units

C. Operation and Maintenance Data: Data shall be provided on the following items:
   1. Indoor Units
   2. Outdoor Units

1.5 QUALITY ASSURANCE

A. Standards
   1. Air Movement and Control Association (AMCA):
      a. Standard 210, Laboratory Method of Testing Fans for Rating, 1985 Edition.
   2. American Refrigeration Institute (ARI)
      a. Standard 240, Air Source Unitary Heat Pump Equipment, 1981 Edition.
      b. Standard 410, Forced Circulation Air Cooling and Air Heating Coils, 1987 Edition.
   3. Underwriters' Laboratories (UL):
      a. Standard 900.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Split system units received and stored on the job site shall be stored on wooden rails, wooden pallets, or shipping skids. Under no condition shall the condensing units or air handling units be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Split system units shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. Split system heat pump units shall be factory fabricated and matched indoor and outdoor units. Indoor and outdoor units shall be constructed and rated in accordance with ARI 240. Split system heat pump units shall be:

	Outdoor Unit	Indoor Unit
Carrier	37MUHAQ	45MUAAQ
Trane	---	---
York	---	---

2.2 INDOOR UNITS

A. Indoor units shall be horizontal or vertical draw through arrangement as indicated on the drawings.

B. Casing shall be steel with internal reinforcing frame and factory baked enamel finish.

C. Fan shall be centrifugal type with direct driven 3 speed motor. Fan shall be dynamically balanced and rated in accordance with AMCA 210. Fan bearings shall have grease fittings accessible from outside of casing while unit is operating.

D. Refrigerant coil shall have copper tubes and aluminum fins. Fins shall be mechanically bonded to the tubes. Coil performance shall be rated in accordance with ARI 410. Coils shall be factory pressure tested.

E. Heating coil shall be manufacturer's standard resistance electric heating coil.

F. Filter shall be manufacturer's standard 1" (25 mm) thick high velocity flat type filter. Filter shall conform to UL 900 for Class I construction.

G. Provide manufacturer’s standard wired 7 day programmable auto changeover thermostat.

2.3 OUTDOOR UNITS

A. Outdoor units shall be designed for exposed operation. Outdoor units shall include compressor, coil, coil fan, motors, reversing valve, charging valves, sight glass, filter-dryer and controls. Units shall require only one electrical service connection.

B. Enclosure shall be constructed of steel with baked enamel finish. Coil section air intake and discharge shall have wire screen guards.

C. Compressor(s) shall be reciprocating hermetic type with oil pump, crankcase heater, high pressure limit switch, and vibration isolators. Compressor motor shall have both thermal and current overload protection.

D. Coil shall be constructed with copper tubes and aluminum fins. Fins shall be mechanically bonded to tubes. Coil capacity shall be rated in accordance with ARI 210.

E. Fan(s) shall be propeller type with direct driven permanently lubricated motor and fan guard(s). Fans shall be statically and dynamically balanced and rated in accordance with AMCA.

F. Controls shall be mounted in a separate compartment with hinged cover and accessible from outside the units while operating. Controls shall include line to 24 volt transformer, compressor and fan contactors, automatic defrost cycle, cooling to heating change over, and overload protection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Horizontal indoor units shall be suspended from structure with hanger rods with isolators.

B. Vertical indoor units shall be supported from floor with angle mounts or on housekeeping pad.

C. Outdoor units shall be mounted on concrete base.

END OF SECTION

SECTION 23 82 39 - UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included:
   1. Unit Heaters
   2. Wall Heaters

1.3 SUBMITTALS

A. General: All submittals shall comply with the requirements of Division 1 - GENERAL REQUIREMENTS and Section 230500 COMMON WORK RESULTS FOR HVAC.

B. Product Data: Data shall be submitted on the following items:
   1. Wall Heaters

C. Operation and Maintenance Data: Data shall be provided on the following items:
   1. Unit Heaters
   2. Wall Heaters

1.4 QUALITY ASSURANCE

A. Standards:
   1. National Electrical Code (NEC)
   2. Underwriter's Laboratories (UL)

1.5 DELIVERY, STORAGE, AND HANDLING

A. Electric heating equipment received and stored on the job site shall be stored in dry storage spaces, (e.g. building, trailer, or shed) whenever possible. Electric heating equipment shall be stored in shipping cartons on wooden rails, or wooden pallets. Under no condition shall the electric heating equipment be stored in such a way that metal components are in direct contact with the ground or floor slabs.

B. Where it is not practical to store items within an enclosure, electric heating equipment may be stored on wooden rails or wooden pallets outside.

C. Electric heating equipment shall be covered with 6 mil polyethylene sheet (taped in place) to protect the equipment from damage and the weather.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Unit heaters shall be UL labeled vertical or horizontal discharge type as indicated on the drawings. Heaters shall have steel housing with baked enamel finish, resistance heating elements, integral fan and motor, discharge louvers, mounting bracket and fan/heater controls.

B. Elements shall be the finned tubular sheathed type and wired to terminal block.

C. Fan shall be propeller type with permanently lubricated motor.

D. Discharge louvers on horizontal units shall be individually adjustable. Discharge louvers on vertical units shall be type indicated on the drawings.

E. Unit heater controls shall include power contactor(s) automatic reset high limit switch, fan delay relay, control power transformer (24 volts), and built-in thermostat.

F. Mounting bracket, unless indicated otherwise on the drawings, shall be manufacturer's standard bracket.

G. Unit heaters shall be:

	Horizontal
Berko	CUH
Q Mark	CUH
Indeeco	---
Redd-i Heat	---
Electromode	---

2.2 WALL HEATERS

A. Wall heaters shall be surface or recessed wall mounted type as indicated on the drawings. Unit shall include cabinet, resistance element, fan, motor, controls, and mounting brackets. Unit shall be tamperproof with concealed controls.

B. Cabinet shall be 16 gauge (1.61 mm) (minimum) steel with factory baked enamel finish. Color shall be selected by the Architect from the manufacturer standard color chart. Discharge and inlet grilles shall be front mounted. Front panel shall be removable without dismounting unit.

C. Heating element shall be finned tubular sheathed type.

D. Fan shall be propeller type with permanently lubricated motor.

E. Unit controls shall include integral thermostat, automatic reset high limit switch, power contactor, built-in power relay, fan delay relay, and disconnect switch.

F. Wall heaters shall be:
1. Berko; FRC Series
2. Q Mark; AWH-3000 Series
3. Indeeco; WCI Series
4. Electromode; EWA Series, Tamperproof

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall Heaters:
   1. Wall heaters shall be mounted with the bottom of the cabinet 12 inches (300 mm) above the finished floor.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 QUALITY ASSURANCE

A. All electrical work shall be in accordance with the following codes and agencies:

1. The National Electrical Code (NFPA-70), 2020 Edition.
2. The Life Safety Code (NFPA 101), 2018 Edition.
3. The International Building Code, 2018 Edition.
4. Regulations of the local utility company concerning metering and service entrance.
5. State and local ordinances governing electrical work.

B. All materials shall be new and shall conform to standards where such have been established for the particular material. All UL listed equipment shall bear the UL label.

1.02 PERMITS

A. Obtain all permits and inspections required for the work involved. Deliver to the owner all certificates of inspection.

1.03 WARRANTY

A. The contractor shall warrant to the owner that all work shall be free from defects and will conform to the contract documents. This warranty shall extend not less than one year from the date of beneficial occupancy.

1.04 DRAWINGS

A. The drawings indicate the general arrangement of electrical equipment, based on one manufacturer’s product. Coordinate installation of equipment with all other trades. Do not scale drawings for connection locations. Bring all discrepancies to the immediate attention of the architect.

B. Contractor shall install and circuit all electrical work as indicated on drawings unless specific building construction requires a change or rerouting of this work. He shall keep a record of the location of all concealed work, including the underground utility lines. He shall document all changes in the manner specified by the General Conditions, Special Conditions and Supplementary General Conditions to the Mechanical and Electrical Work.

1.05 EQUIPMENT REQUIRING ELECTRICAL SERVICE

A. Review all specification sections and drawings for equipment requiring electrical service. Provide service to and make connections to all such equipment.

B. Drawings are based on design loads of one manufacturer. If equipment actually furnished have loads, numbers of connections, or voltages other than those indicated on the drawings, then control equipment, feeders, and overcurrent devices shall be adjusted as required, at no additional cost to the owner. Such adjustments are subject to review by the architect.

C. Catalog numbers indicated with equipment, devices and lighting fixtures are for convenience only. Errors or obsolescence shall not relieve the furnishing of items which meet the technical description given in specifications, noted, or required by function designated.

1.06 MECHANICAL SYSTEM INTERFACE

A. All control wiring for plumbing and HVAC equipment shall be installed under Division 23. Power wiring to all motors and motor controllers and between motors and controllers shall be provided under Division 26. All motor controllers shall be furnished and installed under Division 26.

1.07 SITE INVESTIGATION AND RENOVATION CONDITIONS

A. Prior to submitting bids for the project, visit the site to become familiar with existing conditions. The project shall be restored to its existing condition, with the exception of work under this contract, prior to final payment.

1.08 PRODUCT DELIVERY, STORAGE, HANDLING, AND PROTECTION

A. Provide a dry, weather tight space for storing materials. Store packaged materials in original undamaged condition with manufacturer's labels and seals intact. Handle and store material in accordance with standards to prevent damage. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable. Replace damaged materials.

1.09 CLEANING AND PAINTING

A. Remove oil, dirt, grease and foreign materials from all equipment to provide a clean surface. Touch up scratched or marred surfaces of lighting fixtures, panelboard and cabinet trims, and equipment enclosures with paint manufactured specifically for that purpose. Paint plywood backboards used to mount electrical equipment with two coats of light grey semi-gloss enamel. All other painting shall be done under the "Painting" section of these specifications.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 IMPOSED REGULATIONS

A. Applicable provisions of the State and Local Codes and of the following codes and standards in addition to those listed elsewhere in the specifications are hereby imposed on a general basis for electrical work: codes and standards listed on the electrical drawings.

1.2 SCOPE OF WORK

A. Provide all labor, materials, equipment and supervision to construct complete and operable electrical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.3 RELATED DOCUMENTS AND OTHER INFORMATION

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the portions of work specified in each and every Section of this Division, individually and collectively.

1.4 EXISTING SERVICES AND FACILITIES

A. Damage to Existing Services: Existing services and facilities damaged by the Contractor through negligence or through use of faulty materials or workmanship shall be promptly repaired, replaced, or otherwise restored to previous conditions by the Contractor without additional cost to the Owner.

B. Interruption of Services: Interruptions of services necessary for connection to or modification of existing systems or facilities shall occur only at prearranged times approved by the Owner. Interruptions shall only occur after the provision of all temporary work and the availability of adequate labor and materials will assure that the duration of the interruption will not exceed the time agreed upon.

C. Removed Materials: Existing materials made unnecessary by the new installation shall be stored on site. They shall remain the property of the Owner and shall be stored at a location and in a manner as directed by the Owner. If classified by the Owner's authorized representative as unsuitable for further use, the material shall become the property of the Contractor and shall be removed from the site at no additional cost to the owner.

1.5 PRODUCT WARRANTIES

A. Provide manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits. Where the warranty requirements of a specific specification section exceed the manufacturer's standard warranty, the more stringent requirements will apply and modified manufacturer's warranty shall be provided. In no case shall the manufacturer's warranty be less than one (1) year.

1.6 PRODUCT SUBSTITUTIONS

A. General: Materials specified by manufacturer's name shall be used unless prior approval of an alternate is given by addenda. Requests for substitutions must be received in the office of the Architect at least 10 days prior to opening of bids.

1.7 ELECTRICAL DRAWINGS

A. Electrical contract drawings are diagrammatic and indicate the general arrangement of electrical equipment. Do not scale electrical plans. Obtain all dimensions from the Architect's dimensioned drawings and field measurements. The Contractor shall review Architectural plans for door swings and built-in equipment; conditions indicated on those plans shall govern for this work.

B. Coordinate installation of electrical equipment with the structural and mechanical equipment and access thereto. Coordinate exterior electrical work with civil and landscaping work.

C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be installed to provide the better quality or greater quantity of work; or, comply with the more stringent requirement; either or both in accordance with the A/E’s interpretation.

1.8 SYSTEMS REQUIRING ROUGH-IN

A. Rough-in shall consist of all outlet boxes/raceway systems/supports and sleeves required for the installation of cables/devices by other Divisions and by the Owner. It shall be the responsibility of this Contractor to determine the requirements by reviewing the contract documents and meeting with the Superintendent of the trade involved and Owner’s representative to review submittal data, shop drawings, etc.

B. Sealing of all sleeves, to meet the fire rating of the assembly, whether active or not, is work of this Division.

1.9 SUBMITTALS

A. Refer to section 260510

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Refer to Division 07 sections for additional requirements.

B. A firestop system shall be used to seal penetrations of electrical conduits and cables through fire-rated partitions per the NEC. The firestop system shall be qualified by formal performance testing in accordance with ASTM E-814, or UL 1479.

C. The firestop system shall consist of a fire-rated caulk type substance and a high temperature fiber insulation. It shall be permanently flexible, waterproof, non-toxic, smoke and gas tight and have a high adhesion to all solids so damming is not required. Only metal conduit shall be used in conjunction with this system to penetrate fire rated partitions. Install in strict compliance with manufacturer's recommendations. 3M, Hilti, STI or equal

D. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

E. Comply with BICSI TDMM, "Firestopping Systems" Article.

PART 3 - EXECUTION

3.1 PRODUCT INSTALLATION, GENERAL

A. Except where more stringent requirements are indicated, comply with the product manufacturer's installation instructions and recommendations, including handling, anchorage, assembly, connections, cleaning and testing, charging, lubrication, startup, test operation and shut-down of operating equipment. Consult with manufacturer's technical experts, for specific instructions on unique product conditions and unforeseen problems.

B. Protection and Identification: Deliver products to project properly identified with names, models numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in a dry, well ventilated, indoor space, except where prepared and protected by the manufacturer specifically for exterior storage.

C. Permits and Tests: Provide labor, material and equipment to perform all tests required by the governing agencies and submit a record of all tests to the Owner or his representative. Notify the Architect five days in advance of any testing.

D. Install temporary protective covers over equipment enclosures, outlet boxes and similar items after interiors, conductors, devices, etc. are installed, to prevent the entry of construction debris and to protect the installation during finish work performed by others. Do not install device plates, equipment covers or trims until finish work is complete.

E. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.

F. Replace all equipment and materials that become damaged.

G. No more than three phase conductors, each of opposite phases for a three phase WYE system, shall be combined in a single raceway unless written approval is granted by the engineer or noted otherwise on the construction documents. (For 120 volt and 277 volt receptacle and lighting circuits are no more than 3 circuits unless written approval is granted by the engineer or noted otherwise on the construction documents.)

3.2 LOW VOLTAGE CABLING SEPARATION FROM EMI SOURCES

A. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

B. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches

C. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches

D. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   1. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches
   3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches

E. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches

F. Separation between Cables and light fixtures: A minimum of 5 inches

3.3 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

B. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.

C. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

D. Damaged equipment shall be, as determined by the Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.

E. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

F. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

3.4 UTILITY CONNECTIONS

A. Coordinate the connection of the electrical system with the local power company. Comply with the requirements of governing regulations, franchised service companies and controlling agencies. Pay all utility fees and charges.

3.5 ELECTRICAL WORK

A. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:

   1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.

2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.

3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Contractor. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways. This plan is subject to review and comment by the owner.

B. Nothing in the above shall impose any duty on the Architects and Architect's consultants, nor relieve the General Contractor and its subcontractors of its obligations, duties and responsibilities including but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordinating the Electrical Work in accordance with the Contract Documents and any health or safety precautions required by any regulatory agencies.

END OF SECTION

SECTION 26 05 10 – ELECTRICAL SUBMITTALS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Comply with the applicable requirements of the Division 1 specifications (013300) and the requirements of this Division of the specifications.

1.2 SUBMITTALS

A. Submit for review by the Engineer Architect a schedule with engineering data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, warranties, etc., to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete electrical characteristics shall be provided for all equipment. Submittals for lighting fixtures shall include Photometric Data. The Engineer reserves the right to require samples of any equipment to be submitted for review. Separate submittal documents shall be provided for each individual specification section listed below and shall not be grouped together.

B. The purpose of shop drawing review is to demonstrate to the Architect that the Contractor understands the design concept. The Architect's review of such drawings, schedules, or cuts shall not relieve the Contractor from responsibility for deviations from the drawings or specifications unless he has, in writing, called the Architect's attention to such deviation at the time of submission, and received written permission from the Architect for such deviations.

C. Where cut sheets include an entire product family, mark all specific items to be utilized for this project on equipment cut sheets. Generic cut sheets with no indication of which items on the cut sheet shall be used will be rejected.

D. Response to Submittals: Shop drawings shall be returned by the Electrical Engineer with the following classifications:

1. "No Exceptions Taken": No corrections, no marks. Contractor shall submit copies for distribution

2. "Make Corrections Noted": A few minor corrections. Items may be ordered as marked up without further resubmission. Submit copies for distribution.

3. "Amend and Resubmit": Minor corrections. Item may be ordered at the Contractor's risk. Contractor shall resubmit drawings with corrections noted.

4. "Rejected - Resubmit": Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

E. Prior Approvals and Shop Drawings must be hand delivered, received by mail, or email.

F. Equipment and materials requiring submittals:
   1. Section 260500 – Common Work Results for Electrical
      a. Product Warranties
      b. Firestopping Materials

c. Firestopping Installation Drawings for each conduit penetration, cable in metal sleeve penetration and blank metal sleeve penetration for each type of wall/floor construction encountered

2. Section 260511 – Electrical Work Closeout
   a. Record Drawings
   b. Record Manuals
   c. Close out submittals
   d. Training verification

3. Section 260519 – Low-Voltage Electrical Conductors and Cables
   a. Splice Kits
   b. Waterproof Wire Connectors
   c. Wire
   d. Field Quality Control Test Reports

4. Section 260526 – Grounding and Bonding for Electrical Systems
   a. Ground Rods
   b. Grounding Connections
   c. Ground Wire
   d. Field Quality Control Test Reports
   e. Bonding Bushings
   f. Bonding Jumper Braid
   g. Ground bus bars

5. Section 260529 – Hangers and Supports for Electrical Systems
   a. Product Data

6. Section 260533 – Raceway and Boxes for Electrical Systems
   a. Raceway
   b. Boxes
   c. Enclosure ratings
   d. Dimension data
   e. Corrosion Protection

7. Section 260543 – Underground Ducts and Raceways for Electrical Systems
   a. Raceway
   b. Handholes
   c. Warning Tape

8. Section 260548 – Vibration and Seismic Controls for Electrical Systems
   a. Submit seismic force level (Fp) calculations from applicable building code.
   b. Submit pre-approved restraint selections and installation details
   c. Restraint selection and installation details shall be sealed by a professionally licensed engineer experienced in seismic restraint design.
   d. Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).
   e. Field reports

9. Section 260553 – Identification for Electrical Systems
   a. Product data for all labeling products
   b. Samples of device nameplates

10. Section 260923 – Lighting Control Devices
    a. Lighting Contactors
    b. Lighting Control Panels
    c. Photo Cells.
    d. Enclosures
    e. Dimensional Data
    f. Wiring Diagrams
    g. Time Clock
    h. Zone Control Diagram
    i. Short Circuit Current Rating

11. Section 262400 – Switchboards and Panelboards
    a. Product data
    b. Enclosures
    c. Dimensional Data
    d. Circuit Directory
    e. Circuit Breaker trip curves
    f. Locks
    g. Shunt-Trip Breakers
    h. Busing Diagrams
    i. Ground-Fault Protection
    j. Schematic Wiring Diagram
    k. Layout Drawings and elevations
    l. Short Circuit Current Rating
    m. Device nameplate data.

12. Section 262726 – Wiring Devices
    a. Product data
    b. Device Plates
    c. Weatherproof Covers
    d. Special Purpose Receptacles
    e. Device and device plate colors

13. Section 265100 – Lighting
    a. Lighting Fixtures
    b. Emergency Drivers

14. Section 265600 – Exterior Lighting
    a. Lighting Fixtures
    b. Emergency Drivers
    c. Poles and Accessories

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 MANUFACTURER'S DATA

A. Include the manufacturer's comprehensive product data sheet and installation instructions. Where operating ranges are shown, mark data to show portion of range required for project application. Where pre-printed data sheet covers more than one distinct product-size, type,

material, trim, accessory group or other variations, delete or mark-out portions of the pre-printed data which are not applicable.

3.2 EQUIPMENT LIST

A. Where more than one type of a product is being used (i.e. starters, disconnects, breakers, etc.) provide a list with each submittal correlating the type and size of product to the load served.

3.3 TEST REPORTS

A. Submit test reports which have been signed and dated by the firm performing the tests, and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.

END OF SECTION

SECTION 26 05 11 - ELECTRICAL WORK CLOSEOUT

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 RELATED SECTIONS

A. Refer to section 017839 for additional requirements.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Except where otherwise indicated, electrical drawings prepared by Engineer are diagrammatic in nature and may not show locations accurately for various components of electrical system. Shop drawings, including coordination drawings, prepared by the Contractor show portions of work more accurately to scale and location, and in greater detail. It is recognized that actual layout of installed work may vary substantially from both Contractor drawings and shop drawings.

B. The electrical superintendent shall maintain a white set of contract documents and shop drawings in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. PDF or digital mark-ups is acceptable alternates Mark-up whatever drawings are most capable of showing installed conditions accurately. However, where shop drawings are marked, record a reference note on appropriate contract drawings. Mark with erasable pencil, and use multiple colors to aid in the distinction between work of separate electrical systems. <u>These documents shall be used for no other purpose</u>. In general, record every substantive installation of electrical work which previously is either not shown or shown inaccurately, but in any case record the following:

1. Post all addenda prior to beginning work.
2. Underground feeder conduits, both interior and exterior, drawn to scale and fully dimensioned.
3. Work concealed behind or within other work, in a non-accessible arrangement.
4. Mains and branches of wiring systems, with panelboards and control devices located and numbered, with concealed splices located, and with devices requiring maintenance located.
5. Scope of each change order (C.O.), noting C.O. number.

C. Upon each visit by the Architect/Engineer, the Contractor shall demonstrate that the record documents are being kept current, as specified hereinbefore.

2.2 RECORD MANUALS

A. Record manuals shall include the following:

1. Manufacturer’s operation and maintenance manuals for:
   a. Light Fixtures
   b. Panelboards and Circuit Breakers
   c. Lighting Control Systems

2. Shop drawings, revised to reflect all review comments, supplemented with the installation instructions shipped with equipment.

3. One copy of all panelboard directories.
4. All field test Reports
5. Electrical Contractor's Warranty

B. Submit record manuals in quantities and in the format prescribed in the Division 1 specifications.

2.3 CLOSEOUT SUBMITTALS

A. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On USB drive, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

PART 3 - EXECUTION

3.1 SITE VISITS

A. At all construction observations by the Architect/Engineer, the Contractor shall demonstrate to the Architect/Engineer that all work is complete in accordance with the contract documents and that all systems have been tested and are fully operational. The Contractor shall furnish the personnel, tools and equipment required to inspect and test all systems.

3.2 TRAINING

A. Train Owner's personnel on the operation and maintenance of the following systems:
1. Lighting Control Systems – 2 hours

B. Training shall not be conducted until system has been tested by the Contractor and is 100% operational. Refer to the individual specification sections for additional requirements.

END OF SECTION

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Wire and cable for 600 volts and less.
   2. Wiring connectors and connections.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

B. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

C. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

PART 2 - PRODUCTS

2.1 WIRING REQUIREMENTS

A. Concealed Dry Interior Locations: Use only THHN-2, THWN-2 or XHHW-2 wire in raceway.

B. Exposed Dry Interior Locations: Use only THHN-2, THWN-2, or XHHW-2 in raceway.

C. Above Accessible Ceilings: Use only THHN-2, THWN-2, or XHHW-2 in raceway.

D. Wet or Damp Interior Locations: Use only THWN-2 or XHHW-2 in raceway.

E. Exterior locations (above or below grade) THWN-2, XHHW-2 or USE in raceway.

F. Use conductors not smaller than 12 AWG for power and lighting circuits.

G. Use conductors not smaller than 14 AWG for control circuits.

2.2 BUILDING WIRE

A. Conductor: Copper, unless noted otherwise

B. Insulation Voltage Rating: 600 volts.

C. Temperature Rating: 90°C.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pull all conductors into raceway at same time.

B. Use suitable wire pulling lubricant for building wire 4 AWG and larger. Do not exceed manufacturers recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Neatly train and lace wiring inside boxes, equipment, and panelboards.

E. Clean conductor surfaces before installing lugs and connectors.

F. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

G. Use split bolt connectors or compression fittings for splices and taps on conductors 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

H. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

I. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

J. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values or UL 486A and UL 486B.

K. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

L. For each electrical connection/termination, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other materials necessary to complete splices and terminations. Torque all connections according to installation instructions.

M. Motor connections shall be made with compression connectors forming a bolted in-line or stub-type connection.

N. Splicing of feeder conductors shall not be acceptable, unless specifically indicated on the drawing. Where splicing of feeder conductors is indicated, splices shall be made using compression type butt splice.

O. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of

threaded body and insulating wedging plug or plugs for cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

3.2 LABELING

A. Color Coding
   1. Color shall be green for grounding conductors and green with yellow stripe for isolated grounding conductors.
   2. The color of the circuit conductors shall be as follows:

120/240 volt, 1-phase	Phase A - Black Phase B - Red Neutral - White

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2.

END OF SECTION 260519

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Grounding and bonding components.

B. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing and new metal underground water pipe.
   2. Metal frame of the building.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.4 REFERENCES

A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; current edition.

C. IEEE Standard 142 “Green Book” – Recommended Practices for Grounding of industrial and Commercial Power Systems; current edition.

1.5 PERFORMANCE REQUIREMENTS

A. Maximum grounding system resistance: 15 ohms.

B. Services at power company interface points shall comply with the power company ground resistance requirements.

PART 2 - PRODUCTS

2.1 ELECTRODES

A. Sectionalized steel with copper-welded exterior, 3/4" dia. x 10'. One 10-foot section shall be required at each ground rod location, unless as otherwise directed in this specification.

2.2 CONDUCTORS

A. Bonding Jumper Braid: Copper braided tape, sized for application.

B. Electrical Grounding conductors: Unless otherwise indicated, provide bare or green insulated stranded copper electrical grounding conductors sized according to NEC or as shown or specified. Provide green insulated for conductors sized No. 10 AWG and smaller.

2.3 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors.

B. Above Grade:
   1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.
   2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
   3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

C. Install exothermic connectors and terminals as recommended by the connector and terminal manufacturer for intended applications.

D. Bolted clamp will not be accepted between grounding rods and ground conductors.

2.4 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 3/8 inch x ¾ inch unless noted otherwise.

B. Busbar Connectors: Cast silicon bronze, solderless, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8- or 25.4-mm) centers for a two-bolt connection to the busbar.

C. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

D. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.

E. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

2.5 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 ELECTRICAL AND COMMUNICATION ROOM GROUNDING

A. Building Earth Ground Busbars: Provide ground busbar hardware at each electrical and communication room and connect to pigtail extensions of the building grounding ring.

3.3 CONDUCTIVE PIPING

A. Bond all conductive piping systems (excluding fuel gas piping), interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. Install braided type bonding jumpers with ground clamps on water meter piping to electrically bypass meter where the main is metallic on both sides of the meter. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.4 CORROSION INHIBITORS

A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

B. Where concrete penetration is necessary, non-metallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground wire and the opening shall be sealed with a suitable compound after installation of the ground wire.

3.5 SECONDARY EQUIPMENT AND CIRCUITS

A. Panelboards and Disconnects; Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits, sized in accordance with Article 250 of NFPA 70.

C. Boxes, Cabinets, Enclosures, and Panelboards:
   1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
   2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
   3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

D. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

E. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

F. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

G. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

3.6 INSTALLATION

A. Install ground electrodes at locations indicated. Provide additional electrodes as required to achieve specified resistance to ground.

B. Install nominal 10" diameter x 18" long fiberglass "water valve" type enclosure, with cover, over each ground rod. The top of ground rods shall be 12" below finished grade. The rod and exothermic connection to the grounding electrode conductor shall be accessible from within enclosure. Fill the lower 3" of enclosure with crushed rocks. Top of enclosure shall be flush with finished grade.

C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing.

D. Bond together metal siding not attached to grounded structure; bond to ground.

E. Bond together reinforcing steel and metal accessories in pool and fountain structures.

3.7 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.13.

END OF SECTION

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Conduit and equipment supports.
   2. Anchors and fasteners.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

PART 2 - PRODUCTS.

2.1 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
   1. Do not use powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
   3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
   4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
   6. Solid Masonry Walls: Use expansion anchors or preset inserts.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use wood screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system

components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

B. Cutting or Holes:
   1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Architect prior to drilling through structural sections.
   2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Architect as required by limited working space.

C. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

D. Install surface-mounted cabinets and panelboards with minimum of four anchors.

E. In wet and damp locations use steel channel supports to stand cabinets, disconnects and panelboards 1 inch (25 mm) off wall.

F. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

G. Use stamped steel bridges to fasten flush mounting outlet box between studs.

H. Use adjustable steel channel fasteners for hung ceiling outlet box.

I. Do not fasten boxes to ceiling support wires.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

K. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

L. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits

M. Do not support conduit with wire, wire ties, or perforated pipe straps. Remove wire used for temporary supports.

N. Do not attach conduit to ceiling support wires.

END OF SECTION

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510

1.2 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); current edition

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); current edition

C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); current edition

D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition

E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; current edition

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; current edition

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept conduit on site. Inspect for damage

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS

A. Conduit Size: Comply with NFPA 70.
   1. Minimum Size: 3/4 inch

B. Wet and Damp Locations:
   1. Exterior above ground and in pipe basements: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
   2. Exterior below ground: RNC schedule 40
   3. Interior: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
   4. Interior below grade: RNC schedule 40

5. Where RNC Schedule 40 is installed below grade or under floor slabs, the elbows required to turn the raceway up through the slab shall be RMC.

C. Dry Locations:
1. Concealed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
2. Exposed: Use EMT or FMC (FMC shall be only used with restrictions, see conduit installation)
3. Interior below grade: RNC schedule 40

D. Area subject to physical damage: RMC, IMC, or LFMC (LFMC shall be only used with restrictions, see conduit installation)
1. “Areas subject to physical damage” shall be defined as the most stringent of the following:
a. Exposed conduit below eight feet above finished floor.
b. As interpreted by the authority having jurisdiction (AHJ).

2.2 METAL CONDUIT

A. Rigid Steel Galvanized Conduit (RMC): ANSI C80.1.

B. Intermediate Metal Conduit (IMC): ANSI C80.6.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
5. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2.3 FLEXIBLE METAL CONDUIT

A. FLEXIBLE METAL CONDUIT (FMC) Description: Interlocked steel only construction. Flexible metal conduit shall conform to UL 1.

B. Fittings: NEMA FB 1.
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Clamp type, with insulated throat.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) Description: Interlocked steel

construction with PVC jacket. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

B. Fittings: UL 514B and ANSI/ NEMA FB1.
   1. Only steel or malleable iron materials are acceptable.
   2. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
   3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

2.5 ELECTRICAL METALLIC TUBING

A. ELECTRICAL METALLIC TUBING (EMT) Description: ANSI C80.3

B. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   2. Only steel or malleable iron materials are acceptable.
   3. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
   4. Couplings and connectors: Concrete tight and rain tight for exterior/wet applications and concrete tight for installations in concrete walls or below grade applications, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for all other locations.
   5. Indent type connectors or couplings are prohibited.

2.6 NONMETALLIC CONDUIT

A. RIGID NONMETALLIC CONDUIT (RNC): Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

B. RNC: NEMA TC 2, schedule 40 PVC

C. Fittings shall meet the requirements of UL 514C and NEMA TC3

D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.7 EXPANSION AND DEFLECTION COUPLINGS

A. Conform to UL 467 and UL 514B.

B. Accommodate, 0.75 inch deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

C. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

D. Jacket: Flexible, corrosion resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.8 CORROSION PROTECTION

A. Corrosion protection for conduits passing through concrete slabs shall be by one of the following means: field-wrapped with 3M Scotchrap No. 50, 2-inch wide (minimum), with a 50

percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify routing and termination locations of conduit prior to rough-in.

B. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to provide a complete wiring system.

3.2 CONDUIT INSTALLATION

A. All fire alarm cable shall be installed in metallic conduit. Coordinate with fire alarm system manufacturer for cable routing and quantities.

B. Install conduit securely, in a neat and workmanlike manner, as specified in NECA 101.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

D. Arrange supports to prevent misalignment during wiring installation.

E. Arrange conduit to maintain headroom and present neat appearance.

F. Route exposed conduit parallel and perpendicular to walls.

G. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

H. Route conduit in and under slab from point-to-point.

I. Maintain adequate clearance between conduit and piping.

J. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

K. Cut conduit square using saw or pipecutter; de-burr cut ends.

L. Bring conduit to shoulder of fittings; fasten securely.

M. For power conduits install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

N. For communication conduits install no more than the equivalent of two 90 degree bends between pull points. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch (50 mm) size.

O. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

P. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

Q. Seal the inside of all conduits where conduit passes below floor or outside of the building.

R. Provide suitable pull string in each empty conduit except sleeves and nipples.

S. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

T. Do not install FMC or LFMC in lengths over 6’.

U. Use LFMC or FMC only to connect to equipment subject to vibration or to suspended light fixtures.

V. Wherever possible, install horizontal raceway runs above water and drain piping. Give the right-of-way in confined spaces to piping that must slope for drainage and to larger HVAC ductwork and similar services that are less conformable than electrical services.

W. Complete the installation of electrical raceways before starting installation of cables within raceways.

X. Raceways shall not be installed exposed in finished spaces. Install concealed in walls, ceilings, below slab-on-grade or embedded in slabs above grade.

3.3 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 24 inch, center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.

F. Clean all debris out of floor boxes.

3.4 IDENTIFICATION

A. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1"

B. On all concealed junction box covers, identify the circuits with black marker. For exposed junction boxes use printed labels.

END OF SECTION

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

PART 2 - PRODUCTS

2.1 DUCTBANKS

A. Any grouping of conduits underground shall be considered a duct bank.

B. Ducts shall be 4" diameter minimum, type EB40 for encased burial.

C. Raceways shall be provided in accordance with specification 260533 Raceway and Boxes for Electrical Systems.

D. Fittings for raceways shall be designed specifically for use with the type of raceway installed. All couplings or other connections shall be made tight and sealed to exclude water and concrete.

E. Top, intermediate and bottom spacers of plastic, or other approved non-organic material, shall be provided to maintain a separation between raceways of not less than that shown on drawings. Spacers shall be of the type specifically intended for encased installations.

2.2 HANDHOLES

A. Handholes shall be constructed of steel reinforced 3,000 pound, 28-day strength concrete, or reinforced polymer concrete manufactured in molded structural shapes, on undisturbed or thoroughly compacted earth and shall conform with details and dimensions indicated on the drawings. Neoprene or other suitable water-stops shall be provided at all concrete construction joints.

B. Locations of handholes shall be as dimensioned. Where no locating dimensions are given, handholes shall be approximately where shown, with possible interferences with other utilities, etc.

C. Frames and covers for handholes shall be heavy duty, top quality, close grained gray cast iron or reinforced polymer concrete, both being milled to provide a true fit. Covers shall be equipped with drop lift handles and with the word "ELECTRIC" cast thereon. Type and style of frames and covers shall be as indicated on the drawings.

D. Hardware shall be of gray cast iron or hot-dip galvanized steel.

E. Water, mud, and trash shall be periodically pumped or otherwise removed from handholes by the Contractor until final acceptance of the work.

F. Metal Frames and Covers: Shall be made of cast iron. Cast iron frames and covers shall meet Fed Spec. RR-F-621. Covers shall be rated AASHTO H20. The words "electric" shall be cast in the top face of the covers.

2.3 WARNING TAPE

A. Provide a plastic warning tape in the backfill above all underground cables, conduits and duct banks. The tape shall be 3 inches wide, shall be bright, fade-resistant, red in color for power, yellow/orange in color for low voltage, and shall include an imprinted legend, ""WARNING - BURIED HIGH VOLTAGE LINE", "WARNING - BURIED FIBER OPTIC LINE" or "WARNING - BURIED TELEPHONE LINE", as applicable., repeated continuously throughout the entire length. Tape shall be buried 12 inches below top of trench.

PART 3 - EXECUTION

3.1 GENERAL

A. Layout of duct banks is the responsibility of the Contractor. Coordinate layout with existing site conditions, the elevation of manhole openings and work by other trades. Duct lines shall be sloped to drain towards manholes and pull boxes, with a pitch of not less than 3 inches in 100 feet. For lines run between adjacent manholes or pull boxes, high point may occur in the middle of run.

B. Excavation, Trenching and Backfilling: Provide as required to install duct banks in the manner indicated on the drawings and in accordance with the applicable sections of Division 31 through 33 of the specifications.

C. Provide barricades with warning lights, around all trenches. Barricades shall be orange mesh type supported by rods driven into the earth. Barricades shall remain in place at all times, not just at night. Maintain the integrity and appearance of the barricades until the trenches have been backfilled and compacted.

D. Clearance from Other Utilities: Do not install lines installed under this contract in the same trenches with other utilities. Maintain horizontal and vertical separation as required by ANSI C2.

3.2 INSTALLATION

A. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand and dirt, by means of suitable conduit plugs. As each section of a duct line is completed from manhole to manhole, a testing mandrel not less than 12 inches long with a diameter 1/4-inch less than the size of the conduit, shall be drawn through each conduit, after which a brush having the diameter of the conduit, and having stiff bristles, shall be drawn through until the conduit is clear of all particles of earth, sand, and/or gravel; conduit plugs shall then be immediately installed.

B. Ducts crossing roadways and parking lots shall be reinforced as indicated on the drawings. Cutting and patching shall conform to the details shown on the Civil drawings. Engage the services of the paving and grading contractor to perform all cutting and patching.

C. Install warning tape 12" below grade along the entire length of, and centered on duct banks.

D. Bends: Except at conduit risers, changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet. Sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 48".

E. Connections to Handholes: Connections shall be constructed to have a flared section

adjacent to the manhole to provide shear strength. Underground structures shall be constructed to provide for keying the concrete envelope of the duct line into the wall of the structure. Vibrators shall be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the structure. Conduits shall terminate in end-bells where duct lines enter manholes.

F. Connections at Pad Mounted transformers: Terminate encasement at underside of concrete pad.

3.3 RECONDITIONING OF SURFACES

A. Ground covering and vegetation disturbed during installation, shall be restored to original elevation and condition.

B. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed. Sod that is damaged shall be replaced by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, the restored surface shall be re-seeded with the same quantity and formula of seed as that use in the original seeding.

3.4 CABLE PULLING

A. Pull cables down grade with the feed-in point at the handhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through the handhole opening and into the conduit. Cable slack shall be accumulated at each handhole where space permits. Minimum allowable bending radii shall be maintained.

B. Lubricants: For assisting in the pulling of cables shall be those specifically recommended by the cable manufacturer. The lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.

C. Cable Pulling Tensions: Shall not exceed the maximum pulling tension recommended by the cable manufacturer.

D. Grounding Conductor: Secondary cable runs, 600 volts and less, in non-metallic conduit shall, although not indicated, include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors.

END OF SECTION

SECTION 26 05 48 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 QUALITY ASSURANCE

A. Submittals must be signed and sealed shop drawings from a professional engineer licensed in the state that the project is located in. Shop drawings to include project specific details, sketches, product data cut sheets.

B. The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.

C. System Supports/Restraints Manufacturers shall be firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 - PRODUCT

2.1 SEISMIC BRACING

A. General:
   1. Seismic restraint designer shall coordinate all attachments with the structural engineer of record.
   2. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
   3. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
   4. All seismic restraint devices shall be designed to accept without failure the forces calculated per the details and notes on the construction documents

B. Friction from gravity loads shall not be considered resistance to seismic forces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All seismic restraint systems shall be installed in strict accordance with the manufacturer’s seismic restraint guidelines manual and all certified submittal data

B. Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

D. Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building.

E. Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

F. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.

G. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

H. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.

I. Provide reinforced clevis bolts where required.

J. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

K. Do not brace a system to two independent structures such as a ceiling and wall.

L. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement.

3.2 FIELD QUALITY CONTROL

A. Inspect all seismic supports after installation and submit a report from a professional engineer licensed in the state that the project is located in.

END OF SECTION

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

A. Nameplates: Engraved two-layer laminated plastic, black letters on white background unless noted otherwise.

B. Locations:
   1. Each electrical distribution and control equipment enclosure.

C. Letter Size:
   1. Use 1/4 inch (6 mm) letters for identifying grouped equipment and loads.

D. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches, receptacles, and control device stations. Labels shall identify the panel and circuit number (Ex: PANEL: CIRCUIT).

E. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   1. Minimum Width: 3/16 inch (5 mm).
   2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
   5. Color: burgundy.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using corrosion resistant screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Provide name plates on all disconnects and panelboards.

E. Provide labels on all receptacles, light switches, and wall mounted occupancy sensors.

END OF SECTION

SECTION 26 09 23 – LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to section 260510.

1.2 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated

D. UL Approvals: UL listed under UL 916 Energy Management Equipment.

E. FCC Emissions: Compliance with FCC emissions Standards specified in Part 15 Subpart J for Class A application.

1.3 REFERENCE STANDARDS

A. NEMA ICS 4 – Industrial Control and Systems: Terminal Blocks; National Electrical Manufacturers Association; current edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Leviton Manufacturing, Inc: www.leviton.com.

B. Lutron Electronics Inc: www.lutron.com

C. Wattstopper Inc: www.wattstopper.com

2.2 CONTACTORS

A. Contactors shall be rated 30A/600V and shall be installed in a NEMA 1 enclosure. Coil voltage shall be 120V, unless noted otherwise. Contactors shall be electrically operated, mechanically held type with coil clearing contacts. Contactors shall be field-convertible for use with maintained-contact (two-wire) or momentary-contact (three-wire) control devices. Provide three-wire control unless noted otherwise.

B. Contactors shall be of the number of poles required to control the circuits indicated, plus a minimum of two spare poles. Where number of circuits controlled exceeds the maximum number of poles available, provide multiple contactors connected in parallel.

C. Provide H-O-A switch in cover of enclosure for contactors serving exterior lighting. Connect switch to operate as indicated on the drawings.

D. Contactors shall have silver alloy double-break contacts and coil clearing contacts for mechanically held contactor and shall require no arcing contacts.

2.3 PHOTOCELLS

A. Photocells shall have the following features:
   1. Quick-response, cadmium-sulfide type.
   2. A 15 to 30 second, built-in time delay to prevent response to momentary lightning flashes, car headlights or cloud movements.
   3. Energizes the system when the north sky light decreases to approximately 1.5 footcandles, and maintains the system energized until the north sky light increases to approximately 3 to 5 foot candles.

2.4 CONTROLS

A. Switches

B. Wiring

PART 3 - EXECUTION

3.1 INSTALLATION

A. Photocell Switch Aiming: Aim switch according to manufacturer's recommendations. Set adjustable window slide for proper footcandles photocell turn-on.

B. Locate contactors controlling lighting circuits above panels in which circuits originate; locate contactors controlling receptacles above accessible ceiling of room near location of door to room.

C. Neutral and grounding conductors shall be routed through contactor enclosure with associated phase conductor(s) being switched. Group each branch circuit within enclosure using nylon tie straps.

D. Do not splice conductors within contactor enclosure.

E. Provide wiring troughs with terminal strips adjacent to contactors, so that unswitched portions of circuits (i.e. exit lights, etc.) can bypass the contactors. The use of wirenuts within enclosures is not acceptable. Connect contactor enclosure to panelboard and troughs with conduit nipples sized for the total number of branch circuits conductors encountered.

3.2 LABELING

A. All wiring shall be labeled clearly indicating which lighting control panel or device it connects to.

B. Use only properly color-coded, stranded wire as indicated on the drawings.

3.3 DEMONSTRATION

A. Demonstrate proper operation of system.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect each device for defects.

C. Operate each switch and verify proper operation.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the lighting control system.

END OF SECTION

SECTION 26 10 00 - BASIC MATERIALS

PART 1 - GENERAL

2.01 RACEWAYS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratory, Inc. Publications 1, 6, 467, 651, 797, 1242.
2. American National Standards Institute C-80.1, C-80.3.

B. Raceway is required for all wiring, unless specifically indicated or specified otherwise. The minimum size of conduit shall be 1/2", but shall not be less than size indicated on the drawings or required by the NEC.

C. Conduits shall be electrical metallic tubing (EMT) except for the following conditions:

1. Conduits which penetrate the building roof or exterior shall be rigid aluminum.
2. Conduits installed within concrete slabs shall be schedule 40 heavy wall PVC. Where transition is made from raceway in slab to any type of raceway out of slab, make transition with a rigid aluminum elbow.
3. Conduits installed in direct contact with earth shall be schedule 40, heavy wall PVC. Where transition is made from below earth to any type of raceway out of earth, make transition with a rigid aluminum fully taped elbow.
4. Use flexible conduit for connections to motors, flush mounted lighting fixtures, and all vibrating equipment.
   a. Length shall not exceed 18," except lengths up to 6’-0” may be used for lighting fixtures.
   b. Maintain ground continuity through flexible conduit with a green equipment grounding conductor.
   c. Liquid-tight flexible conduit shall be used in mechanical equipment rooms and exterior installations.

D. EMT conduit couplings and connectors shall be steel raintight type, compression type. All EMT connectors shall be insulated throat type. Rigid aluminum fittings shall be standard threaded couplings, locknuts, bushings, and elbows. Non-metallic conduit fittings shall be of the same material as the conduit furnished and shall be the product of the same manufacturer.

E. All conduit support parts and hardware shall be hot-dipped galvanized. Conduit straps shall be single hole cast metal type or two hole galvanized metal type. Conduit support channels shall be 1 ½” x 1 ½” – 14 gauge channel, with ¼” threaded steel rods used for suspension. Wire or chain is not acceptable for conduit hangers. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose. Individual conduit straps on metal studs shall be spring steel and should wrap around the entire face of the stud; tie wraps are not acceptable.

F. Conceal all conduits except in unfinished spaces such as equipment rooms or where indicated by symbol on the drawings. Leave all empty conduits with a 200 lb. test nylon cord pull line. Complete raceway runs prior to installation of wires or cables. Deformed conduits shall be replaced. Protect conduits against dirt, plaster, and foreign debris with conduit plugs.

G. Fasten conduit support devices to structure with wood screws on wood, toggle bolts on hollow masonry, expansion anchors on solid masonry or concrete, and machine bolts or clamps on steel. Nails are not acceptable. Seal all conduits penetrating building exterior with insulating electrical putty to prevent entrance of moisture.

H. Conduit shall be run parallel or at right angles to walls, ceilings, and structural members. Support branch circuit conduits at intervals not exceeding 10 feet, and within 3 feet of each box or change of direction. Restore the fire rating of all wall and floor penetrations. Provide an expansion and deflection coupling where conduits cross a building expansion joint.

2.02 WIRES AND CABLES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 44, 83, 486, 493.
2. Insulated Cable Engineers Association Standards S-61-402, S-66-524.
3. National Electrical Manufacturer's Standards WC-5, WC-7.

B. Conductors shall be electrically continuous and free from short circuits or grounds.

C. All open, shorted, or grounded conductors and any with damaged insulation shall be removed and replaced with new material free from defects.

D. Conductor size shall be minimum of No. 12 AWG, unless larger size is required by the drawings or the NEC. Emergency system conductors shall be minimum No. 10 AWG. Insulation voltage level rating shall be 600 volts. All wire and cable shall bear the UL label. Fire alarm, data, and communication conductors are not included in this specification; they shall comply with NEC requirements.

E. Conductors No. 10 and smaller shall be solid copper, 90 degrees C. type THWN/THHN. Conductors larger than No. 10 shall be stranded copper, 90 degrees C. type THWN/THHN, or XHHW. Fixture wire shall be No. 16 AWG silicone rubber insulated, stranded fixture wire type SFF-2 or No. 16 thermoplastic nylon jacketed stranded fixture wire type TFFN.

F. Color code all conductors. No. 10 and smaller shall have solid color compound or coating. No. 8 and larger shall have solid color compound or colored phase tape; tape shall be installed on conductors in every box, termination point, cabinet, or enclosure. Coding shall be as follows:

1. 120/240 volt singe phase three wire system: Phase A-black, Phase B-red, neutral-white.
2. Grounding conductors shall be green or green traced. Grounding conductors for isolated ground circuits shall be green with a yellow trace.
3. Neutral conductors No. 6 and smaller shall have solid insulation or continuous color tape for the entire length of conductor. Neutral conductors No. 4 and larger shall have colored phase tape. Colored tape shall be installed on conductors in every box, at each termination point, cabinet or other accessible location.

G. Maintain phase rotation established per N.E.C. at service equipment throughout entire project.

H. Group and lace with nylon tie straps all conductors within enclosures. Make splices in conductors only within junction boxes, wiring troughs, or other NEC approved enclosures. Do not splice conductors in pull boxes, switchboards, panelboards, safety switches, or motor control enclosures. Identify each conductor as to circuit connection in all boxes and enclosures.

I. Terminate stranded conductors No. 10 AWG and smaller with crimp-type lug or stud. Crimp terminal shall be the configuration type suitable for terminal point.

J. Torque each terminal connection to the manufacturer's recommended torque value. A calibrated torquing tool shall be used to insure proper torque application.

2.03 BOXES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 50, 467, 514.

B. Review architectural drawings for areas where outlets occur within specific features and install outlets as shown on architectural drawings; or, if not shown, center and align boxes within the predominant features.

C. Boxes shall be hot-dipped galvanized steel sheet metal, unless rustproof cast metal is specified or required by the NEC. Boxes for surface and pendant mounted lighting fixtures shall be 4" octagon boxes, 1 1/2" deep. Boxes for flush mounted lighting fixtures, switches, receptacles, and wall mounted junction boxes shall be 4" square boxes, 1 1/2" deep; where only one conduit enters box, 3 1/2" deep single gang switch box may be used for wall mounted devices. Outlet boxes for GFI receptacles shall be 2 3/4" deep.

D. Outlet boxes for switches and receptacles in exposed wiring systems shall be cast FS type with matching device plate. For exterior installations, use spring loaded hinged covers. Boxes for individual devices flush mounted in exposed concrete block shall be single gang masonry boxes 3 1/2" deep. Boxes installed in poured concrete or cast in place shall be concrete-tight type; box depth shall allow 2" minimum concrete cover. Provide larger boxes as required for special purpose devices. For receptacles, provide heavy duty metal in-use covers.

E. Dimensions of pull and junction boxes shall not be less than those required by the NEC for the number, size, and position of conductors entering the box. Wood supports within pull boxes are not acceptable. Provide box covers for all boxes.

F. All boxes shall be completely accessible and as required by the NEC. Provide access panels in all non-accessible spaces to permit access to boxes. Provide an outlet box for each lighting fixture or as indicated on the drawings and for each device. Box sizes shall be increased from those outlined above if required by Article 314 of the NEC.

G. Support every box from structure. Secure to wood with wood screws, hollow masonry with toggle bolts, metal with sheet metal screws, solid masonry or concrete with expansion anchors, metal studs with spring steel clamp, and structure with threaded steel rod when suspended. Set outlet boxes for flush mounted devices to within 1/8" of finished walls; spacers or shims between box and device are not acceptable. Support outlet boxes for support of surface mounted incandescent lighting fixtures by light weight channel spanning between and mounted to main ceiling support member, attached by galvanized tie wire or nylon tie straps.

H. Remove only knockouts as required and plug all unused openings. After completion, using indelible ink wide tip marker, indicate on the cover of each junction and pull box the designation of each circuit contained therein.

2.04 WIRING DEVICES

A. The following specifications and standards are incorporated into and become a part of this specification:

1. National Electrical Manufacturer's Association Publications WD-1, WD-5.

B. Single pole, 20 amp, 277 volt toggle switches shall be Hubbell 1221. Three-way, 20 amp, 277 volt switches shall be Hubbell 1223. Weatherproof, 20 amp, 277 volt switches shall be Hubbell 1281-1750. Single pole, 20 amp, 277 volt switches with pilot lamp in handle shall be Hubbell 1221-Pl7. Equivalent switches manufactured by Arrow Hart, General Electric, Legrand, or Leviton are acceptable.

C. Fifteen amp, 125 volt grounded duplex receptacles (NEMA 5-15R) shall be Hubbell 5252. Twenty amp, 125 volt grounded duplex receptacles (NEMA 5-20R) shall be Hubbell 5352. Ground fault interrupter (GFI) receptacles shall be Hubbell GF-8200. Special purpose receptacles shall be as specified on the drawings. Equivalent receptacles manufactured by Arrow Hart, General Electric, Legrand, or Leviton are acceptable.

D. Vacancy sensor wall switch shall be Sensorworx SWX-121-WH. Ceiling mounted occupancy sensors shall be Hubbell OMNIDT2000. Equivalents of the same quality by Wattstopper and Leviton are acceptable.

E. Device plates shall be one piece single or multi-gang type selected to match the device or combination of devices. Device plates for flush mounted devices shall be medium size nylon of the same finish as the devices. Device plates for use with devices flush mounted in exposed masonry construction shall be jumbo type. All devices installed in areas exposed to the weather shall be provided with a weatherproof device plate.

F. All devices shall be provided with finish as specified by architect. Mount all devices within outlet boxes to allow device plates to be in contact with wall on all sides. Install wall switches on the strike side of doors.

G. Circuits with GFCI receptacles shall have a dedicated neutral conductor.

2.05 CIRCUIT AND MOTOR DISCONNECTS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 98, 198.2, 198.4.
2. National Electrical Manufacturer's Association Publications KS-1.

B. Products of GE/ABB, Eaton, Square D, or Siemens which comply with these specifications are acceptable.

C. Disconnect switches shall be heavy duty non-fusible safety switch type, unless fused type is indicated on the drawings, with the number of poles required to disconnect all ungrounded conductors serving the equipment.

1. Furnish a solid neutral when the circuit includes a neutral conductor.
2. Furnish an equipment grounding conductor lug bonded to the switch enclosure.
3. Furnish NEMA type one enclosure for all interior dry locations, and NEMA type 3R for all damp, wet, or exterior locations unless other types are indicated on the drawings.
4. Switches for air conditioning equipment shall be fused if required by the equipment manufacturer. Fuse size shall be as shown on the equipment nameplate.

D. Switches shall have the following features:

1. Quick-make, quick break switching mechanism.
2. Line terminal shields.
3. Provisions for padlocking in the "off" position.
4. Door interlocks to prevent door from opening when switch is closed. Provide inconspicuous means to defeat this interlock.
5. Permanent name plate indicating all ratings.
6. Arc chute for each pole.
7. 600 volt rating for 250 to 600 volt systems, 250 volt rating for systems below 250 volts.
8. Rejection clips to accept only RK1 or RK5 fuses when switch is fusible type.

E. Disconnect switches for three phase motors rated two horsepower and above shall be three pole non-fusible type. Disconnect switches for three phase motors rated less than two horsepower shall be three pole manual motor starter switches without overload protection. Disconnects for single phase motors shall be single or two pole horsepower rated switches without overload protection.

F. Locate switches to provide full accessibility and working clearances required by the NEC. Locate adjacent to equipment served unless drawings indicate otherwise. Mount switch directly to structure or to metal channel depending upon field conditions. Mount switch handle between 36" and 60" above finished floor.

2.06 SUPPORTING DEVICES

A. Provide and install supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published standards and as required for complete installation.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices. Install hangars, supports, clamps, and attachments to support piping properly from building structure only. Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form water-tight seal.

2.07 ELECTRICAL IDENTIFICATION

A. Install engraved plastic - laminate sign on each major unit of electrical equipment. Provide a single line of text, 1/2" high lettering on 1 1/2" high sign (or 2" high sign if 2 lines required). Provide signs for each unit of the following:

1. Panelboards
2. Electrical cabinets and enclosures
3. Motor controllers
4. Disconnect switches

B. Apply cable/conductor identification, including voltage, phase, and feeder number, on each cable/conductor in each box or enclosure where wires are present.

END OF SECTION

SECTION 26 24 00 – SWITCHBOARDS AND PANELBOARDS

PART 1 - GENERAL

1.1 SUBMITTALS

A. See section 260510.

1.2 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

B. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; current edition.

C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; current edition.

D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; current edition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer

B. ABB

C. Square D

D. Siemens

2.2 PANELBOARDS

A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

B. Panelboard Bus: Copper (98% conductivity).

C. Provide copper ground bus in each panelboard

D. Enclosure: Interior - NEMA 1, Exterior locations – gasketed NEMA 4X, Kitchen - Stainless NEMA 1

E. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. Paint all hallway panels to match wall finish.

F. All panelboards shall be hinged “door in door” type with:
   1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.
   2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips or other fasteners requiring a tool for entry, hand operated latches are not acceptable.
   3. Push inner and outer doors shall open left to right.

G. All panelboard shall have bolt-on style breakers.

H. Provisions for future breakers shall be fully bussed complete with all necessary mounting hardware.

2.3 CIRCUIT BREAKERS

A. For circuit breakers 1200 amps and over (or capable of being adjusted to 1200 amps and over) – Provide a means of arc energy reduction per NEC 240.87.

B. For Circuit breakers 1000 Amps and over – Provide low voltage AC power circuit breaker, with fixed mounting, stored energy and solid state trip devices.
   1. Provide individual adjustable solid-state elements as an integral part of the solid-state trip devices for complete system selective coordination. All breakers shall have LSI settings. All breakers shall have LSIG settings for 277/480V distribution.
   2. Position indicator: Provide an indicator visible from the front of the unit to indicate whether the breaker is open or closed.
   3. Trip button: Provide a mechanical trip button accessible from the front of the door to trip the breaker.
   4. Padlocking: Include provisions for padlocking the breaker in the open position.
   5. Operation: Unless otherwise shown on the drawings, breakers 1600 ampere frame size and less may be manually operated. Breakers larger than 1600 amperes frame size shall be electrically operated.
   6. Trip devices shall have the following features:
      a. Trip device in each pole.
      b. Metering, voltage, current memory and LCD display
      c. Mechanically and electrically trip free.
      d. Long time element with adjustable pick-up and selective maximum, intermediate, and minimum time delay bands.
      e. Short time element with adjustable pick-up and selective maximum, intermediate, and minimum time delay bands.
      f. Ground fault element with adjustable pick-up and selective maximum, intermediate and minimum time delay bands.
      g. Maintenance setting option to reduce Arc Flash hazards.

C. For circuit breakers over 200 amps – Provide adjustable trip molded case, solid state adjustable trip type circuit breakers.
   1. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip). (where indicated)
   2. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. (where indicated)
   3. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts. (where indicated)

4. Trip units shall have field adjustable tripping characteristics as follows:
   a. Ampere setting (continuous).
   b. Long time band.
   c. Short time trip point.
   d. Short time delay.
   e. Instantaneous trip point.

D. For all circuit breakers 200 amps and smaller – Provide molded case circuit breakers: Thermal magnetic trip circuit breakers.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Do not use tandem circuit breakers.
   5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip). (where indicated)

E. Circuit breakers serving elevators shall have adjustable long-time setting and shall be provided with a shunt trip coil rated for 120V operation. Breaker shall also have a set of Form C contacts. Connect shunt trip coil to operate as indicated on the drawings.

F. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

G. Circuit breakers serving fire alarm devices shall be provided with a red fire alarm circuit breaker lockout kit that permanently identifies circuit as “FIRE ALARM”.

H. Circuit breakers serving emergency communication devices (e.g. mass notification, area of refuge, two way communication) shall be provided with a circuit breaker locking device and be permanently identified as “EMERGENCY COMMUNICATIONS”.

2.4 CONTROL WIRING

A. Control wiring shall be 600 volt class B stranded SIS. Install all control wiring complete at the factory adequately bundled and protected. Wiring across hinges and between shipping units shall be Class C stranded. Size in accordance with NEC. Provide control circuit fuses.

2.5 SHORT CIRCUIT CURRENT RATING

A. Devices which achieve the level of fault protection indicated by means of "series" or "integrated" rating shall not be acceptable unless specifically indicated on the drawings. All panelboards shall be fully rated.

B. Minimum SSCR
   1. 240 Volt Panelboards: Minimum 10,000 amperes rms symmetrical unless noted otherwise on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates on all panelboards.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 6 empty 1 inch conduits.

H. Ground and bond panelboard enclosure according to Section 260526.

I. Do not splice conductors in panelboard enclosure.

J. Each section of two section panels shall contain only those conductors which originate in that section. Do not use panel as a wireway.

K. Piggy-back or tandem type breakers shall not be used.

L. Multi-pole breakers shall be common trip, with a single handle.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA STD ATS, except Section 4.

B. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.3 ADJUSTING

A. Touch-up scratched or marred surfaces to match original finish.

B. Clean all debris from panel interiors.

3.4 LABELING

A. Provide nameplates on all electrical panels that new circuits are modified or installed. Indicate the following information:
   1. Panel name
   2. Panel fed from
   3. Normal (Black with white letters)
   4. Voltage, phase, wire
   5. Date installed

B. Provide a typed legend for all modified or new electrical panels. Update the panel board schedules after load balancing.

C. Identify load served and location by room names assigned by user, not by room numbers on floor plans. Note spares and spaces as such.

D. Provide a laminated 11x17 one line diagram in the main electrical room mounted to the wall or main electrical panel.

E. Provide ARC flash identification per NFPA 70E.

3.5 CLEARANCE AND WORKSPACE

A. Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the panelboard. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the following:
   1. Receptacles.
   2. Device plates.
   3. Ceiling fan controllers
   4. Wall switches.

1.2 SUBMITTALS

A. Refer to section 260510.

1.3 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; current edition.

B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; current edition).

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; current edition.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Acceptable manufacturers, contingent upon compliance with the contract documents, are as listed below. Bidders shall carefully review the requirements listed in the technical specifications and only submit products that are equal or better. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed in the front end specifications and approved by the A/E. Bidders shall carefully review the front end documents and submit all information required to allow the A/E the ability to make a fully informed decision.
   1. Cooper Wiring Devices
   2. GE Industrial
   3. Leviton Manufacturing, Inc
   4. Hubbell, Inc
   5. Lutron Electronics Inc
   6. Wattstopper Inc

7. Schneider Electric
8. Legrand – Pass & Seymour
9. C.W. Cole & Company
10. Acuity Brands Lighting, Inc

2.2 RECEPTACLES

A. Receptacles: Specification Grade Receptacles, Fed spec listed complying with NEMA WD 6 and WD 1.
   1. Device Body: color by architect plastic, or Red for emergency power devices.
   2. Configuration: NEMA WD 6, type as specified and indicated.
   3. Type 5-20.

B. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Feed through GFCI devices shall not be used. GFCI devices shall contain self-testing feature with power lockout if self-test fails.

C. Special Purpose Receptacles: Provide heavy-duty type as indicated on the drawings.

D. Wet Location: A receptacle installed in a wet location shall be GFCI listed weather-resistant type.

2.3 WALL PLATES

A. Cover Plates: Provide one piece wall plates for wiring devices, with ganging and cutouts as required. Provide blank wall plates for all un-used outlet boxes. Provide with metal screws for securing plates to devices, screw heads colored to match finish of plate. All plates shall be standard size, smooth stainless steel.

B. Weatherproof Cover Plates: All devices installed outdoors and indoor devices specifically indicated, shall be provided with weatherproof covers. Covers shall be of the type that maintains weatherproof integrity when in-use and not in-use. Covers shall be listed and identified as “extra duty” type.

2.4 CEILING FAN CONTROLLERS

A. Switch for lights.

B. Adjustable speed control slider switch for fan speed.

2.5 WALL SWITCHES

A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: color by architect plastic with toggle handle, or red for emergency power devices.
   2. Locator Light: Lighted handle type switch; red color handle.
   3. Ratings: Match branch circuit and load characteristics.
   4. Switch shall be rated for the horse power of the motor served.

B. Switch Types: Single pole, double pole, 3-way, and 4-way.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

B. Install devices plumb and level.

C. Do NOT utilize back wiring on any wiring device.

D. Install receptacles with grounding pole on top.

E. Do not install receptacles within 6” of the edge of sinks.

F. Connect wiring device ground terminal to outlet box with bonding jumper.

G. All receptacles installed as listed below shall be GFCI type.
   1. Receptacles installed outdoors.
   2. Any other receptacles specifically indicated on the drawings.

H. Install decorative plates in finished areas.

I. Connect wiring devices by wrapping conductor around screw terminal.

J. Provide screen-printed nylon wall plates that indicate the branch circuit to which the associated device is connected. Use 1/8” high black letters.

K. Install switches with OFF position down.

3.4 FIELD QUALITY CONTROL

A. Perform all field inspection, testing, and adjusting specified in NETA STD ATS.

B. Inspect each wiring device for defects.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Operate each wall switch with circuit energized and verify proper operation.

3.5 CLEANING

A. It is anticipated that painting and other finish work may occur after device installation. Device plates shall not be installed until these activities are completed. Protect device and conductors by installing molded plastic cover.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 40 00 - DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

3.01 GROUNDING SYSTEMS

A. Equipment grounding system shall be established with equipment ground conductors. The use of metallic raceways for equipment grounding is not acceptable. Unless indicated otherwise, provide equipment ground the same size as phase conductors.

B. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 44, 83, 467, 486, 493.
2. National Electrical Manufacturer's Association Standards WC-5, WC-7.

C. Grounding electrode conductors shall be bare or green insulated copper sized as indicated on the drawings. Equipment grounding conductors shall be green insulated type THW, THWN, or XHHW sized as indicated on the drawings. Where sizes are not indicated, grounding conductor shall be sized in accordance with NEC Article 250.

D. Each receptacle and switch device shall be furnished with a grounding screw connected to the metallic device frame. Provide a conductor termination grounding lug bonded to the enclosure of each transformer, motor controller, and disconnect switch.

E. Ground all non-current carrying parts of the electrical system, i.e., wireways, equipment enclosures and frames, junction and outlet boxes, machine frames, and other conductive items in close proximity with electrical circuits. Ground the neutral of all dry type transformers to building steel that shall serve as the grounding electrode for the separately derived system. In reinforced concrete structures, building steel shall be considered to be the reinforcing steel of vertical columns. Grounding connections to structural steel shall be made with a chemical exothermic weld.

F. Grounding conductors for branch circuits are not shown on the drawings; however, grounding conductors shall be provided in all branch circuit raceways and cables, including flexible conduit. Grounding conductors shall be the same AWG size as branch circuit conductors.

G. A feeder serving more that one panelboard shall have a continuous grounding conductor which shall be connected to each related cabinet grounding bar. The equipment grounding conductor shall be terminated with a screw or bolt used for no other purpose. Equipment grounding conductors shall terminate on panel board, switchboard, or motor control center grounding bus only. Do not terminate on neutral bus.

H. Each telephone backboard shall be provided with a No. 6 grounding conductor. This conductor shall terminate on building steel as defined above.

3.02 PANELBOARDS

A. The following specifications and standards are incorporated into and become a part of this specification:

1. Underwriter's Laboratories, Inc. Publications 50, 67,489.
2. National Electrical Manufacturer's Association Publications PB-1, AB-3.

B. Products of GE/ABB, Eaton, Square D, or Siemens which comply with these specifications are acceptable.

C. All panels and circuit breakers shall be UL listed and bear a UL label. Where panels serve as service entrance equipment, panel shall bear a UL label indicating such. Panels shall be of the dead front safety type. Provide panels complete with factory assembled circuit breakers connected to the bus bars. Number all panel boards in the following sequence: Circuits 1 and 2 - Phase A; circuits 3 and 4 - Phase B; circuits 5 and 6 - Phase C.

D. All bus bars shall be copper. Main lugs and main breaker shall be UL approved for copper or aluminum conductors and shall be of a size range for the conductors indicated on the drawings. Each panel shall contain a full size grounding bus and, when required, a full size insulated neutral bus. The neutral and ground busses shall have a sufficient number of lugs to singularly terminate each individual conductor requiring a connection. The ground bus shall be brazed or riveted to the panel enclosure, but not attached to the panel interior. Where designated, each "space' shall include all bussing, device supports and connections for future breaker installation. Where indicated, provide sub-feed or through-feed lugs and increase box height to provide additional cable bending space; lug size shall match ampacity of mains.

E. Branch circuit panel board width shall be between 20 and 22 inches; depth shall be 5 3/4" maximum. Distribution panel board width shall be 32" minimum and depth shall be 14" maximum. Provide gutters and bending space to conform with the NEC. Key all panels throughout the project alike. Where two section panels are required, provide a fully rated bus for each section with interconnecting copper conductors of ampacity equal to the rating of the main bus.

F. Circuit breakers shall be quick-make, quick-break, thermal magnetic type bolted to the bus. Multi-pole breakers shall be common trip and common reset type; tie handle connections are not acceptable. Interrupting ratings on 208 volt systems shall be 10,000 RMS symmetrical amps minimum and on 480 volt systems shall be 14000 RMS symmetrical amps minimum; provide higher ratings when indicated on the drawings. Provide the following when specified, indicated on the drawings, or required by the NEC:

1. Ground fault interrupting circuit breaker (GFI).
2. Handle lock-off device for exit lights, egress lighting, fire alarm system, securing system, refrigeration equipment, and as indicated.

G. Mount panel boards with top circuit not more than 6'-6" above finished floor. Enclosures shall be secured by a minimum of four fastening devices. Attach enclosure directly to masonry, concrete, or wood, maintaining a 1” rear clearance. Mount enclosure to metal channel for installations on steel structure or drywall.

H. Provide in each panel board a typewritten circuit directory mounted under clear plastic in metal holder in the door of the panel reflecting all field changes additions. Install push-in knock-out closure plugs in any unused knock-out openings.

265000 - LIGHTING SYSTEM

4.01 INTERIOR LIGHTING FIXTURES

A. All materials shall be new, free from defects, and bear a UL label. All fixtures installed in damp or wet locations shall be UL listed and labeled for that application. Fixtures installed in fire rated ceilings shall preserve the fire rating of the ceiling.

B. Fixtures shall not be manufactured with less than code gauge steel. Hinged doors shall be gasketed on all sides to prevent light leaks. Where fixtures are specified with a prismatic plastic lens, the lens shall be manufactured with UV stabilized virgin acrylic. The lens shall not be less than 0.125 inch nominal thickness +.005-0.010. Where prismatic wrap fixtures are specified, the lens shall have a DR type additive.

C. Lighting fixtures shall be installed per the manufacturer's recommended mounting methods and the provisions of the drawings. It is the contractors responsibility to review the architectural plans and specifications to verify the mounting compatibility of the lighting fixtures with the ceiling type before fixtures are released for ordering. Provide ceiling compatible fixtures in all cases regardless of the catalog number on the drawings. Recessed fixtures shall be installed without viable cracks or light leaks between ceiling and fixture trim.

D. Fixtures flush mounted in exposed tee ceilings shall be attached to the main runners at each end with clips intended for that purpose. Surface mounted fixtures shall be supported by light weight channel attached to two members of the ceiling suspension system. Pendant mounted fluorescent fixtures shall be attached to ceiling suspension system or structure by pendants, hangar rods, or conduits.

END OF SECTION

SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Refer to Section 260510.

1.2 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.3 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; current edition.

B. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Poles: Do not store poles on ground. Store poles so they are at least 305 mm (one foot) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. As scheduled or listed on the contract documents. Acceptable manufacturers, contingent upon compliance with the contract documents, are as follows: Manufacturer A, Manufacturer B, Manufacturer C. Equal products by other manufacturers are acceptable providing substitutions are submitted in accordance with requirements listed elsewhere in the Bid Documents and approved by the A/E.

2.2 LUMINAIRES

A. Furnish products as indicated in Schedule on the contract documents.

B. UL 1598 and NEMA C136.17. Luminaries shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of driver heat and safe cleaning.

C. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging resistant resilient gaskets to seal and cushion lenses and refractors in luminary doors.

D. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

E. IESNA Cutoff Category: cutoff

2.3 POLES

A. Furnish products as indicated in Schedule on the contract documents.

B. The pole and arm assembly shall be designed for wind loading of 100 miles per hour, with an additional 30 percent gust factor, supporting luminaire(s) having the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base as shown on the drawings.

C. Poles shall be anchor-bolt type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws.

D. Provide a steel-grounding stud opposite hand hole openings

E. Provide a base cover matching the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts

F. Hardware: All necessary hardware shall be 300 series stainless steel.

G. Aluminum: Provide aluminum poles manufactured of corrosion resistant AA AAH35.1 aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys, and Alloy 356-T4 (3,5) for ASTM B108-03 cast alloys. Poles shall be seamless extruded or spun seamless type. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Base covers for aluminum poles shall be cast from 356-T6 aluminum alloy in accordance with ASTM B108-03

H. Steel: Provide steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and //hot-dipped galvanized// //iron-oxide primed// factory finish. //Galvanized steel poles shall comply with ASTM A123 and A153.// Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Base covers for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield of 36,000 psi.

2.4 FOUNDATIONS FOR POLES

A. Foundations shall be cast-in-place concrete.

B. Foundations shall support the effective projected area of the specified pole, arm(s), and luminaire(s) under wind conditions previously specified in this section.

C. Place concrete in spirally wrapped treated paper forms.

D. Rub-finish and round all above-grade concrete edges to approximately 1/4 inch radius.

E. Concrete shall have 3000 psi minimum 28 day compressive strength.

F. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings and meet ACI 318. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.

G. Prior to concrete pour, install a copperclad steel ground rod, not less than 3/4-inch diameter by10 feet long, below each foundation. Drive the rod vertically under the foundation so not less than 6 feet of rod is in contact with the earth. Remainder of rod may be in the concrete

pour. Where rock or layered rock is present, drill a hole not less than 2 inches in diameter and 6 feet deep, backfill with tamped fine sand and drive the rod into the hole. Bond the rod to the pole with not less than number 6 AWG bare copper wires.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

B. Poles:
   1. Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
   2. After the poles have been installed, shimmed and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 3/8-inch inside diameter, through the grout tight to the top of the concrete base for moisture weeping.

C. Foundation Excavation: Depth shall be as indicated. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

D. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

E. Install accessories furnished with each luminaire.

F. Connect luminaires and exit signs to branch circuit outlets provided under Section 26 05 37 using flexible conduit.

G. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.2 GROUNDING

A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable and listed for this purpose.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. Aim and adjust luminaires as indicated.

3.5 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.6 CLOSEOUT ACTIVITIES

A. Demonstrate luminaire operation for minimum of two hours.

3.7 PROTECTION

A. Replace/Repair luminaires that have failed at Substantial Completion.

END OF SECTION

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Stripping and stockpiling rock.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and removing site utilities.
   8. Temporary erosion and sedimentation control.

B. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.
   2. Section 01500 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.03 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of sub-soil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings or indicated according to requirements in Section 015639 "Temporary Tree and Plant Protection.

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

1.04 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 INFORMATIONAL SUBMITTALS

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

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other sub-surface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

1.07 FIELD 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 trafficways if required by Owner or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premise where indicated.

C. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

F. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and dis-charge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

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

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.04 EXISTING UTILITIES

A. Locate, identify, and disconnect utilities indicated to be abandoned in place.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches (50 mm) in diameter, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches (150 mm) in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, and other waste materials.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain ex-posed.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 31 10 10 – SOILS STRUCTURAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to DIVISION 300 “BASES AND SUBBASES” of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”

PART 2 - PRODUCTS

A. Refer to DIVISION 300 “BASES AND SUBBASES” of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”

PART 3 - EXECUTION

A. Refer to DIVISION 300 “BASES AND SUBBASES” of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”

END OF SECTION

SECTION 31 11 00 – AGGREGATE

PART 1 - GENERAL

A. Refer to Appendix A-2 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use crushed stone, gravel, or slag that meets the gradation requirements of Coarse Aggregate No. 57 as provided in the Appendix.

B. Do not use slag with more than 60% abrasion loss when tested according to AASHTO T 96. Use aggregate obtained from sources listed on Qualified Products List 2.

PART 3 - EXECUTION

A. Refer to Appendix A-2 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

END OF SECTION

SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements turf, grasses, and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
3. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.02 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
1. 24 inches (600 mm) outside of concrete forms other than at footings.
2. 12 inches (300 mm) outside of concrete forms at footings.
3. 6 inches (150 mm)] outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.03 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock:
   1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) 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:
      a. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom.

      b. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.04 PREINSTALLATION MEETINGS

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Geofoam.
   4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. Geotextile: 12 by 12 inches (300 by 300 mm).
   2. Warning Tape: 12 inches (300 mm) long; of each color.

1.06 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D2487.
   2. Laboratory compaction curve according to ASTM D1557.

1.07 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.08 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.

C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

D. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

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

F. Do not direct vehicle or equipment exhaust towards protection zones.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

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: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487 or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C33/C33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability as follows:
   a. Grab Tensile Strength: 157 lbf (700 N); ASTM D4632.
   b. Sewn Seam Strength: 142 lbf (630 N); ASTM D4632.
   c. Tear Strength: 56 lbf (250 N); ASTM D4533.
   d. Puncture Strength: 56 lbf (250 N); ASTM D4833.
2. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D4751.
3. Permittivity: 0.2 per second, minimum; ASTM D4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability as follows:
   a. Grab Tensile Strength: 247 lbf (1100 N); ASTM D4632.
   b. Sewn Seam Strength: 222 lbf (990 N); ASTM D4632.
   c. Tear Strength: 90 lbf (400 N); ASTM D4533.
   d. Puncture Strength: 90 lbf (400 N); ASTM D4833.
2. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D4751.
3. Permittivity: 0.02 per second, minimum; ASTM D4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.03 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows or per local jurisdiction requirement:
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.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   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.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.03 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
   1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

      a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
   2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

      a. 24 inches (600 mm) outside of concrete forms other than at footings.
      b. 12 inches (300 mm) outside of concrete forms at footings.
      c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
      f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.04 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 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 to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms:
   1. 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.

      a. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
      b. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
      c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
      d. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

   2. Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

      a. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
   3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.07 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes)] to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.08 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.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, damp proofing, water-proofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.

6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before back-filling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:
1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:
1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.12 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use 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.
6. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   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 Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm) .
   2. Walks: Plus or minus 1 inch (25 mm).
   3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.16 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support sub-drainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of

filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Over-lay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D1557.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

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

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with sub-sequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) 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 every 100 feet (30 m) 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 every 150 feet (46 m) or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 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 sur-faces 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 greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 22 00 - GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers grading for the roadways, parking areas, drives and/or walks, including all excavations, formation of embankments, preparation of subgrade for pavements and finishing and dressing of graded earth areas, shoulders, and ditches. Work in connection with excavation, trenching, and backfilling for utility lines is specified under section entitled "Excavating, Trenching, and Backfilling for Pipe Lines." Work in connection with grading for site structures is specified under section title "Excavating and Backfilling for Structures."

B. In the course of preparing the site to final grades, the Contractor shall work in close coordination with the representative of the geotechnical engineer to identify problem areas and to properly pre-pare subgrade soils for their use in supporting the loads to be imposed. Preparation of soils may include proof rolling; in-place compaction; removal, replacement and compaction; removal, importation of borrow and compaction; or other method approved by the geotechnical engineer.

C. Refer to the Geotechnical Report included in the Contract Documents.

PART 2 - PRODUCTS

2.01 SELECTION OF BORROW MATERIAL

A. Borrow material shall be selected to meet the requirements and conditions of the particular fill for which it is to be used. The material shall consist of sand soils or sand-clay soils capable of being readily shaped and compacted to the required densities and shall be free of roots, trash and any other deleterious material. All fill soil to be utilized shall be subject to approval prior to their use.

B. Any necessary clearing, grubbing, disposal of debris and satisfactory trimming and drainage of the borrow areas shall be considered incidental to operation of the borrow excavation and shall be per-formed by the Contractor at no additional cost to the Owner. On-site excavated materials may be used as borrow provided that they are approved for use as backfill by the geotechnical engineer.

C. Borrow Area(s): Borrow material shall be furnished by the Contractor from private sources selected by the Contractor and shall consist of a suitable material of the type mentioned above. The Contractor shall obtain from the Owners the right to procure material, shall pay all royalties and other charges involved, and shall bear all the expenses of developing the sources, including rights-of-way for hauling.

PART 3 - EXECUTION

3.01 CONSERVATION OF TOPSOIL

A. Except where otherwise noted on the plans, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or shall be

transported and deposited in storage piles convenient to areas that are to receive application of topsoil later, or at locations indicated.

B. Topsoil shall be stripped to a depth determined by the geotechnical engineering firm's field representative and when stored, shall be kept separate from other excavated materials and piled free of roots, stones, and other undesirable materials.

3.02 EXCAVATION

A. Classification: Excavation will be classified as common excavation or rock excavation in accordance with the following definitions.
   1. Common Excavation: Shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline, or clam shell) appropriate to the character of the materials and the site conditions.
   2. Rock Excavation: Shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.
   3. Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.
   4. The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

      a. For the purpose of this classification, the following definitions shall apply:
      b. Heavy Ripping Equipment: Shall be defined as rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of at least 200 net horsepower (at the fly-wheel).
      c. Wheel Tractor-Scraper: Shall be defined as self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 yards.
      d. Pusher Tractor: Shall be defined as a track type tractor having a power rating of at least 200 net horsepower (at the flywheel) equipped with appropriate attachments.

B. Excavation of every description regardless of material encountered within the grading limits of the project, shall be performed to the lines and grades indicated. Suitable excavated material shall be transported to and placed in fill areas within the limits of the work. When directed, unsuitable material encountered within the limits of the work shall be excavated below the grade shown and replaced with suitable material. Materials considered unsuitable are those conforming to Classes PT, OH, CH, MH, or OL as described under the Unified Soil Classification System, or as determined on-site by Owner or Owner’s representative. Unsuitable and surplus excavation material not re-quired for fill shall be disposed in designated waste or spoil areas. During construction, excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Material required for fills in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor, as specified herein.

1. Blasting: The transportation, handling, storage and use of dynamite and other explosives shall be directed and supervised by a licensed person of proven experience and ability in blasting operations. Blasting shall be done in such a way as to prevent damage to the work and existing structures and utilities or unnecessary fracturing of the foundation and shall conform to any special requirements of this specification. No blasting shall be completed without written approval of the Owner.
2. Excavation of Ditches and Gutters: Ditches and gutters shall be cut accurately to the cross-sections and grades indicated by the drawings. All roots, stumps, and other foreign matter in the sides and bottom of ditches and gutters shall be cut one foot below finish grade. Care shall be taken not to over-excavate ditches and gutters below the grades indicated.
    a. Any excessive ditch and gutter excavation due to removal of roots, stumps, etc., or due to over-excavation shall be backfilled to grade either with suitable material, thoroughly compacted, or with suitable stone or cobble to form an adequate gutter paving, as directed.
    b. The Contractor shall maintain all ditches and gutters excavated under this specification free from detrimental quantities of leaves, sticks, and other debris until final acceptance of the work.
    c. Suitable earth material excavated from ditches and channel changes shall be placed in embankments. Excavated material shall not be deposited within a distance from the edge of any excavation of less than 1-1/2 times the depth of the excavation.
    d. When storm drain pipe terminates in a new ditch, the headwall or end section together with ditch pavement shall be constructed immediately as called for on the plans.
    e. Ditch slopes and disturbed earth areas shall be grassed as required under section entitled "Grassing." The Contractor shall be responsible for maintaining these newly constructed ditches and take immediate action subject to approval to keep erosion of the ditch bottom and slopes to a minimum during the life of the contract.
    f. No additional compensation will be given to the Contractor for the required maintenance.

C. Compaction: In parking and slab areas where excavation is required to reach finished grades, the upper 12 inches of material shall be scarified and recompacted to a minimum of 100 percent of standard proctor maximum dry density.

3.03 PROTECTION OF EXISTING SERVICE LINES AND UTILITY STRUCTURES

A. Existing utility lines that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation that are to be retained, as well as utility lines constructed during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his expense. In the event that the Contractor damages any existing utility lines that are not shown, or the locations of which are not known to the Contractor, report thereof shall be made immediately to the Engineer.

3.04 FILLING AND BACKFILLING

A. Preparation of Ground Surface for Fill: All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is

started. In no case will unsuitable material remain in or under the fill area. Sloped ground surfaces steeper than 1 vertical to 4 horizontal on which fill is to be placed shall be plowed, stepped or benched, or broken up as directed, in such manner that the fill material will bond with the existing surface. Pre-pared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the compaction specified.

B. Proofrolling: After the subgrade has been stripped of topsoil, associated root mat and debris, evaluate all at grade or fill areas by proofrolling. Proofrolling will consist of patrolling the subgrade are-as utilizing a fully loaded tandem-axle dump truck (20 ton minimum) during a period of dry weather. Areas which rut or deflect excessively under the wheelload of the proofrolling vehicle will not be considered suitable for the placement of fill or structures and will therefore require remediation. It may be possible to compact the existing soils in place, or these soils may have to be removed and replaced with suitable soils. The decision on the type of remediation will be made in the field in consultation with the geotechnical engineer. All proofrolling will be performed in the presence of the geotechnical engineer.

C. Fill: Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall correspond to the shape of the typical section indicated or shall meet the requirements of the particular case. Suitable material removed from the excavation shall be used in forming the fill. Fill material shall be reasonably free from roots, other organic material and trash, and from stones having maximum dimensions greater than 6 inches. No frozen material will be permitted in the fill. Stones having a maximum dimension larger than 4 inches shall not be permitted in the upper 6 inches of fill or embankment. The material shall be placed in successive horizontal layers of 8 inches in loose depth for the full width of the cross section and shall be compacted as specified below.

D. Backfill Adjacent to Structures: Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used. Backfill for storm drains and subdrains, including the bedding, shall conform to the additional requirements as specified.

3.05 COMPACTION

A. Structural Fill: Each layer of the fill or embankment, except in areas indicated as not requiring compaction, shall be compacted by rolling with an approved tamping roller, heavy rubber-tired roller, three-steel wheeled power roller, vibratory roller or other compaction equipment, whichever is best suited for the types of soil encountered. Compact fill to a minimum of 95 percent of Standard Proctor maximum dry density. Compact the upper 12 of fill for paved and building areas to 100% of Standard Proctor maximum dry density.
   1. Field Control: Refer to Geotechnical Report.

3.06 FINISHED EXCAVATIONS, FILLS, AND EMBANKMENTS

A. All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth graded. The finished surface shall be reasonably smooth, compact-ed, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade grader or scraper operations, supplemented with hand

raking and finishing, except as otherwise specified. The finished surface shall be not more than 0.10 foot above or below the established grade or approved cross section.

B. Ditches and gutters shall be finished so as to permit adequate drainage. The surface of areas to be grassed shall be finished to smoothness suitable for the application of grassing materials. The sur-face of embankments or excavated areas for road construction or other areas to be paved on which a base course or pavement is to be placed shall not vary more than 0.05 foot for the established grade and approved cross section. In areas where the bulking of soil as a result of grassing operations will tend to retard surface drainage along the edge of pavements, the finished grades shall be left 0.1 foot below grade prior to grassing.

3.07 DISPOSAL OF WASTE MATERIAL

A. All vegetation, roots, brush, sod, broken pavements, curbs and gutter, rubbish, and other unsuitable or surplus material stripped or removed from the limits of construction shall be disposed of off the site, except where otherwise approved in writing by the Engineer. The material shall be dumped, spread, and leveled to drain. Surplus excavation shall be hauled to, compacted in accordance with overall and overlot areas and sloped to drain in the disposal area where directed. The unsuitable material shall be leveled to drain and firmed under the normal operation of spreading and hauling equipment. Any trees, stumps, brush, down timber, etc., in the area to be used for disposal shall be cleared by cutting (to within six (6) inches of the ground) and shall be disposed of by removal from the property. Clearing and disposal of trees, stumps, etc. shall comply with the applicable portions of the clearing and grubbing specifications.

3.08 PLACEMENT OF TOPSOIL

A. Topsoil shall be placed on all shoulders, slopes, ditches, landscaped areas, and other earth areas graded under this contract, excluding borrow areas, unless otherwise specified on the plans. Top-soil shall be uniformly placed, in 12-inch loose layers maximum, on these areas to a depth of not less than four (4) inches after compaction as specified below.

B. The material shall be free from clods of soil, matted roots, roots greater than 2 inches in diameter, and any other objectionable material which might hinder subsequent grassing and mowing operations. The material shall be placed, leveled, and lightly compacted with at least one pass of a cultipacker or light pneumatic-tired roller, to required cross sections, but shall be left one-tenth (0.1) of a foot below the finished earth grade.

3.09 PROTECTION

A. Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades re-established to the required elevations and slopes, at no additional expense to the Owner.

END OF SECTION

SECTION 31 22 19 - FINISH GRADING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section applies to the final subgrade preparation and includes the following:
   1. Placement of Soil Mixes (Imported / Off-site).
   2. Amending In-Situ soil.
   3. Finish grading of lawn and planting bed areas.

1.02 REFERENCE STANDARDS

A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

PART 2 - PRODUCTS

2.01 SOILS

A. Refer to Sections as noted per the Landscape Plans.

PART 3 - EXECUTION

3.01 FIELD ENGINEERING

A. General:
   1. Provide all layout work required. Establish extent of fine grading by area and elevation; designate and identify datum elevation and project engineering reference points. Set required lines, levels, and elevations.
   2. Provide as many grade stakes and string lines as required to achieve smooth finish grades acceptable to the Landscape Architect. Mark each stake to indicate design finished grade indicated.

B. High Points and Low Points: Install grade stakes at high points and low points including top of berms, catch basins and area drain rims.

3.02 EXAMINATION

A. Examine areas and conditions under which work is to be performed. Obtain and examine the records and drawings of adjacent work and of existing utilities and their connections for conditions which may affect the work under this Section.

B. Verify all work requiring access through or adjacent to areas where each planting soil mix is to be placed has been completed and no further access will be required. If access will be required, this must be coordinated with the Contractor.

C. Confirm subgrade is clear of all construction debris, trash, rubble, and any foreign material. If fuels, oils, concrete washout silts or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required subgrade compaction.

D. Confirm subgrade is at the proper elevation, parallel to the finished grade and compacted as shown on the drawings.

E. Verify that conditions are suitable to receive Work and that no defects or errors are present which would cause defective installation of products or cause latent defects in workmanship and function.

F. Excessive Compaction: Verify subgrade in planting area is not excessively compacted.

G. Soil Preparation: Verify off-site soil preparation is complete and ready for transporting to site.

H. Notify Landscape Architect of any unacceptable sub-grade conditions. Do not start the installation of the soil mix until sub-grade conditions have been corrected.

3.03 PREPARATION

A. Protection of Existing Conditions:
   1. Protect structures, utilities, sidewalks, pavements, irrigation systems, paving, plant materials, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by fine grading operations.
   2. Provide barricades, fences, or other barriers to protect existing conditions to remain from damage during construction.
   3. Use every possible precaution to prevent excessive compaction of planting area soil within or adjacent to the areas of Work.
   4. Do not store material or equipment, permit burning, or operate or park equipment under the branches of existing trees to remain.
   5. Submit written notification of conditions damaged during construction immediately to the Owner’s Representative.

B. Assure all grass and weed growth has been extinguished prior to placing the specified soil mix as indicated on the drawings. Respray areas still exhibiting grass, weed, or other plant growth. Follow manufacturer’s recommendation for allowing grass and weed control to properly kill vegetation prior to amending soils.

C. De-compact sub-grade soils and in situ soils by soil ripping.
   1. Prior to placing stockpiled soils and each specified soil mix, rip sub-grade areas to receive the specified soil on the same day soil mix is placed.
   2. Rip subgrade to a depth of 6 inches. Place ripping tines at 18 inches on center.
   3. Make second ripping pass in the direction 90 degrees to the direction of the first ripping pass.
   4. Do not rip closer than 24 inches to installed underground utility lines and structures.
   5. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so soil material will bond with existing material.
   6. Once the subgrade is ripped, only equipment with a ground pressure not to exceed 4.5 p.s.i. shall be used, ex. padded, wide-tracked LGP rated dozers and/or excavators, small to medium tractors with turf tires, etc.

D. Transition Layer:
   1. Uniformly place 3 inches or as designated by the drawings, the specified soil over the ripped areas. Using mechanical equipment, blend the specified soil into the ripped subgrade approx. 2-4 inches in depth or as designated on the drawings.
   2. Do not place final lifts of specified soil until the Transition Layer has been blended.
   3. Remove any debris (see Definitions) greater than 1 inch in diameter or 2 inches in length that has been worked to the surface of the transition zone.
   4. Tree Root Protection
      a. All work infringing on root systems of existing plant material shall be reviewed and approved by the Landscape Architect prior to beginning work.
      b. Protect tree root systems from damage adjacent to soil work where ripping is required.
      c. Soil ripping may not be conducted when existing roots are in the immediate vicinity. All work infringing on root systems of existing plant material shall be reviewed and approved by the Landscape Architect prior to beginning work.
      d. Where tree roots are present within the designated soils zone, carefully blend native soils with the Compost using hand tools.

E. Uniformly moisten or aerate Transition Layer before compaction to within 2 percent of optimum moisture content.

3.04 AMENDING IN SITU SOIL

A. Uniformly grade In Situ and Redistributed Stockpiled Soil areas to within “Finish Grade” tolerances.

B. Rip soil surfaces of In Situ and Redistributed Stockpiled soils.
   1. Rip to a depth of 6 inches. Place ripping tines at 18 inches on center.
   2. Make second ripping pass in the direction 90 degrees to the direction of the first ripping pass.

C. Provide approved Organic Compost at the locations indicated on the Contract Drawings per the Testing Agency recommendations.
   1. To establish baseline Bid Quantities, provide 3-inch depth of approved organic compost to areas where existing soils have been ripped or tilled to 6-inch depth, (Equivalent to 1 cu. yd compost for every 108 sq. ft.).

2. Actual compost mix ratio volumes will be established upon completion of the testing of the existing soil and compost as required per Section 32 91 00 Amended In Place Soils specification. The controlling factor will be the percent (%) organic matter by weight as specified for the specified soil system profile.
    a. Organic Level for Turfgrass Areas: 3 to 5 percent
    b. Organic Level for Planting Areas: 6 to 8 percent
    c. The intended volume ratios of the Organic Amendment (compost) components will be, in large part, determined by the organic matter content of the compost. Follow the recommendations on mix design provided by the soil testing laboratory to achieve the target organic matter content for the soil mix.

D. All amendments shall be in proper condition (moisture content, loose and friable condition) to be able to be spread evenly when dropped or spread on existing soils.
    1. Additional amendments shall be mixed into the soil bed as recommended by the testing laboratory and as approved by the Landscape Architect for each plant type and condition of installation.
    2. Adequate quantities of compost mix materials shall be provided to attain, after compaction and natural settlement, all design finish grades. Verify quantities for placement as specified to suit site conditions.

E. Uniformly mix components using a mechanical soil tiller designed for such purpose as specified for depths as shown on the drawings. Unless noted on the drawings, provide 6-inch minimum tilling depth, tilling amendments a minimum of 3-inch depth into ripped soil profile.

F. Method of settlement shall be as previously approved by the Landscape Architect. Method may include, but is not limited to, natural settlement over an approved period or light hand-tamp, light rolling or the use of a light-weight plate compactor with the number of passes approved by the Landscape Architect.
    1. Compact to 80-85% Proctor ASTM D698 (latest version), as measured with a nuclear densitometer. Testing shall be conducted for every 500 cu. yds. of compost placement.
    2. Allow amended soil in lawn areas to remain undisturbed until fully settled in accordance with settlement methodology submitted as approved by the Owner's Representative.
    3. After settlement has occurred, add amended soil to maintain finished grades. If for any reason mix area is left exposed for a long duration prior to planting, add native soil, amend and re-grade as required if erosion occurs. Fills shall not be so compacted as to in any way restrict the flow of water or air through the soil.
    4. After any additional settlement has occurred, restore areas to finished grade prior to seeding or planting.

G. Protect areas where soil has been placed and prepared against construction activity with site protection fence. See Section 32 92 00 Turf Grass and Sod for additional protection.

3.05 FINISH GRADING

A. Perform grading within contract limits, including adjacent transition areas, to new elevations, levels, profiles, and contours indicated. Provide subgrade surfaces parallel to finished surface grades. Provide uniform levels and slopes between new elevations and existing grades.

B. General:

1. Uniformly grade areas to a smooth uniform surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
2. Provide a smooth transition between adjacent existing grades and new grades.
3. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
4. Slope finish grades to drain surface water away from buildings, walks, paving, and other structures unless indicated otherwise.
5. Slope finish grades to drain surface water to drainage swales, catch basins, area drains, or trench drains as shown on the Drawings.
6. Grade soil surface smooth to be free of high and low areas which will inhibit surface drainage.
7. Grade the soil surface at the edges of lawn areas, along paving areas, and curbs to an elevation 1 inch below the finished surface of adjacent paving and curbs, unless indicated otherwise.
8. Hand-rake soil surface using screed boards, string lines, and laser levels to achieve smooth surfaces acceptable to the Landscape Architect.

C. Equipment: Use equipment and hand tools of appropriate size and type to achieve the profiles, and a smooth soil surface free of high areas, depressions, equipment tracks, and excessive compaction.

D. Depressions and Loose Material: Fill any depressions and remove loose material to finish surface true to line and grade, presenting a smooth and unyielding surface.

E. Excessive Compaction:
1. Take precautions to prevent finished graded surfaces from becoming excessively compacted.
2. Protect finished graded surfaces from excessive compaction from vehicular, equipment, and foot traffic by laying down planks, plywood, or other accepted protective devices.
3. Do not store or stockpile materials on finished graded surfaces.
4. Mechanically loosen excessively compacted soil areas to full depth.

3.06 TOLERANCES

A. Planting Areas:
1. Grade soil surface to within 0.05-foot of grades indicated on the Drawings, except bring soil surface grades along paving, curbs, and other structures to within 0.01-foot of grades indicated on the Drawings.
2. Transition soil surface grades along paving, curbs, and other structures to areas of less strict tolerance over a 5-foot distance.

B. Allowances: Make proper allowances for settlement.

3.07 ADJUSTING

A. Soil Finished Grade:
1. After the soil surface elevations have been graded to be within the specified tolerances, perform adjustment grading Work under the direction of the Landscape Architect in the field.

2. Do not rely on adjustment grading to bring finished grade elevations to within specified tolerances.

3.08 FIELD QUALITY CONTROL

A. Aesthetic Acceptance of Grades:
   1. Upon completion of finish grading Work, schedule a review by the Landscape Architect to obtain aesthetic acceptance.
   2. Provide 3 days advance written notification.
   3. Do not commence seeding, sodding, or other planting Work until receiving aesthetic acceptance in writing.

B. Test for Excessive Compaction:
   1. Where excessive compaction is suspected by Landscape Architect, have a Geotechnical Engineer perform nuclear density field tests.
   2. Correct excessively compacted soil areas to the depth of the excessive compaction by means and methods acceptable to the Landscape Architect prior to installing plant material.

3.09 PROTECTION

A. Protecting Fine Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where, completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Scarify or remove and replace soil material to depth as directed by Soils Engineer; reshape and recompact.

D. Repair erosion that occurs before and during plant or lawn installation.

E. During construction, maintain temporary soil erosion and sedimentation control measures in place. Inspect, repair, and replace damaged or missing items as work progresses.

3.10 DISPOSAL AND CLEAN UP

A. Promptly remove soil and debris created by soil work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Legally dispose of off-site all refuse and debris from these operations. Do not dump or burn materials on site.

C. Maintain the site in an orderly condition during the progress of the Work. Continuously and promptly remove excess waste materials; keep lawn areas, walks, and roads clear. Store materials and equipment where directed. Promptly remove equipment, surplus materials, and debris and trash resulting from operations under this Contract upon completion and prior to initial acceptance or Work. Leave the site in a neat, order condition “broom clean”.

END OF SECTION

SECTION 31 23 00 – EXCAVATING, TRENCHING, AND BACKFILLING FOR PIPELINES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in other divisions of these Specifications.

PART 2 - PRODUCTS

2.01 EXCAVATED MATERIALS

A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.

B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.

C. Remove and deposit unsuitable or excess materials as directed by the Engineer.

2.02 BACKFILL MATERIALS

A. Provide from materials excavated for installation of utility.

B. Select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2" in greatest dimension for backfill up to 12" above top of utility being covered.

C. Do not permit rocks larger than 2" in greatest dimension in top 6" of backfill.

2.03 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material as approved by the Engineer at no additional expense to the Owner.

C. Provide select materials from on-site if acceptable material as approved by the Engineer is available onsite. Otherwise, provide approved select material from an off-site source.

PART 3 - EXECUTION

A. Refer to SCDOT Standard Specification Section 658.3.9.

END OF SECTION

SECTION 31 25 00 – EROSION, SEDIMENTATION, AND POLLUTION CONTROL MEASURES

1.01 DESCRIPTION

A. This section covers erosion control measures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Refer to Section 812 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

PART 3 - EXECUTION

A. Refer to Section 812 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

END OF SECTION

SECTION 32 11 23 – GRADED AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers construction of an aggregate base course for a prepared foundation (subgrade or subbase).

B. The equipment, workmanship and materials therefore shall conform to the applicable requirements of the SCDOT Standard Specifications for Highway Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials shall meet the specifications noted in SCDOT Standard Specifications for Highway Construction Section 305.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. Refer to SCDOT Standard Specification Section 305.

END OF SECTION

SECTION 32 12 16 – HOT-MIXED ASPHALT PAVING

PART 1 - GENERAL

1.01 SUBMITTALS

A. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1.02 SITE CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg f (10 deg C) and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40 deg F (4 deg C) and when base is dry. Base course may be placed when air temperature is above 30 deg F (minus 1 deg C) and rising.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Use locally available materials and gradations that exhibit a satisfactory record of previous installations. The asphalt concrete mixtures shall conform to the South Carolina Department of Transportation (SCDOT) Standard Specifications For Highway Construction, latest edition.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. General: Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction.

B. Tack Coat:
   1. Apply to contact surfaces of previously constructed asphalt and surfaces abutting or projecting into hot-mixed asphalt pavement.
   2. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface. Allow to dry until at proper condition to receive paving.
   3. Exercise care in applying bituminous materials to avoid smearing onto adjoining concrete surfaces.
   4. Remove and clean damaged surfaces.

3.02 PLACING MIX

A. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture at minimum temperature of 225 deg F (107 deg C). Place areas inaccessible to

equipment by hand. Place each course to required grade, cross-section, and compacted thickness.

B. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.

C. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.

3.03 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement. Com-pact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.

C. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.

D. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated, and course has attained 95 percent laboratory density.

E. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
   1. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.04 PAINT STRIPING

A. Planting Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping: Refer to South Carolina Department of Transportation (SCDOT) Standard Specifications for Highway Construction, latest edition.

3.05 FIELD QUALITY CONTROL

A. General: Testing in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness will be done by Owner's testing laboratory. Repair or remove and replace unacceptable paving as directed by Architect.

B. Thickness: In-place compacted thickness tested in accordance with South Carolina Department of Transportation (SCDOT) Standard Specifications for Highway Construction, latest edition.
   1. Base Course: Plus or minus 2 inches.
   2. Surface Course: Plus or minus 3 inches

C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:
   1. Base Course Surface: 3 inches.
   2. Wearing Course Surface: 3/16 inch.

D. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 3 inches.
   1. Check surface areas at intervals as directed by Architect.

END OF SECTION

SECTION 32 12 16.13 - ASPHALT TRAIL PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes asphalt pavement for the pedestrian asphalt trails:
   1. Vegetation killer on sub-grade and aggregate base.
   2. 304 aggregate base course over prepared sub-grade.
   3. Hot mix asphalt paving intermediate course.
   4. Hot mix asphalt paving surface course.

B. Related Requirements:
   1. Refer to Civil drawings for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   2. Section 32 13 13 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of ODOT for asphalt paving work.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 degrees Fahrenheit.
2. Tack Coat: Minimum surface temperature of 60 degrees Fahrenheit.
3. Asphalt Base Course: Minimum surface temperature of 40 degrees Fahrenheit and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 degrees Fahrenheit at time of placement.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.02 ASPHALT MATERIALS

A. Emulsified Asphalt Prime Coat: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

B. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

C. Water: Potable.

D. Undersealing Asphalt: ASTM D3141; pumping consistency.

2.03 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D1073, Grade No. 2 or No. 3.

C. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D6690, Type I, hot-applied, single-component, polymer-modified bituminous sealant.

2.04 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

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

3.02 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
   1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
   2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
   3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Landscape Architect, and replace with compacted backfill or fill as directed.

3.03 SURFACE PREPARATION

A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use 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.

3.04 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Place hot-mix asphalt surface course in single lift.
   2. Spread mix at a minimum temperature of 250 degrees Fahrenheit.
   3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.

4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
   1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
   2. Complete a section of asphalt base course 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 depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.05 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time
   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.

3.06 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 degrees Fahrenheit.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 96 percent of reference laboratory density according to ASTM D6927, but not less than 94 percent or greater than 100 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials 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.

3.07 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Surface Course: 1/8 inch.
   2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.08 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979.
   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.09 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan.

END OF SECTION

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes concrete paving including the following:
   1. Driveways.
   2. Parking lots.
   3. Curbs and gutters.
   4. Walks.

B. Related Requirements:
   1. Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
   2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   3. Section 321713 "Parking Bumpers."
   4. Section 321723 "Pavement Markings."

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

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

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or epoxy adhesive.
   8. Joint fillers.
   9. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.05 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Personnel conducting field tests must be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.06 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.07 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) 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 design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in 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.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

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

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from galvanized-steel wire into flat sheets.

B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

C. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420); deformed.

D. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, Grade 60 (Grade 420) deformed bars.

E. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 (Grade 420) deformed bars; assembled with clips.

F. Plain-Steel Wire: ASTM A1064/A1064M, galvanized.

G. Deformed-Steel Wire: ASTM A1064/A1064M.

H. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420) plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

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

J. Zinc Repair Material: ASTM A780/A780M.

2.04 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C150/C150M, gray portland cement Type I.
   2. Fly Ash: ASTM C618, Class F.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4M, uniformly graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C260/C260M.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.

2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

E. Water: Potable and complying with ASTM C94/C94M.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

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

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

2.06 RELATED MATERIALS

A. Joint Fillers: ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 per-cent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-dispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
   1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.07 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

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

D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing admixture, high-range, water-reducing admixture, high-range, water-reducing and retarding admixture, or plasticizing and retarding admixture in concrete as required for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

F. Concrete Mixtures: Normal-weight concrete.
   1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
   2. Maximum W/C Ratio at Point of Placement: 0.50.
   3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C9. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving, excluding walks to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
   2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
   3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 312000 "Earth Moving."

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

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 INSTALLATION OF STEEL REINFORCEMENT

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

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement 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. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. 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 (50-mm) overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) 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. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Control 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, to match jointing of existing adjacent concrete paving:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

      a. Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

      b. Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.
   3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

E. 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.

F. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only

square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform sur-face plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete sur-face.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing 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 (300-mm) lap over adjacent absorptive covers.

F. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:
   1. Elevation: 3/4 inch (19 mm).
   2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
   3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/2 inch (13 mm).
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
   6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
   8. Joint Spacing: 3 inches (75 mm).
   9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
   10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.10 FIELD QUALITY CONTROL

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

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M will be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. (465 sq. m) or fraction thereof of each concrete mixture placed each day.

      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

      a. A compressive-strength test to be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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 (3.4 MPa).

D. Test results to be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests to contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

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

F. Additional Tests: Testing and inspecting agency will make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

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

I. Prepare test and inspection reports.

3.11 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing sur-face stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 14 00 - UNIT PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes all labor, materials, equipment, and testing requirements necessary to complete the installation of unit pavers as specified on the drawings:
   1. Brick Pavers - Pedestrian pavers set on a mortar setting bed.
   2. Permeable Concrete Pavers - Interlocking set on Aggregate leveling bed.

B. Related Requirements:
   1. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.

C. ASTM C902 - Standard Specification for Pedestrian and Light Traffic Paving Brick; 2022.

D. ASTM C1272 - Standard Specification for Heavy Vehicular Paving Brick; 2022a.

E. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012 (Reapproved 2022).

F. Federal, State, and local laws and regulations governing this Work are hereby incorporated into and made part of this Section. When this Section calls for certain materials, workmanship, or a level of construction that exceeds the level of Federal, State, or local requirements, provisions of this Section take precedence.

G. BIA: The Brick Institute of America

1.03 ACTION SUBMITTALS

A. Product Data: For the following:
   1. All paver types.
   2. Aggregate setting bed materials

B. Samples for Verification:
   1. Full-size units of each type of unit paver indicated. Assemble not less than five Samples of each type of unit on suitable backing and grout joints.]

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

C. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

D. Cleaning and Maintenance Instructions:
   1. Brick Pavers.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Paver Manufacturer’s Qualifications:
   1. The manufacturer shall demonstrate a minimum of 5 years successful experience in the manufacture of pavers.
   2. The manufacturer shall have sufficient production capacity and established quality control procedures to produce, transport, and deliver the required number of pavers with the quality specified, without causing a delay to the work.
   3. The manufacturer shall have suitably experienced personnel and a management capability sufficient to produce the number of quality pavers as depicted on the contract drawings and as specified herein.

C. Installer Qualifications:
   1. A qualified unit paving installer. Installer's field supervisor shall have Paver Installer Certification from one of the following designations:
      a. Commercial Paver Technician Designation.
   2. Time: Not less than 5 years successful experience with installation of work of the type required by this project.
   3. Projects: Successfully completed a minimum of five projects of not less than the size required by the Work of this Section. The project sizes must represent not less than the minimum amount of unit paving types required for this project.
   4. Workmanship: Use an adequate number of skilled personnel who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.
   5. Installer’s foreman shall have at least 5-years of experience and be on site at all times while this Section is being performed. Foreman shall not be changed during the course of work unless approved in writing by Landscape Architect.

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. Construction of Mock-ups
      a. Construct one 10-foot by 10-foot area of unit paving for each material type.
         1) Mock-up of vehicular permeable pavers to include compacted setting bed material, pavers representing pattern as per drawings, edge restraint and filled joints with specified sand.
         2) Mock-up for mortared pavers shall include pavers placed with the setting bed mortar, the intended pattern, and joints tuck-pointed and struck.
      b. Coordinate locations of in-place mock-ups at Pre-construction conference.

1) Identify quantity of key areas each mock-up is to represent. Submit drawing for Landscape Architects approval.
2) Construct mockup in a location where mockup can be referenced.
3) Construct as many mockups as necessary to achieve an acceptable mockup to Owner and Landscape Architect.
4) Remove all rejected mockups immediately after “approval” of mockups samples have been officially accepted by the Landscape Architect.

2. Approval:
   a. Demonstrate the proposed range of aesthetic effects and workmanship.
   b. Obtain Owner’s Representative approval of mockups before starting unit paver installation.
   c. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   d. Demolish and remove mockups when directed.
   e. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store pavers 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.

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

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

D. Store liquids in tightly closed containers protected from freezing.

1.07 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

1.08 WARRANTY / GUARANTY

A. Neither the final certificate of payment nor any provision in the Contract Documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

B. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of two years from the date of final acceptance of the work unless a longer period is specified. The Owner will give notice of observe defects with reasonable promptness.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.02 BRICK AND CONCRETE PAVERS

A. Brick Pavers-Pedestrian, Light-Traffic Paving Brick: ASTM C902, Class SX Type I, Application PS. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
   1. Basis of Design – Manufacturer: Old Carolina Brick Co.
   2. Style: 010 Patio 4x8
      a. Thickness: 2-1/4 inches
      b. Face Size: 4" x 8" (consider a 020 SG paver to have a 3/8" MJ)
      c. Color: Savannah Gray
   3. Leveling Bed: Mortar

B. Permeable Concrete Pavers-Vehicular, Heavy Vehicular Paving Brick: ASTM C1272, Class SX, Type F, Application PX. Provide brick without frogs or cores in surfaces exposed to view in the completed Work. Pavers noted below contain spacer nibs for gravel filled joints.
   1. Basis of Design – Manufacturer: Belgard permeable pavers
   2. Style: Aqualine Series permeable pavers
      a. Thickness: 3-1/8"
      b. Width: 4-1/2"
      c. Length: 9"

C. Chippage Limits of Installed Pavers: In addition to the requirements of ASTM C902 the following shall apply at final completion:
   1. Chipping: No more than 5% of all installed pavers shall be chipped on their exposed edges.
   2. Individual Edges: No more than 20% of the length of any exposed edge shall be chipped.
   3. Size of Chips: No individual chip shall be more than 1/2 inch long as measured along the edge of the paver. No chip extending more than 1/8 inch from the edge of the paver shall be more than 1/8 inch deep.
   4. No chip shall expose underlying material of a different color to the face of the paver.
   5. Stacked Bond Pattern Requirements: The overall measurement for outside face to outside face of 24 pavers, when laid in contact in a straight line shall not vary by more than 3-1/2 inches for end to end and 1-1/2 inches for sided to side width.

D. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C67/C67M.

2.03 EDGE RESTRAINTS

A. Job-Built Concrete Edge Restraints: Comply with requirements in Section 32 13 13 "Concrete Paving" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi.

2.04 AGGREGATE LEVELING-BED MATERIALS

A. Bedding leveling materials for permeable pavers on concrete base:
   1. Crushed #89 Limestone grits, ASTM D448.

B. Subbase material:
   1. Refer to details.

2.05 MORTAR FOR SETTING BED AND JOINTS FOR PEDESTRIAN PAVERS

A. General;
   1. Mortar setting bed: Type 'S' mortar
   2. Mortared joints: Type 'S' mortar

2.06 SUB-BASE AND SUB-SLABS

A. Compacted Aggregate Base Course: Refer to civil drawings.

B. Concrete Sub-slabs: Section 32 13 13 Concrete Paving specifications apply.

C. Geotextile Sub-Surface Drainage and Structural Fabrics: Refer to civil drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance or cause latent defects in workmanship or function.
   1. Verify concrete sub-base is level, smooth, capable of supporting pavers and imposed loads, and ready to receive Work of this section. Section 32 13 13 Concrete Paving specifications apply.
      a. Verify concrete substrate has cured at least 14 days and has attained 75 percent design strength.
   2. Verify subgrade and aggregate sub-base have been installed as per details and compacted to specifications.
   3. Paving contractor shall verify that gradients and elevations of subbases are correct and in compliance with anticipated finish grades. Contractor shall notify construction manager if subgrades need to be amended. The responsible contractor shall adjust subgrades as needed.

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

3.02 PREPARATION

A. Remove dirt, debris, and loose particles from concrete sub-bases prior to installation of paver systems. Remove substances from concrete substrates that could impair mortar bond, including curing compounds, form oil, and laitance.

B. Place Geotextile fabric over expansion joint where paver system abuts another pavement or structure. Turn up fabric 1” below pavement surface and extend 12” beyond expansion joint. Fabric to be continuous along expansion joint.

C. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

3.03 INSTALLATION, GENERAL

A. Manufacturer's Requirements: Meet requirements of paver manufacturers' current printed instructions, except requirements that conflict with the Contract Documents.

B. Temporary Edge Restraints: Install temporary edge restraints at transitions between project phases or as needed to maintain traffic. Provide edge restraints suitable for the support of vehicular traffic or as approved by the Engineer.

C. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

D. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Use a wet saw if possible. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

E. The setup area for wet saws shall be located in an area which debris from the sawing operation shall not stain, contaminate, or otherwise soil surfaces of completed Work, either from the settling of dust or from the runoff of the dust onto finish Work.

3.04 AGGREGATE SETTING-BED INSTALLATION

A. Place leveling course and screed to thickness shown on the drawings, utilizing screed rails for proper thickness and placement. Ensure moisture content remains constant and density is loose and constant until pavers are set and compacted.
   1. The bedding material shall be spread over the areas to be constructed to create an uncompacted loose surface onto which the pavers shall be placed. The laying course shall be such that after compaction it forms a uniform layer nominally 2" inches thick. Upon completion of the works the final surface of the pavers shall be [1/8] inch. to [1/4] inch. above adjacent finishes.
   2. It shall be laid to a tolerance of plus or minus [3/16] inch. allowing for the correct surcharge. Where distances between screed rails exceed 12 ft. intervals an intermediate rail shall be set to line and level. Screed rails shall be used at 4 ft. centers where grade changes occur.
   3. The screeded bedding material shall not be subjected to any traffic by either mechanical or pedestrian use.
   4. Sufficient material shall be placed to ensure that no delay occurs to paver laying. Bedding material that has been screeded but not covered with pavers at the end of each days work shall be taken up and re-screeded prior to re-commencement of work.
   5. The voids left after the removal of screed rails shall be filled with loose bedding material as the laying of pavers proceeds.
   6. Spreading of the bedding course material shall stop when weather conditions are unsuitable. If inclement weather causes deterioration of the laying course sand it shall be lifted and stored to one side to drain before its reuse.

3.05 VEHICULAR PERMEABLE PAVER INSTALLATION (AGGREGATE BASE):

A. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures as recommended by the manufacturer.

B. Laying Paver Units:

1. Place pavers away from an edge restraint or the existing laying face in such a manner as to ensure squareness of pattern. Cut header course pavers to accommodate alignment tolerances of the restraints. Full pavers shall be laid first.
2. Place pavers so that joints are aligned and installed in the pattern as shown on the Drawings.
3. Use string lines to hold pattern lines and elevations true.
4. All radial units are to be uniformly tapered with minimum 1/16" width and maximum 3/16" joints.
5. Lay rows of full units first.
6. Cut off and fit closure units subsequently.
7. Cut paver units with power diamond blade masonry saw where partial pavers abut straight surfaces.
8. Cut paver units such that paver edges are parallel with adjacent surface.
9. Cut radial paver edges with a diamond-blade masonry saw by kerfing and grinding, or other accepted method, where pavers abut round elements such as manholes, tree grates, cleanouts, and bollards to achieve smoothly curved edges parallel with the abutting surfaces with maximum 1/8” wide joints.
10. Do not allow other construction traffic on pavement during the paver installation until pavers have been compacted and joints have been filled with sand.

C. Rolling: Machine roll units to plane surface. Use neoprene coated rollers or operate rollers on plywood to avoid causing damage to the pavers.

D. Joint Pattern: As indicated on the drawings.
   1. Where pattern is on a radius or curve, saw cut pavers both sides to maintain radii as follows:
      a. Radii up to 5 ft. cut every paver,
      b. Radii 5 to 10 ft. cut every second paver,
      c. Radii 10 to 15 ft. cut every third paver,
      d. Radii 15 to 25 ft. cut every fifth paver,
      e. Radii over 25 ft. no cutting required

E. Modify paver pattern and /or provide additional cuts to adjacent pavers as necessary when the cutting of a paver will result in less than one third of a full paver. Pavers sliced longitudinally, except when being placed around utility manholes will not be accepted. All cut paver faces to be vertical, top edges shall be free from chips and pattern modification/additional cuts shall be as acceptable to the Landscape Architect.

F. Tolerances:
   1. Unit to Unit - Joint Width: as block spacer nibs allow.
   2. Maximum Variation of Finished Paving Surface from 10 Foot Straight Edge: 1/8-inch.
   3. Maximum Lippage Between Paver Units: 1/16-inch.
   4. No “birdbaths” or other surface irregularities will be permitted.
   5. Correct all irregularities to the satisfaction of the Landscape Architect.

G. At the end of the laying period, the pavers shall be adjusted to form straight pattern lines and uniform joints.

H. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses maintaining protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller.

I. If weather conditions are such that the performance of the pavement may be compromised, laying operations shall be discontinued and all laid pavers shall be aligned and compacted prior to suspension of the works.

J. On re-commencement of laying operations the edge two courses of existing paving shall be lifted and the setting bed rescreeded before further pavers are laid.

K. At the end of each day, after the pavers have been aligned, and cut pavers incorporated at edge restraints and between lanes, the pavers shall be compacted.

L. Joint Aggregate: Install joint aggregate per manufacturer’s current written instructions.

3.06 BRICK PEDESTRIAN PAVER INSTALLATION, MORTAR BASE

A. Prepare the base: Ensure the area is prepared and has a solid concrete base.

B. Mix the mortar: Prepare the mortar according to the manufacturer's instructions, ensuring a workable consistency.

C. Apply the mortar bed: Spread the mortar evenly over the prepared base in an area limited by how many pavers can be set at one time, to a desired depth (approx 3/4 - 1").

D. Lay the pavers: Wet the pavers to help them adhere to the mortar. Lay the pavers on the fresh mortar bed, using a rubber mallet to gently tap them into place.

E. Check for evenness and alignment: Use a level to ensure the surface is sloped per grading plans and use string lines to ensure horizontal alignment of paver joints.

F. Use plastic spacers at the width specified on all sides of bricks to make consistently spaced joints. Do not remove spacers until the paver joints are to be tuckpointed.

G. When the mortar bed under the pavers has sufficiently hardened to support, grout the joints: Fill the joints between the pavers with mortar and smooth them off. If a mortar bag is used to fill the joints, be careful to not to spill or splatter the mortar onto the brick. Clean off excessive mortar immediately and wipe brick with a wet rag to remove all mortar paste.

H. Joints shall be slightly concave after being struck.

3.07 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

3.08 MAINTENANCE

A. Inspection: Undertake an inspection of the paver surface with the installer, the construction manager and Landscape Architect and rectify all noted defects prior to handover.

B. Repairs: Repair or replace any damaged Work to original specified condition prior to handover.

C. Maintenance:
   1. The Contractor shall arrange for the installer to return to the site, as directed by the Owner's Representative, to rectify any problems in the Work caused by his failure to adequately align or bond the pavers, compact the bedding material or fill the joints.
   2. Where lateral displacement of the sand set pavers has occurred adjacent to edge restraints the cut pavers shall be replaced with new pavers of the correct size to comply with the specified joint widths and the joint sand shall be re-sanded and additional joint sand stabilizer applied.

3.09 PROTECTION

A. Provide barricades and warning devices as required to protect pavement and the general public.

B. Protect completed paving against damage during subsequent construction activities until date of Final Completion.

C. Cover openings of structures in the area of paving until permanent coverings are placed.

3.10 FINAL ACCEPTANCE

A. Review Date: Submit a written request for review for Final Acceptance at least five (5) working days in advance

B. Completion: Work will be accepted upon satisfactory completion of all unit paving work.

END OF SECTION

SECTION 32 18 13 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the installation and applications of following resilient synthetic grass system.
   1. Synthetic grass surface for recreational areas.
      a. ADA Accessible.
   2. Aggregate Base.

B. Related Requirements:
   1. Section 03 30 00 “Cast-In-Place Concrete” for sub-slabs and base.
   2. Section 31 20 00 "Earth Moving" for preparation, compaction, and grading of granular base.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
   2. ASTM D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
   3. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
   4. ASTM D2859 Standard Test Method for Flammability of Finished Textile Floor Covering Materials.
   5. ASTM E303 Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
   6. ASTM F1292 Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
   7. ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.

B. Standards and Guidelines: CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F1292; and ASTM F1487.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site Insert location.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including installation instructions, applicable ASTM results and IPEMA Certificates of Compliance.

B. Samples for Verifications: For each type of synthetic grass surfacing indicated.
   1. Turf Fabric: 12 inches square.
   2. Infill Material: 4 oz. of each type.
   3. Seam Sample: 24 inches square with seam centered in sample.

C. One (1) construction project plan to include: project timeline with details and dates of each phase of construction; identification and contact information for project foreman; a letter from the turf manufacturer that the installation crew and foreman are certified as competent in the installation of this material.

D. Prior to the beginning of installation, the manufacturer/installer of the synthetic turf shall inspect the subbase and supply a Certificate of Subbase Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic playing surface.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each synthetic grass surfacing assembly.

C. Field quality-control reports.

D. Warranty: Sample warranty and third-party insurance certificate, noting any exceptions to the warranty information listed in the warranty section of this specification.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain synthetic grass surface system materials from single source, from single manufacturer.

B. Contractor (Installer) Qualifications:
   1. The synthetic grass Contractor must be experienced in the installation of synthetic grass play surface systems and have completed a minimum of Five (5) major systems, within the United States, Three (3) systems, within 150 miles of project site.
      a. Provide a Certified list of at least three (3) existing installations, including Owner representative and telephone number, attesting compliance with quality assurance information.
      b. The Contractor shall have been in the synthetic turf installation business, under the same ownership, for at least five (5) years.
      c. The installer must be IPEMA certified to install the synthetic grass surface.
   2. The synthetic grass Contractor shall employ only qualified, experienced supervisors and technicians skilled in the installation of synthetic grass systems.
   3. The synthetic grass Contractor shall provide a written letter or resume confirming that the installation crew and foreman are certified as competent in the installation of specified material, including attachment of seams and proper installation of infill material prior to the start of turf installation.
   4. The Contractor shall have a representative on site to certify the installation and Warranty compliance.
   5. Contractor must meet the following criteria:
      a. Have proper Contractor's license, in good standing, and have never had a license revoked.
      b. Have not had a Surety or Bonding company finish work on any contract within the last ten (10) years.
      c. Have not been disqualified or barred from performing work for any public Owner or other contracting entity.
      d. No current litigation for unacceptable work or non-completion of work.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For synthetic grass surfacing.
   1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for repairing, replacing, proper care, cleaning, and preventative maintenance of the synthetic turf system.
   2. Hold on-site meetings with Owner and Maintenance personnel and provide brief training sessions on cleaning, repairing and proper care.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Turf Fabric: Minimum of 100 sq. ft. for each type indicated.
   2. Infill: Minimum of two bags of each type.
   3. Seaming Tape and Adhesive: One roll of seaming tape and one gallon of adhesive.
   4. One new set of maintenance tools of type recommended by synthetic grass surfacing manufacturer for installation.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees Fahrenheit and a maximum temperature of 90 degrees Fahrenheit.

1.10 WARRANTY

A. Warranty The synthetic grass vendor shall submit its Manufacturer's warranty, which warrants the usability and playability of the synthetic grass system for its intended uses commencing with the date of Substantial Completion, against all defects in workmanship of the subgrade, drainage, associated sub-surface bases, attenuation, and turf surface material. The warranty coverage shall not be prorated nor limited to the amount of usage.
   1. Failures include, but are not limited to, the following:
      a. Deterioration and excessive wear.
      b. Deterioration from UV light.
      c. Excessive loss of shock attenuation.
      d. Seam separation, including markings.
   2. Warranty Period: 8 years from date of Substantial Completion.
   3. Full Warranty submitted must have the following characteristics:
      a. Provide full coverage of materials and workmanship for a minimum of eight (8) years from the date of substantial completion.
      b. Warrant the workmanship and materials installed meet or exceed the product specifications.
      c. Cover defects in the installation and workmanship.
      d. Repair or replace such portions of the installed materials that are no longer serviceable to maintain a usable and playable surface.
      e. Be from a single source covering workmanship and all materials.
      f. Assure the availability of exact or substantially the same replacement materials for the synthetic grass system for the full warranty period.

g. The turf manufacturer/installer must provide a third-party insurance policy covering contractual liability for the full 8-year term of the warranty. The policy must have an A.M. Best Rating of A, with a limit of $500,000 per warranty claim and an aggregate of $5,000,000.00 per policy year. The policy must cover both the base work and surface installation.
h. Warrant that the yarn used to make the grass-like tufts will maintain its UV stability and tensile strength such that the strength of the fiber when measured in accordance with ASTM D-2256 will not decrease by more than 50% during the warranty period due to breakdown of UV stability.
i. The warranty may specifically exclude vandalism and Acts of God beyond the control of the manufacturer or installer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. ADA Handicap accessible surface as per COSC No. 325, “Handbook for Public Playground Safety”; ASTM F1292; and ASTM F1487.

B. Turf Fabric: Turf fabric tested according to the following methods, with additional test method conditions for each method according to ASTM F1551.

C. Provide a 2-layer (bottom layer rubber-polyurethane/top layer synthetic grass with infill surfacing system that has been designed, manufactured and installed to meet the following criteria.
1. Flammability (ASTM D2859): Pass.
2. Tensile Strength (ASTM D412): 60 psi.
3. Tear Resistance (ASTM D624): 140%.
4. Water Permeability: 0.4 gal/yd2/second.
5. Accessibility: Comply with requirements of ASTM F1951.

D. All turf components and their installation method shall be designed and manufactured for use on playgrounds. The materials as hereinafter specified shall withstand full climatic exposure in the location of the designated turfgrass area, be resistant to insect infestation, rot, fungus, mold and mildew; it shall also withstand ultra-violet rays and extreme heat; the free flow of water vertically through the playing surface and into the drainage system below the surface.

E. The seams of all system components shall provide a permanent, tight, secure, and hazard free playing surface.

F. The installed synthetic grass shall allow for drainage and water flow through the system at a rate of not less than 8 inches per hour.

G. At the time of substantial completion, the system’s ASTM 1292 rated surface shall have an average fall height rating per installed equipment requirements. Testing shall be based on ASTM 1292-04. At no time throughout the life of the warranty shall the fall height rating be less than required.

H. To ensure safety compliance and per ASTM F1292 Section 4.4.1 and 19.1.2, the Owner has declared the official “Drop Height” for field testing to be 36 inches higher than the average fall height rating per installed equipment requirements. At the time of Substantial completion, the system’s ASTM 1292 rated surface shall meet the above “amended” standards. At no time throughout the life of the warranty shall the fall height rating be less than required.

2.02 MANUFACTURES

A. Manufactures and Type: ForeverLawn – Fusion Pro _____.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by:
   2. ForeverLawn Low Country, Inc.
   3. 702 Mall Blvd
   4. Savannah GA, 31406
   5. Ph. (912) 349-6154
   6. Website: www.foreverlawn.com.
   7. Or comparable product by one of the following:
      a. XGrass, Dalton, GA
      b. SynLawn, Powell, OH
      c. Genesis Turf, Mauldin, S.C.

B. Synthetic Grass Materials
   1. Yarn Type:
      a. Primary – Nylon monofilament.
      b. Secondary – Textured nylon monofilament.
   2. Yarn Color: Primary – Verde/Lime/Tan, Secondary: Field/Olive Green
   3. Yarn Count: Primary: 8800/8, Secondary: 4950/9
   4. Tufting Construction: Dual yarn, same row
   5. Blade Height: 1-3/8 inch.
   6. Tufting Gauge: 3/8 inch.
   7. Face Weight: 45 oz.
   8. Total Product Weight: 100 oz.
   9. Backing: 3-layer premimum backing including Biocel polyurethane and geotex non-woven fbric.
   10. Seaming: Micromechanical bonding.
   11. Infill: 3 lbs. +/- of rounded sand psf.

2.03 MATERIALS

A. Resilient Infill System:
   1. Synthetic Grass Infill: Recommended infill amount is three pounds of 12-20 mexh coated sand per square feet.
   2. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F1292 and for accessibility according to ASTM F1951.

B. Seam Adhesive: One- or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.

C. Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches wide.

D. Seaming Cord: Seaming cord or thread, recommended by the synthetic grass surfacing manufacturer.

2.04 MISCELLANEOUS

A. Aggregate base – see drawings for general notes and conditions.

B. Concrete base – see drawings for general notes and conditions.

C. Nailer board – pressure treated, size varies or as per Manufacturer's requirements.

D. Nails/Screws – galvanized.

E. Staples – galvanized 1 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine site installation area conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, permeability, and other conditions affecting performance of the Work.
   1. Prior to installation and upon inspection and acceptance of the subbase, Installer shall supply a Certificate of Subbase Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic playing surface.

B. Conduct inspection with Construction Manager and Landscape Architect to examine installation to all amenities for compliance with drawings regarding horizontal and vertical locations/elevations of elements within the surface area.

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

3.02 PREPARATION

A. General: Prepare substrates to receive surfacing products according to synthetic turfgrass surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
   1. Install sub-drainage system according to manufacturer's requirements. Coordinate installation and point of connection to storm line with General Contractor.
   2. Install aggregate base as per drawings and details.

B. Cleaning - the entire surface shall be clean and free of any foreign material.

3.03 INSTALLATION

A. The perimeter of the area shall be defined with a composite nailer board secured into concrete and held in place as per the manufacturer's instructions.
   1. Secure turf to boards placing staples every 1/2 inch.

B. Drainage Mat System: Install Manufacturer's specified drainage system per approved shop drawings for each area.

C. Roll out turf fabric and allow to relax at least four hours prior to seaming.

D. All seams shall be installed and secured with micromechanical primary bonding or as per the manufacturer's specifications. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.

E. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.

F. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

3.04 FIELD TESTING PROCEDURES AND QUALITY CONTROL

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

B. Perform the following tests and inspections:
   1. Permeability: 20 in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.
   2. ADA Compliance as per ASTM F1292 and ASTM F1951.

3.05 PROTECTION

A. Protect the installed synthetic turfgrass surface from damage resulting from subsequent construction activity on the site.

3.06 FINAL CLOSURE

A. Provide owner with maintenance manuals and hold on-site meetings with owner representatives with instructions for maintaining and repair the turfgrass.

B. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

END OF SECTION

SECTION 32 18 23.53 - ASPHALT PICKLEBALL COURT SURFACE COLOR COATING SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Asphalt court cushioned surface and color coating system.

1.02 RELATED REQUIREMENTS

A. Section 32 12 16 - Asphalt pavement as it pertains to the Pickleball courts.

1.03 REFERENCE STANDARDS

A. American Sports Builders Association (ASBA).

B. United States of America Pickleball Association (USAPA) Rules of Pickleball.

1.04 SUBMITTALS

A. Samples: Submit manufacturer’s color samples of color coating.

B. Test Reports: Submit independent test results for solar reflectance index.
   1. Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.

C. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

D. Manufacturer’s Project References: Submit manufacturer’s list of successfully completed asphalt pickleball court surface color coating system projects, including project name, location, and date of application.

E. Applicator’s Project References: Submit applicator’s list of successfully completed asphalt pickleball court surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.

F. Warranty Documentation: Submit manufacturer’s standard warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
   1. Manufacturer regularly engaged, for past 5 years, in manufacture of asphalt pickleball resilient court surface and color coating systems of similar type to that specified.
   2. United States owned company.
   3. Member: ASBA.

B. Source Limitations: Obtain Court Surfacing System materials through one source, from a single manufacturer.

C. Applicator's Qualifications:
   1. Applicator regularly engaged, for past 3 years, in application of pickleball court cushion surface and color coating systems of similar type to that specified.
   2. Employ persons trained for application of court surface and color coating systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until application.
   3. Store materials in clean, dry area indoors.
   4. Store materials out of direct sunlight.
   5. Keep materials from freezing.
   6. Protect materials during storage, handling, and application to prevent contamination or damage.
   7. Close containers when not in use.

1.07 AMBIENT CONDITIONS

A. Do not apply asphalt pickleball court cushion surface and color coating system when air or surface temperatures are below 50 degrees Fahrenheit during application or within 24 hours after application.

B. Do not apply asphalt pickleball court cushion surface and color coating system when rain is expected during application or within 24 hours after application.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design:
   SportMaster Sport Surfaces
   PO Box 2277
   3307 Biedler Street, Suite B
   North Charleton, SC 29418
   Phone: (843) 760-2070.
   Website www.sportmaster.net

B. Or approved equal.

2.02 MATERIALS

A. Asphalt Pickleball Court Surface Color Coating System: Basis of Design: SportMaster Procushion System.

B. Acrylic Resurfacer.
   1. Acrylic Resurfacer to be applied to ashpalt surface in preparation for cushion and color finish systems.
   2. Apply Acrylic resurfacer with a soft rubber squeegee. Apply succesive coats in cross directions. Scrape all rough spots and ridges before applying the next coat. Apply two coats on new or uncoated asphalt.
   3. New asphalt system must cure 14 to 30 days prior to application.

4. Coverage: .07 to .09 gallons per square yard per coat.

C. CushionMaster II.
   1. Base layer for Pro Cushion System, made of coarse rubber particles for high cushion build.
   2. Application: Use soft rubber squeegee. Do not apply until preceding coat has dried. Three coats of CushionMaster II followed by two coats of Cushion Master I are required for standard resiliency. Can also be sprayed wit dual diaghragm pump system.
   3. Coverage: 0.15 gallons per square yard per coat.

D. CushionMaster I.
   1. Secondary layer of fine rubber particles to be applied following coats of CushionMaster II to create a smooth, resilient surface.
   2. Application: Use a soft rubber squeegee. Do not apply unitl preceeding coat has dried. Three coats of CushionMaster II followed by two coatsof CushionMasterI are required for standard resiliency.
   3. Coverage: 0.10 to 0.12 gallons per square yard per coat.

E. ColorPlus Pigment Dispersion.
   1. SportMaster ColorPlus is a highly concentrated water based pigment dispersion designed for mixing with SportMater Neutral Concentrate and all oter SportMaster neutral-based coatings.
   2. Application: Apply mixed coating with a soft rubber squeegee. A minimum of two coats.
   3. Mixing Porcedures: Refer to manufactures instructions and recommendations for mix design.

F. PickleMaster RTU Base.
   1. Product Desription: RTU base is a specialized coating system. Coating is packaged in an untinted neutral base and produced with a fine rounded aggregate blend to provide non-slip texture, PickleMaster RTU Base is tinted by pouring in the desired color of ColorPlus Pigment Dispersion.
   2. Application: Apply mixed PicleMaster RTU with a soft rubber squeegee. Allow each coat to thoroughly dry before applying the next coat. A minimum of two coats.
   3. Coverage: Approximately .09 to .11 gallon per square yard per coat. (80 to 100 square feet per gallon, per coat.
   4. Drying Time: Dries in 30 to 60 minutes under optimum drying conditions. Allow 48 hours before allowing foot traffic or play.
   5. Color: Court - blue, NVZ - bright red and border - light green.

G. Line Paint: SportMaster “Textured Line Paint”.
   1. 100 percent acrylic emulsion line paint fortifide with fine sand to provide a textured playing surface.
   2. Coverage: 500 to 600 lineal feet of 2-inch line per gallon.
   3. Drying Time: 30 to 60 minutes under optimun drying conditions.
   4. Important: Stir befire using. Temperatures must be above 50 degrees farenheit both during application and for a period of at least 24 hours after application.
   5. Color: White.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine asphalt pickleball court surfaces to receive color coating system.

B. Verify asphalt pickleball courts meet ASBA requirements.

3.02 SURFACE PREPARATION

A. Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with asphalt pickleball court surface color coating system.

B. Prepare surfaces in accordance with manufacturer's instructions.

C. Cure new asphalt surfaces a minimum of 14 to 30 days before application of asphalt pickleball court surface color coating system.

D. Remove dirt, dust, debris, oil, grease, vegetation, loose materials, and other surface contaminants which could adversely affect application of asphalt pickleball court surface color coating system. Pressure wash entire surface.

E. Flood test all courts. Reference Section 32 12 16 - Asphalt Pavement, Article 3.02, paragraph 'H' for procedure.

F. Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of filler course and color coating.

G. Level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.

H. Apply 1 or 2 coats of filler course as required by surface roughness and porosity to provide smooth underlayment for application of color coating.

I. Ensure surface repairs are flush and smooth to adjoining surfaces.

3.03 APPLICATION

A. Apply asphalt pickleball court cushion surface and color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Allow material drying times in accordance with manufacturer's instructions before applying other materials or opening completed surface to foot traffic.

3.04 LINE MARKINGS

A. Lay out pickleball court line markings in accordance with USAPA Rules of Pickleball.

B. Apply line markings primer, after masking tape has been laid, to seal voids between masking tape and pickleball court surface to prevent bleed-under when line paint is applied.

C. Apply a minimum of 1 coat of line paint in accordance with manufacturer's instructions.

3.05 PROTECTION

A. Allow a minimum of 24 hours curing time before opening pickleball courts for play.

B. Protect applied asphalt pickleball court surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Posts, rails, and frames.

B. Wire fabric.

C. Concrete for footings

D. Manual gates with related hardware.

E. Accessories including windscreens and acoustic sound control panels.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCE STANDARDS

A. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2022).

B. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026c.

D. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.

E. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework; 2018 (Reapproved 2022).

F. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2018 (Reapproved 2022).

G. CLFMI CLF-FIG0111 - Field Inspection Guide; 2014.

H. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2023.

I. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

C. Design Calculations: For high wind load areas, provide calculations for fence fabric and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.

D. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

E. Samples: Submit two samples of fence fabric, 12" inch by 12" inch in size illustrating construction and colored finish.

F. Manufacturer's Qualification Statement.

G. Fence Installer Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Chain Link Fences and Gates:
   1. Master-Halco, Inc., www.masterhalco.com/#sle.
   2. Ameristar, Inc.

2.02 COMPONENTS

A. Line Posts: 1.9 inch diameter, black powder coated.

B. Corner and Terminal Posts: 2.38 inch diameter, black powder coated.

C. Gate Posts: 3-1/2 inch diameter, black powder coated

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.

F. Gate Frame: 1.66 inch diameter for welded fabrication.

G. Fabric: 2 inch diamond mesh interwoven wire, PVC infused vinyl-coated, black 9 gauge, 0.1483 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

H. Tension Wire: 6 gauge, 0.1920 inch thick steel, single strand.

I. Tie Wire: Aluminum alloy steel wire.

2.03 MATERIALS

A. Posts, Rails, and Frames: steel:

1. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; zinc coating complying with ASTM F1043 and ASTM F1083.
2. Line Posts: Type I round in accordance with FS RR-F-191/1D.
3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.

B. Wire Fabric:
1. ASTM A392 zinc coated and PVC infused vinyl coated steel chain link fabric.

C. Concrete for posts:
1. Type as specified in Section 03 30 00.
2. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 3,000 psi strength at 28 days, 3 inch slump; ____ inch nominal size aggregate.

2.04 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for all gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

B. Hardware for Double Swinging Gates: 180 degree hinges, 2 for all dbl. gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

C. Hinges: Finished to match fence components.

2.05 ACCESSORIES

A. Caps: Cast steel galvanized and powdercoated; sized to post diameter, set screw retainer.

B. Wind Screen:
1. Products: Pickleball Court Supply.
a. Tenn-Ait Pro Open Mesh Windscreen and gate panel
b. Material: 10 oz. 100% vinyl coated polyester with solid brass grommets every 12", three-ply reinforced hems and a 78% shade and windbreak factor.
c. Color: Black..
d. Substitutions: or approved equal.

C. Acoustifence Noise Barrier: (Acoustic Fence Sound Barrier)
1. Products: Outdoor model STC - NRC 1.04 with a STC perfomance of 28.
a. Pickle|blok RPA or arroved equal.
b. Height: 8'. 1/8" thick and 6' wide.
c. Color: Black..
d. Substitutions: or approved equal..

2.06 FINISHES

A. Components and Fabric: Vinyl coated over coating of 1.8 ounces per square foot galvanizing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.02 PREPARATION

A. Removal: Obstructions or debris.

3.03 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Place fabric on outside of posts and rails.

C. Set intermediate posts plumb , in concrete footings with top of footing 6 inches (150 mm) below finish grade to allow for court pavement above.

D. Line Post Footing Depth Below Finish Grade: ASTM F567.

E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

F. Brace each gate and corner post to adjacent line posts. Install brace rail one bay from end and at gate posts.

G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.

H. Install center brace rail on corner gate leaves.

I. Do not stretch fabric until concrete foundation has cured 28 days.

J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

K. Position bottom of fabric 2 inches above finished grade.

L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

N. Install bottom tension wire stretched taut between terminal posts.

O. Do not attach the hinged side of gate to building wall; provide separate gate posts.

P. Install hardware and gate with fabric to match fence.

Q. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

R. Peen all bolts upon installation.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

3.05 FIELD QUALITY CONTROL

A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

B. Post Settings: Randomly inspect three locations against design for:
   1. Hole diameter.
   2. Hole depth.
   3. Hole spacing.

C. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.

D. Gates: Inspect for level, plumb, and alignment.

E. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

3.06 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

C. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.

D. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Seating including benches in pickleball courts
   2. Tables.
   3. Bicycle racks.
   4. Trash receptacles.
   5. Parasol (Umbrella).
   6. Bollards.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for installing pipe sleeves cast in concrete footings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Verification: For each type of exposed finish, not less than 6-inch-long linear components and 4-inch-square sheet components.
   1. Include full-size Samples of bench Approved samples may be incorporated into the Work.

D. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.
   1. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Bench Replacement Slats: No fewer than two full-size units for each size indicated.
   2. Trash Receptacle Inner Containers: Three full-size units for each size indicated. Where each container has two or more liners, provide Three of each size of liner.
   3. Anchors: Insert type and number.

PART 2 - PRODUCTS

2.01 SEATING

A. As manufactured by Vestre:

B. Model: (S1a) Vroom Bench and (S1b) Vroom 2-Tier Bench
   1. Material:
      a. Painted Steel: Edge framed.
      b. Wood: Kebony Clear ; formed into evenly spaced parallel slats
   2. Arms: None

C. Finish: Galvanized and Powdercoated.
   1. Color: custom RAL Bronze color

D. Mounting: surface mount

E. Steel Finish: Galvanized and coated.
   1. Color: As indicated in a site furnishing schedule

F. Wood Finish: Unfinished.
   1. Stain: Manufacturer's standard

2.02 PICNIC SET

A. As manufactured by Site Pieces, 2409 Spring Grove Ave., Cincinnati OH 45214. Ph.: (800) 484-0797, website: www.sitepieces.com.

B. Model: S2: Monoline Standard Community Table (ML-CMT)
   1. Materials:
      a. Slats: Kebony Clear.
      b. Metal: Aluminum frame construction.
   2. Dimensions: 82" x 36.25" x 30.75" height.

C. Color and Finish:
   1. Metal Color: custom RAL Bronze color.
   2. Stain (wood): Manufacturer's standard

2.03 BICYCLE RACKS

A. As manufactured by Streetlife: Philadelphia, PA Ph.: (215) 247-0148. website: www.streetlife.com.

B. Model: Solid Bicycle Rack
   1. Materials:
      a. Frame: hot-dipped galv. steel
      b. Wood: 100% Cumaru hardwood
   2. Finish: FSC virgin hardwood II
   3. Color: RAL: Bronze.
   4. Security: Designed to lock wheel.
   5. Installation Method: Embedded.

C. Wood Finish: Unfinished.

2.04 SHADE STRUCTURE BETWEEN COURTS

A. As manufactured by Suntrends

B. Model: Cabana Bench w/8' Table

C. Steel Finish: Color coated.
   1. Color: As indicated by manufacturer's designation

D. Fiberglass Color: As indicated by manufacturer's designation

2.05 TRASH RECEPTACLES

A. TYPE 1: As manufactured by BigBelly
   1. Model: BigBelly Element - Sense max compacting bin, double with hopper interface with foot pedal, solar powered.
   2. Finish: standard
   3. Mounting: embedded base
   4. Color: Custom Charleston Green.

B. TYPE 2: As manufactured by Max R.
   1. Model: Infinity Bin.
   2. Size: 55 gallon capacity.
   3. Finish: Smooth grained, black panels, liner and lid. (HDPE).
   4. Opening: Standard.
   5. Mounting: Free standing.
   6. Branding: Custom - Hilton Head Island.

C. Graphics: Surface-applied copy, content, and style as indicated on Drawings.
   1. Copy: Waste and recycling with custom Tohhi branding.

2.06 PARASOL

A. Manufacturer: Tuuci, 1000 SE 8th Street, Miami-Hialeah FL Ph.: (305) 364-5116. website: www.tuuci.com

B. Model: Parasol Collection - Ocean Master Mega Max.

C. Size: 14x20 Rectangular Parasol.

D. Color: Java Mast, Premier PXT 10000 Fabric.

E. Base: Above ground base with locking wheels.

F. Support Frames: Steel; welded.

2.07 BOLLARDS

A. Maunfacturer: StreetLife. Philadelphia, PA Ph.: (215) 247-0148. website: www.streetlife.com.
   1. Model Solid Quattro - 6" square.
      a. Size: 6" Square, 2'-5.5" height..
      b. Material: Cumaru wood.
      c. Stainless Steel: Tubes.
   2. Square Wood: Accoyo., 10 inches in diameter.
   3. Installation Method: Cast in concrete.

2.08 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
   1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B211.
   2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B221.
   3. Structural Pipe and Tube: ASTM B429.
   4. Sheet and Plate: ASTM B209.
   5. Castings: ASTM B26.

B. Steel and Iron: Free of surface blemishes and complying with the following:
   1. Plates, Shapes, and Bars: ASTM A36.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53, or electric-resistance-welded pipe complying with ASTM A135.
   3. Tubing: Cold-formed steel tubing complying with ASTM A500.
   4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513, or steel tubing fabricated from steel complying with ASTM A1011 and complying with dimensional tolerances in ASTM A500; zinc coated internally and externally.
   5. Sheet: Commercial steel sheet complying with ASTM A1011.
   6. Perforated Metal: From steel sheet not less than 0.075-inch nominal thickness; manufacturer's standard perforation pattern.
   7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F1267.
   8. Malleable-Iron Castings: ASTM A47, grade as recommended by fabricator for type of use intended.
   9. Gray-Iron Castings: ASTM A48, Class 200.

C. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.

D. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
   1. Polyethylene: Fabricated from virgin plastic HDPE resin.

E. Anchors, Fasteners, Fittings, and Hardware: Stainless steel; commercial quality, tamperproof, vandal and theft resistant.
   1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on-grade substrate; one per leg
   2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit

F. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107; recommended in writing by manufacturer, for exterior applications.

G. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

H. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:

1. Hot-Dip Galvanizing: According to ASTM A123, ASTM A153, or ASTM A924.

2.09 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment: Pressure-treat wood according to AWPA U1, Use Category UC3b, and the following:
   1. Use preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

2.10 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.11 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 ALUMINUM FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION

SECTION 32 84 00 – LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. General Description Includes:
1. Underground irrigation system.
2. Pipe and fittings, valves, sprinkler heads, drip tubing, and accessories.
3. Automatic two-wire control system with communication to a central control software.
4. Excavation and backfilling for installation of underground system.
5. All necessary permits, licenses and fees.

1.2 SYSTEM DESCRIPTION

A. Layout design:
1. Full and complete coverage is a requirement. Contractor shall, at no additional costs to the Owner, modify layout, make necessary adjustments, as needed to obtain full coverage without overthrow on roadways, pavements, structures, furniture, fountains or buildings and to protect trees and shrubs from close high spray velocity.
2. Provide irrigation layout with separate plant type zones:
   a. Lawn (seed and sod)
   b. Plant beds containing Groundcover, Perennials, Shrubs and/or Trees
3. Provide flow velocities that do not exceed 5.0 ft. per second.
4. Provide irrigation of lawn areas with no overspray into planting beds or pavements, unless so designed on the drawings.
5. Provide independent irrigation of individual bed zones or planters.

B. Only similar types of heads with matched precipitation rates may run on same zone.

C. Piping Design: Do not mix different heads for each line. Provide main size as needed for proper flow, but not less than specified on plan.

D. Provide electric solenoid controlled underground irrigation system manufactured especially for control of automatic circuit valves of underground irrigation system. Provide unit of capacity to suit number of circuits indicated.
1. Source Power: 120 volts
2. Low Voltage Controls: 24 volts AC.

E. Provide controller to control all zones.

F. The extent of the irrigation system is shown on the Drawings.

1.3 SUBMITTALS - REVIEW

A. Product Data: Submit manufacturer’s technical data and installation instructions for all components and equipment used.

B. Shop Drawings:
1. Indicate piping layout to water source.
2. Include piping layout and details illustrating location and types of sprinkler heads, valves, control system and wiring diagram showing routes, wire sizes, wiring details and source of current and connections, and schedule of fittings.
3. Indicate location of sleeves under pavements and conflicts with existing utilities.

1.4 SUBMITTALS - CLOSE-OUT

A. Comply with the requirements of the General Conditions.

B. Record Drawings:
   1. Prepare a map diagram showing location of all valves, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. “As-built” drawings must be approved before charts are prepared.
   2. Provide one chart per controller showing the area covered by each satellite controller. The chart shall be a reduced drawing of the actual “as-built” system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door. A second full-sized copy of each chart is to be given to the Landscape Architect.
   3. The chart shall be a photographically reproduced print with a different color used to show coverage for each station. When completed and approved, the chart shall be hermetically sealed between two pieces of clear plastic. Charts must be completed and approved prior to final inspection of the irrigation system.
   4. At the time of the irrigation mainline test, provide a preliminary set of “Record” drawings to the Owner.

C. Operation and Maintenance Data:
   1. Provide schedule indicating length of time each valve is required to be run to provide a determined amount of water.
   2. Include complete parts list with manufacturer’s designations for each component.

D. Loose Equipment to Furnish: Loose irrigation equipment, operating keys and spare parts will be furnished by the Irrigation Contractor in quantities below:
   1. Two (2) quick coupler keys and matching swivel hose ells for ¾” garden hose.
   2. Two (2) valve keys for gate valves.
   3. Two (2) keys for each controller.
   4. Two (2) of each type of sprinkler used on project, complete with housings.

1.5 QUALITY ASSURANCE

A. Installer’s Qualifications: Single firm specializing in irrigation work with a minimum of five years experience properly installing irrigation systems of comparable size. Crew leader is to hold a certification of competence in irrigation design or installation.
   1. Provide references of your last five consecutive systems, and five systems of comparable size with bid proposal.

B. Multiple units: when two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.

C. Materials, equipment, and methods of installation shall comply with the following codes and standards:
   1. State of Ohio Building Codes.
   2. American Society for Testing and Materials (ASTM).
   3. National Sanitation Foundation (NSF).

D. Nameplates: Nameplate bearing manufacturer’s name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

E. Requirements of Regulatory Agencies:
   1. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety; the Uniform Building Code and other applicable laws or regulations, including any local Plumbing Codes.

2. Should the Contract documents be at variance with the rules and regulations, notify the Owner for instructions before proceeding with work affected.

F. Testing:
1. Preliminary review of completed main line and wire installation will be made prior to backfilling of trenches and hydrostatic testing.
2. Final review and testing shall be made in conjunction with the final review of lawn, shrub and tree planting. The irrigation system must be operational for 14 days prior to this final inspection. Any failures are to be corrected and the testing cycle is to be repeated.
3. Contractor is to notify Landscape Architect three days prior to testing.

G. Permits and Inspections:
1. Any permits for the installation or construction of any work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the contractor, each at the proper time.
2. The Contractor shall also arrange for and pay all costs in connection with any inspection and examination required by these authorities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver irrigation system components in manufacturer's original, undamaged and unopened containers, with labels intact and legible.

B. Deliver plastic pipe in bundles, packaged to provide adequate protection of pipe ends.

C. Store and handle materials to prevent damage and deterioration.

D. Provide secure, locked storage for valves, sprinkler heads and similar components that cannot be immediately replaced to prevent installation delays.

E. Contractor is responsible for materials through final acceptance.

1.7 PROJECT CONDITIONS

A. Protect existing trees, plants, and lawns and other features designated to remain as part of the final landscape.

B. The Contractor shall carefully coordinate with the landscape work and other site developments, including all new and existing utilities.

C. The Contractor shall verify the correctness of all finish grades within the work area to ensure the proper soil coverage of the irrigation pipes.

D. Irrigation system layout is diagrammatic. Exact location of piping, sprinkler heads, valves, and other components shall be established by Contractor in the field at time of installation.

E. Where possible sprinkler head layout should match drawings as closely as possible; field stake line and head locations for coordination with landscape contractor and approval by Landscape Architect prior to installation. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown. Lines are to be common trenched wherever possible.

F. Space sprinkler components as indicated. Do not exceed sprinkler spacing shown on Drawings.

G. Locate existing utilities in areas of work. If utilities are to remain, provide adequate means of protection during the system installation. Repair utilities damaged during the work to the satisfaction of the Utility Owner and at the Contractor's expense. Notify local Utilities Protection Service 48 hours before start of construction.

H. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, notify the Owner immediately for direction as to procedure. Cooperate with the Owner and Utility companies in keeping active services and facilities in operation.

I. Minor adjustments in system layout will be permitted to clear existing field obstruction. Final system layout shall be acceptable to the Landscape Architect.

1.8 WARRANTY

A. Warranties are subject to the General Conditions and Supplementary Agreements.

B. Irrigation Contractor is responsible to ensure complete coverage as specified herein of the areas to be irrigated. During the warranty period the Irrigation Contractor shall make any adjustments as necessary to maintain proper coverage.

C. The Contractor shall guarantee all parts and labor for a period of one year from the date of final inspection. If within that period settlement occurs, and adjustments in pipes, valves and sprinkler heads, lawn areas or paving are necessary to bring the system, grade or paving to the proper level of the permanent grades, the Contractor, as part of the work under his Contract, shall make all adjustments without extra cost to the Owner, including the restoration of all damaged planting, paving or other improvements of any kind.

1.9 OPERATION & MAINTENANCE — IRRIGATION SYSTEM

A. It is the Landscape Contractor's responsibility to determine water application rates and controller cycling. The Irrigation Contractor will coordinate system installation with planting soil placement and planting activities. The Irrigation Contractor will also instruct the Landscape Contractor on the operation and programming of the controller and will assist the Landscape Contractor as necessary in such operations throughout the one-year maintenance period. Any adjustments, repairs, etc., other than programming, are the total responsibility of the Irrigation Contractor.

B. As part of this contract, the Irrigation Contractor shall winterize the system the first year and provide written instructions to the Owner for future service and maintenance. The Irrigation Contractor shall return to the site during the subsequent spring season and demonstrate to the Owner the proper procedures for the system start-up, operation and maintenance.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyl (PCB) or other hazardous materials identified by the Owner.

2.2 IRRIGATION SYSTEM MANUFACTURERS

A. All irrigation system components shall be supplied by regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all aspects.

2.3 MATERIALS

A. All materials to be incorporated in this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of this system.

B. Plastic Pipe
1. All piping shall be from virgin parent material. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles and dents. All pipe shall be National Sanitation Foundation (NSF) approved.
2. For all mainline piping 3” and over, use SDR 21, Class 200 gasketed PVC bell & spigot pipe.
3. For all other irrigation piping, use polyvinyl chloride (PVC) 1120 with a minimum class rating of 200, sized to maintain a maximum flow velocity of less than 5 ft. per second (FPS).
4. Outside diameter of pipe shall be the same as iron pipe.
5. Pipe shall be marked at intervals (not to exceed 5’) with the following information: Manufacturer’s name or trademark, nominal pipe size, schedule, PVC type and grade (i.e. PVC 1120), SDR rating class, working pressure at 73 degrees F. and NSF approval.
6. Caution should be utilized in handling Type I pipe due to the possibility of cracking or splitting when dropped or handled carelessly.
7. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench.
8. Comply with pipe sizes indicated on drawings. No substitution of smaller pipe will be permitted. Larger sizes may be used subject to acceptance of the Landscape Architect. Remove damaged and defective pipe from site.
9. All PVC pipe to be furnished in 20’ lengths.
10. Acceptable Manufacturer:
    (a) Silverline Plastics or approved equivalent

C. Piping for Sleeving
1. For sleeves less than six inches in size, use high impact type, polyvinyl chloride (PVC) 1120, minimum Schedule 40.
2. Sleeves six inches and above in size shall be Polyvinyl Chloride (PVC) 1120 Class 200.
3. Irrigation Contractor shall be responsible for the coordination of sleeves for all piping passing through concrete curbing, under paved areas, concrete or masonry walls and floors while the same are under construction.
4. Acceptable Manufacturer:
    (a) Silverline Plastics or approved equivalent

D. PVC Fittings
1. Schedule 40 or 80, polyvinyl chloride (PVC), Type 1 injection molded fittings suitable for solvent weld or threaded connections. Fittings made of other materials are not permitted.
2. Threaded PVC nipples shall be Schedule 80. Use high quality grade of Teflon tape for threaded fittings.
    (a) Saddle fittings are not permitted.
    (b) Use high quality grade of Teflon tape for sprinkler head and electric control valve connections.
3. Acceptable Manufacturer:
    (a) Spears Manufacturing or approved equivalent

E. Isolation Valves
1. Gate valves under 3” shall be 200 PSI rated W.O.G. 200 with bronze bodies. Valves shall be equipped with tee handles.
2. The valve shall have a 100% urethane coated wedge insuring a bubble-tight seal up to 200 PSI. The valve shall be fusion-bonded epoxy coated with PVC push-on, threaded or mechanical connections and a two-inch square nut for vertical valve stem key.

3. Acceptable Manufacturer:
   (a) Nibco TI-8 or T113-K or approved equivalent

F. Quick Coupling Valves
1. Valve shall be of two-piece construction with a one-inch female top thread with vinyl cover.
2. Furnish one valve key fitted with one-inch swivel hose ells.
3. All quick coupling valve keys and hose swivels shall be of the same manufacturer as the quick coupler.
4. Acceptable Product:
   (a) Rain Bird model 5RC or approved equivalent

G. Valve Boxes
1. Tapered rib reinforcement enclosure of rigid tensile strength plastic material components chemically inert and unaffected by moisture, ultraviolet light, corrosion and temperature changes. Lid and base shall withstand normal loads exerted by turf equipment without collapsing. Box and lid to be black.
2. For remote control valves use rectangular standard turf box, 16” x 12”.
3. For Isolation valves and quick coupler valves use 10” circular turf box.
4. Acceptable Manufacturer:
   (a) Armor Access or approved equivalent

H. Spray Heads
1. Full or part circle pop-up fixed spray sprinkler.
2. 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-down and a ratcheting system for easy alignment of the pattern. The sprinkler shall have a soft elastic pressure-activated co-molded wiper seal for cleaning debris from the pop-up stem as it retracts into the case to prevent the sprinkler from sticking up to minimize “flow-by.” The sprinkler shall have a matched precipitation rate (MPR) plastic nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall be capable of housing under the nozzle; protective, non-clogging filter screens or pressure compensating screens. The screen shall be used in conjunction with the regulating screw for regulating.
3. The sprinkler shall have a flush plug reinstalled. The plug shall prevent debris from clogging the sprinkler during installation and allow for system to be flushed before installing nozzles. The plug shall be bright orange in color and constructed of polypropylene material.
4. Sprinklers subject to low head drainage shall have integral check valves capable of holding back to 7’ of head. Such sprinklers shall be clearly marked with “SAM” on top.
5. The sprinklers shall also include an integral pressure-regulating device (PRS) where noted on the Drawings. These units shall be identifiable from the top with the marking “PRS” on top.
6. Pop-up heights: 4 inches, 6 inches and 12 inches (see drawings).
7. Spray nozzles for sprinkler heads shall be of the same manufacturer as the spray head.
8. Acceptable Product:
   (a) Rain Bird model 1800 or 1800SAMPRS or approved equivalent

I. Rotator Nozzles
1. The rotary nozzle shall have an adjustable arc of between 90 and 210 degrees and shall be capable of covering a 10-30’ radius at 30 PSI.
2. The rotary nozzle shall have multiple arced streams and have a matched precipitation rate of 0.60 in/hr.

3. The rotary nozzle shall be constructed of UV-resistant plastic. The radius adjustment screw shall be of stainless steel and shall include a removable mesh screen to protect the nozzle against clogging.
4. Acceptable Products:
   (a) Rain Bird R-VAN Rotator series or approved equivalent

J. Mid-Range Turf Rotors
1. The full or part circle rotor sprinkler shall be a single stream, water lubricated, gear drive.
2. The part circle sprinkler shall have adjustable arc coverage from 30 to 350 degrees.
3. The sprinkler shall have a thread-on nozzle assembly whose installation shall not require any tools. The arc adjustment shall not require any tools.
4. The sprinkler shall have a pressure-activated multi-function wiper seal that positively seals against the nozzle flange to keep debris out of the rotor and to clean debris from the pop-up stem as it retracts. The wiper seal shall prevent sprinkler from sticking up and be capable of sealing the sprinkler cap to sprinkler body under normal operating pressures.
5. The sprinkler shall have a screen attached to the drive housing to filter inlet water, protect the drive from clogging and simplify its removal for cleaning and flushing of the system. It shall have a 3/4” bottom inlet.
6. The sprinkler shall have a stainless steel retract spring for positive pop down.
7. The sprinkler shall have an adjusting screw capable of reducing the radius by up to 25%.
8. Pop-up heights: 4 inches and 12 inches (see drawings).
9. Acceptable Products:
   (a) Rain Bird model 5000 or approved equivalent

K. Automatic Controller, 2-Wire
1. The controller shall be of a hybrid type that combines electro-mechanical and microelectronic
2. circuitry capable of fully automatic or manual operation. The controller shall be housed in a stainless-steel pedestal with a key-locking door suitable for outdoor installation.
3. The controller shall have a base station capacity of 50 stations with two additional expansion slots capable of receiving modules to create a controller capacity of up to 200 stations. Station timing shall be from 0 minutes to 12 hours.
4. The controller shall have a Seasonal Adjustment by program which adjusts the station run time from 0 to 300% in 1% increments. The controller shall also have a Monthly Seasonal Adjustment of 0 to 300% by month. Station timing with Seasonal Adjustment shall be from 1 second to 16 hours.
5. The controller shall have 4 separate and independent programs which can have different start times, start day cycles, and station run times. Each program shall have up to 8 start
6. times per day for a total of 32 possible start times per day. The 4 programs shall be allowed to overlap operation based on user defined settings which control the number of simultaneous stations per program and total for the controller. The controller shall allow up to 8 valves to operate simultaneously per program and total for the controller including the master valves.
7. The controller shall have a 365-day calendar with Permanent Day Off feature that allows a day(s) of the week to be turned off on any user selected program day cycle. (Custom, Even, Odd, Odd31, & Cyclical). Days set to Permanent Day Off shall override the normal repeating
8. schedule and not water on the specified day(s) of the week. The controller shall also have a Calendar Day Off feature allowing the user to select up to 5 dates up to 365-days in the future when the controller shall not start programs.

9. The controller shall incorporate a Rain Delay feature allowing the user to set the number of days the controller should remain off before automatically returning to the auto mode.
10. The controller shall have Cycle+Soak water management software which can operate each station for a maximum cycle time and a minimum soak time to reduce water run-off. The maximum cycle time shall not be extended by Seasonal Adjustment.
11. The controller shall incorporate an optional FloManager feature providing real-time flow, power, and station management. FloManager shall manage the number of stations operating at any point in time based on water source capacity, station flow rate, number of valves per station; user-defined simultaneous stations per program and for the controller. FloManager shall incorporate the ability to provide station priorities to determine the order in which stations shall operate. The controller shall ignore the station number and instead operate the highest priority stations first and the lower priority stations last when FloManager is enabled. FloManager shall be an option that is disabled by default and the controller shall operate zones in order of station number, started with the lowest numbered zone set to irrigate and ending with the highest number zone.
12. The controller shall offer Water Windows for each program. This function sets the allowed start and stop time where watering is allowed. If the watering cannot be completed by the time the Water Window closes, the stations with remaining run time are paused and watering automatically resumes when the Water Window opens the next time.
13. Acceptable Product:
    (a) Rain Bird ESP-LXIVM or approved equivalent

L. Line Decoders
1. The factory pre-coded decoders shall be fully waterproof and have a working range shall be 0 degrees C to 50 degrees C at up to 100% humidity.
2. Decoders shall be capable of operating from one to six solenoids depending on the model specified on the Drawings
3. Four and six address decoders shall have integral surge protection.
4. Acceptable Product:
   (a) Rain Bird LD series or approved equivalent

M. Control Wire
1. Two conductors of single strand solid copper wire type, with PVC jacket. UF 600-volt AWG #14 minimum size, approved for direct burial. For runs over 2,000 L.F. use AWG #12. Contractor is to verify that wire sizes are within recommended wire run lengths for proper solenoid operation.

N. Rain Shutoff
1. One device shall be provided for each controller. Install per manufacturer's latest printed instructions.
2. Verify with Landscape Architect as to final location of rain shutoff.
3. Acceptable Product:
   (a) Rain Bird WRS2 or approved equivalent

O. Remote Communication and Control
1. The irrigation central control system shall be the IQ™ Platform as hereafter specified and as shown on the drawings. The system shall be fully programmable, providing the operator with absolute and full control of the entire control system. The system shall provide a degree of flexibility such that, in effect, anything that could be done at the satellite controller shall be capable of being done at the central computer.
2. The system shall have a Windows® graphical user interface (GUI) that allows easy programming and graphical depiction of the satellite controller programming.

3. The system shall be compatible with the ESP-LXME Series traditionally-wired controllers with 1 to 48 station capacity. The system shall also be compatible with ESP-LXD Series Two-wire decoder controllers with 1 to 200 station capacity. The system shall have an adjustable satellite controller capacity allowing the customer to expand the system capacity over time.
4. The system shall allow virtual log-on passwords to administer access privileges to multiple users of the system. The system shall support multiple languages including English, Spanish, French, German, Italian, and Portuguese. The system shall also support user defined date/time, number, and unit formats
5. The system shall allow virtual site configurations, allowing the user to group satellite controllers into a site to simplify common adjustments. The system shall incorporate a satellite controller dry-run feature that graphically depicts the program operation, showing minute-by-minute program activity, expected flow rates, and the programs/stations operating at any point in time. The system shall incorporate program adjust values for each satellite controller program. The system shall also include a site-level daily or monthly seasonal adjust percentage that adjusts the station run times for all satellite controllers in the site. The system shall also offer site-level daily or monthly ET value adjustments as an alternative to seasonal adjustment percentage.
6. The software shall utilize NCC Network Communication Cartridges to interface with the system controllers. The cartridges shall be available with internal 3G Cellular, Ethernet, & Wi-Fi modems or RS-232 external modem port. The cartridges installed in the controller shall be field configurable as a Direct, Server, or Client Satellite. The Server satellite shall share its IQ central computer communication link with up to 149 Client satellites and be capable of sharing weather sensors and master valves amongst the 150 satellite controllers. The software shall incorporate a site configuration utility that contacts the satellite controller, reports the hardware configuration and retrieves the configuration and programming data. The software shall verify the satellite hardware configuration has not changed each time it contacts the satellite controller. The controller and NCC cartridge firmware shall be upgradeable from the system central computer. The software shall be capable of manually starting a program, test program, or station on any satellite controller. The software shall be capable of overriding the satellite controller Auto/Off dial position and sensor Active/Bypass switch position.
7. Satellite controllers equipped with flow sensors shall provide a learn flow utility to measure the nominal flow rate of each station. The learn flow rate shall be compared to the actual flow sensor flow rate each time the station operates. A user defined percentage above and below the learned flow rate shall be used to determine if the flow rate is problematic. User defined reactions shall be programmable including a diagnose mode where the cause of the problem flow rate is identified, and the problem station or water source is shut off. A manual MV water window shall be provided to automatically open the master valve and account for manual watering flow rates without turning off the flow sensing functions of the satellite controller. Both normally closed and open master valves shall be supported. All flow sensing features shall be programmable through the software. The system shall offer user definable station-level priorities and a program-level water window. Stations are selected to operate based on their priority with high priority stations operating first. If a program cannot complete the run time of all stations in the water window the station operation shall be paused and resumed at the start of the next water window.
8. The system shall provide user definable number of simultaneous stations to operate per program and for the whole satellite controller. The combination of these features shall be used to automatically shorten the overall operating time of the satellite controller programs. All features listed shall be programmable through the software. The system shall provide automatic communication and email reports.

9. The system shall provide satellite controller PIN code lock-out and 2-way programming. Each satellite shall have minimum of 5 assigned PIN-codes. Lockout options shall include full or partial lockout. All PIN-codes shall be programmed through the software. The system shall provide automatic program adjustment-based management allowed depletion scheduling. ET/rain weather sources shall include CIMIS Internet, ETMI Weather Reach, and WSPROLT and WSPRO2 Weather Stations, and IQ Global Weather. The system shall provide minute-by-minute flow logs in a graph comparing actual flow and projected flow. Actual flow totals shall be included in the automated email reports.
10. Acceptable Product:
    a. Rain Bird model IQ-4G-USA or approved equivalent

P. Drip Tubing
1. Drip tubing shall be continuously self-flushing and pressure compensating. It shall consist of nominal sized one-half inch low density, linear polyethylene tubing, housing internal pressure compensating, continuously self-flushing, integral drip emitters.
2. The tubing shall be brown in color and conform to an outside diameter (O.D.) of 0.67 inches, and an inside diameter (I.D.) of 0.57 inches. The emitters shall have the ability to independently regulate discharge rates, with an output pressure of seven (7) to seventy (70) PSI, at a constant flow.
3. The emitter discharge rate shall be either 0.61 or 0.91 gallons per hour (GPH), utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and a diaphragm to maintain uniform discharge rates. The emitters shall continuously clean themselves while in operation. The tubing shall have 12” or 18” spacing between emitters as noted on drawing.
4. Acceptable Product:
   (a) Rain Bird XFD series inline drip tubing or approved equivalent

Q. Control Valves (Drip)
1. The control valve shall be normally closed 24 VAC 50/60-cycle solenoid actuated globe pattern. The pressure rating shall not be less than 200 PSI.
2. The valve body and bonnet shall be constructed of UV-resistant plastic and have stainless steel screws; diaphragm shall be of nylon reinforced nitrile rubber.
3. The valve shall have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electrically energizing the solenoid. The valve’s internal bleed shall prevent flooding of the valve box.
4. The valve shall house a fully encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24-VAC 50/60 Hz solenoid shall open with 19.6-volt minimum at 200 PSI. At 24 VAC average inrush current shall not exceed .23 amps.
5. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.
6. The complete valve control kit shall consist of the electric valve, a 200-mesh stainless steel filter screen, and a 30-PSI pressure regulator.
7. Valves connected to the exterior two-wire controller shall be retrofitted with Manufacturer-approved solenoids for compatibility with the decoder system.
8. See Drawings for size of valves.
9. Acceptable Product:
   a. Rain Bird model XCZPGA-100-PRF or approved equivalent

R. Control Valves (Sprinklers)

1. The electric control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe/angle pattern design. The valve pressure rating shall not be less than 150 PSI.
2. The valve body and bonnet shall be constructed of high-impact, water-resistant PVC for the
3. body and glass-filled nylon for the bonnet with stainless steel screws.
4. The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
5. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24-VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 150 PSI. At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps.
6. The valve shall have a flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than 1 minute at 150PSI and less than 30 seconds at 20 PSI.
7. The valve construction shall provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The body shall have a removable O-ringed plug for installation in either globe or angle configuration.
8. Acceptable Product:
   (a) Rain Bird model PGA or approved equivalent

S. Master Valve
1. The electric control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe/angle pattern design. The valve pressure rating shall not be less than 200 PSI.
2. The valve body and bonnet shall be constructed of high-impact, water-resistant glass-filled nylon for the with stainless steel screws.
3. The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.
4. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24-VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 200 PSI. At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps.
5. The valve shall have a flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than 1 minute at 150PSI and less than 30 seconds at 20 PSI.
6. The valve construction shall provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The body shall have a removable O-ringed plug for installation in either globe or angle configuration.
7. Acceptable Product:
   (a) Rain Bird model PEB or approved equivalent

T. Accessory materials
1. Drainage fill at valve boxes:
   (a) Provide 1" washed pea gravel in each valve box.
2. Suitable excavated materials removed to accommodate the irrigation system work shall be used as fill materials provided it conforms to the requirements of fill as noted above.

U. PVC Solvent Cement:

1. Provide professional grade cement, Whitlam #PR32 or approved equivalent for PVC pipe and fittings.

V. PVC Primer/Cleaner
1. Provide professional grade primer/cleaner, Whitlam #PP32 or approved equivalent (purple) primer.

PART 3 - EXECUTION

3.1 GENERAL

A. Lay out work as accurately as possible to Drawings. Drawings are diagrammatic to the extent that swing joints, offsets, and fittings are not shown.

B. The Irrigation Contractor shall carefully schedule his work with the Landscape Contractor and all other site developments.

C. Sleeves are required wherever piping or electrical wires are placed under paved surfaces. (Installed as part of other sections and Contract). Irrigation Contractor is responsible for coordination of all sleeves.

D. Full and completed coverage is required. Contractor shall make any necessary minor adjustments to layout as required to achieve full coverage of irrigated areas at no additional cost to the Owner.

E. Where piping is shown on drawings to be under paved areas but running parallel and adjacent to planted areas, the intent is to install piping in planted areas. Do not install directly over another line in the same trench.

F. It shall be the Contractor's responsibility to establish the location of all sprinkler heads in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on drawings. No substitution of smaller pipe sizes will be permitted, but substitutions of larger sixes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection.

G. Install irrigation system after completion of site grading, the irrigation system shall be installed and completely operational three days prior to the installation of any planting operations.

3.2 POINT OF CONNECTION

A. Provide irrigation system complete from point of connection. See Drawings for Point of Connection (POC).

3.3 EXCAVATING

A. All piping is to be trenched, other than one inch which may be pulled.

B. Excavate to depths required to provide six inches of Granular Fill bedding material under paved surfaces.

C. Should utilities not shown on the plans be found during excavations, the Contractor shall promptly notify the Owner for instructions as to further actions required. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the record drawings promptly.

D. Install main line irrigation lines with a minimum cover of eighteen inches and a maximum cover of twenty-four inches based on finished grades.

E. Install lateral irrigation lines with a minimum cover of twelve inches and a maximum cover of twenty-four inches based on finished grades.

F. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations, to their original condition.

G. Trenches shall be open, vertical sided construction wide enough to provide free working space around work installed and to provide adequate space for backfilling and compacting.

H. When two pipes are to be placed in the same trench, a six-inch space is to be maintained between the pipes. The Contractor shall not install two pipes with one directly above the other.

I. The Contractor shall cut trenches for pipe to required grade lines and compact trench bottom to prove accurate grade and uniform bearing for the full length of the line.

J. The Contractor shall be held responsible for damages caused by these operations and shall immediately repair or replace damaged parts.

3.4 PIPELINE ASSEMBLY

A. General
1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
2. Clean all pipes and fittings of dirt, scales and moistures before assembly.
3. All pipe, fittings and valves, etc., shall be carefully placed in the trenches. Interior of pipes shall be kept free from dirt and debris and when laying is not in progress, open ends of pipe shall be closed by approved means.
4. All lateral connections to the main line as well as all other connections shall be made to the side of the main line pipe. No connections to the top of the line shall be allowed.

B. Solvent-Welded Joints for PVC Pipe
1. Use solvents and methods approved by solvent and pipe manufacturers.
2. Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty-four hours before placing the joint under water pressure, unless otherwise specified by the manufacturer. Cut all pipe with square ends and remove burrs, ridges and dirt. Check dry fit pipe and fitting. Clean pipe and fitting with purple primer and apply thin coat of cement to fitting with a liberal coat to pipe. Quickly push pipe fully into fitting using a ¼ turning motion. Hold pipe and fitting together a minimum of 30 seconds, wipe off excess with cloth.

C. Threaded Joints for PVC Pipe
1. Use Teflon tape on all threaded PVC fittings.
2. Use strap-style friction wrench only. Do not use metal-jawed wrench.

D. Laying of Pipe
1. Pipes shall be bedded in at least in at least two inches of finely divided material with no rocks or clods over one-inch diameter to provide a uniform bearing.
2. Pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
3. Do not lay PVC pipe when there is water in the trench.
4. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner to ensure that a square cut. Burrs at end cuts shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

5. All plastic-to-plastic joints will be solvent-weld joints or slip seal joints. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

3.5 PVC SLEEVES AND ELECTRICAL CONDUIT

A. Provide all sleeves indicated and as otherwise required for the successful completion of the irrigation system. Coordinate sleeving efforts with General Contractor and the Owner.

B. All PVC sleeves shall be a minimum of twice the diameter of pipe to be sleeved.

C. All PVC control wire conduit shall be of sufficient size to hold the required quantity of control and common wires. Electrical wires are not to be placed in the same trench with water pipes.

3.6 ISOLATION VALVES

A. Shall be located in the following locations:
   1. After backflow preventer and prior to main supply loop.
   2. Between main line and each quick coupler valve.
   3. As located on irrigation system drawings within lawn areas.

B. Install each isolation valve in an individual valve box with a six-inch (deep) layer of washed gravel below the bottom of the valve.

C. Seal threaded connections with Teflon tape.

3.7 IRRIGATION CONTROL VALVES

A. Coordinate location of all valve boxes with Landscape Architect. Do not proceed in uncertainty.

B. All irrigation control valves shall be installed with ductile iron service tees.

C. Install line size bronze gate valve on pressure side of each control valve. Locate in valve box with control valve.

D. Install each electric control valve in an individual valve box with a six-inch (6") (deep) layer of washed gravel below the bottom of the valve.

E. Seal threaded connections with Teflon tape.

F. Valves shall be installed as shown in details and in accordance with manufacturer's instructions and specifications.

3.8 QUICK COUPLING VALVES

A. Shall be set a minimum of twelve inches from walks, curbs, or paved areas where applicable or as otherwise noted. Quick coupling valves shall be housed in standard size valve boxes.

B. All quick coupler valves shall be installed on to ductile iron service tee.

C. Install one-inch bronze gate valve on pressure side of each quick coupler valve. Locate in valve box with quick coupler valve.

D. Valves shall be installed on a three-elbow PVC Schedule 80 swing joint assembly.

E. Provide six-inch (deep) layer of washed gravel below the bottom of the valve. Top of quick coupler valves shall be as close to the top of the valve box as possible. Top of gravel layer shall be three inches below the top of the valve.

F. Quick coupling valves shall be set perpendicular to finished grade unless otherwise designated on the plans.

G. Quick coupler locations are to be staked in the field by installer for approval by Landscape Architect prior to installation.

3.9 VALVE BOXES

A. Valve boxes shall be set flush with grade in lawn areas and one-half inch (1/2") above finish grade in ground cover and shrub bed areas.

B. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the valve box.

3.10 DRIP TUBING

A. Tubing is designed for use in surface and sub-surface applications utilizing a grid design, the result being a complete wetted area within the grid. It can also be installed as single or "snaked" lines where grids are not justified. The most uniform way to install tubing is sub-surface at a uniform depth as specified.

B. Tubing shall be staked down using 6" galvanized sod staples. Staples shall be spaced no further than 24" on center, but the contractor will place staples as closely as necessary to ensure that tubing will not work its way to the surface.

3.11 SPRAY HEADS AND TURF ROTORS

A. All sprinkler heads shall be pop-up type heads. Permanent shrub risers are not permitted.

B. All sprinkler heads within a zone shall have matched precipitation rates.

C. Install plumb to within 1/16", unless otherwise noted (see detail for heads on sloped areas on detail sheet). Top of collar (not nozzle) should be flush with finish grade.

D. Place part-circle pop-up sprinkler heads at least two inches and no more than six inches from edge of adjacent walks, curbs and mowing bands, or paved areas at time of installation.

E. Install pop-up sprinkler heads, and accessories in accordance with manufacturer's latest printed instructions, except as otherwise noted.

F. All sprinkler nozzles shall be adjusted for the proper radius and direction of spray pattern. Adjust where possible to prevent over spraying onto walks, pavement or buildings.

G. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw as required for proper radius.

H. Install pop-up spray heads with approved flexible thick wall polyethylene swing pipe with spiral barb fittings. Do not install to side inlet of sprinkler head.

I. Install pop-up mid-range turf rotors with approved flexible thick wall polyethylene swing pipe with spiral barb fittings.

J. Install pop-up long-range turf rotors with PVC unitized swing joints with one-piece riser assembly. Swing joints to be factory assembled with 360-degree O-ring seals as manufactured by Lasco. All connections to be threaded, no glued connections shall be allowed on the swing joints.

K. Polyethylene swing joints are not to be used to extend head more than eighteen inches from lateral.

L. Heads to be installed at the top of a slope shall be tilted toward the toe of the slope. They shall also be installed slightly down from the top edge of the slope to decrease wind drift.

M. Mid-slope sprinkler heads shall be installed at an angle halfway between vertical and perpendicular to the slope. For example, a 2:1 or 50% slope has an angle of 26 degrees, so tilt the heads 13 degrees into the slope from the perpendicular.

N. Heads installed at the toe of the slope shall be tilted slightly away from the slope to avoid driving water into the slope directly in front of the sprinkler.

O. Do not mix different types of heads within a zone.

3.12 CONTROLLER

A. Mount the controller flush with the mounting surface. Controller should be level with the surface of the floor or concrete mounting pad. Install controller with display at eye-level.

B. Mount the controller pedestal with the mounting hardware and template supplied.

C. The automatic controller shall be installed at the approximate location shown on the Drawings. (Suitable power supply will be supplied as part of other sections and Contract).

D. All local and other applicable codes shall take precedence in connecting the 110-volt electrical service to the controller.

E. Install per local code, manufacturer's latest printed instructions, and as detailed.

F. Valve control wires shall be numbered at the terminal strip.

3.13 CONTROLLER POWER SUPPLY

A. Power to the controller shall be supplied from a dedicated circuit (installed as part of work of other sections and Contract).

B. The Irrigation Contractor shall be responsible for all wiring and associated equipment to connect power supply to the controller.

C. All wiring is to be in accordance with local codes.

3.14 CONTROL WIRING

A. All electrical equipment and wiring shall comply with local and state codes and be installed by those skilled and licensed in the trade.

B. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines whenever possible and shall have a minimum of twelve inches cover.

C. Control wires shall be installed to the side of the main line whenever possible. Placement over pipes is not permitted.

D. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of twenty feet.

E. An expansion curl shall be provided within three feet of each wire connection and at least every one-hundred feet of wire length on runs of more than one hundred feet in length. Expansion curls shall be formed by wrapping at least five turns of wire around a one-inch diameter pipe, then withdrawing pipe.

F. Control wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than five hundred and they must be located in ten-inch round splice boxes that are green in color. The connector shall be 3M DBY splice kit by 3M Corporation, or accepted Substitute. Use one splice per connector sealing pack.

3.15 CLOSING OF PIPE AND FLUSHING OF LINES

A. All testing shall be done under the supervision of the Landscape Architect and Owner. Submit written requests for inspections to the Owner at least three days prior to the anticipated inspection date.
1. Thoroughly flush out all water lines under a full head of water before installing heads, valves, quick coupler assemblies, etc. Maintain flushing for a minimum of three minutes at the valve located furthest from water supply.
2. After flushing, cap or plug all openings to prevent entrance of materials that would obstruct the pipe or clog heads. Leave in place until removal is necessary for completion of installation.
3. Test as specified below.
4. Upon completion of testing complete assembly and adjust sprinklers for proper distribution.

3.16 TESTING

A. Make hydrostatic when welded PVC joints have cured as per manufacturer's instructions.
1. Pressurized mainlines:
(a) Completely install water meter, mains, isolation valves and control valves. Do not open laterals.
(b) Open all isolation valves.
(c) Fill all lines with water and shut off at meter.
(d) Test piping at hydraulic pressure of 70 PSIG for one-half hour. Maximum loss shall be five PSI. Locate pump at low point in line and apply pressure gradually.
(e) Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks.
(f) Leaks resulting from tests shall be repaired and tests repeated until the system passes.

B. Non-pressurized laterals:
(a) Test piping after laterals are installed and system is fully operational.

3.17 INSPECTIONS

A. The contractor shall maintain proper facilities and provide safe access for inspection to all parts of the work.

B. Irrigation inspection shall consist of a minimum of:
1. Mainline pressure test.
2. Coverage test.
3. Final irrigation inspection.

C. If the specifications, the Owner's and/or Landscape Architect's instructions, laws, ordinances or any public authority require any work to be tested or approved, the contractor shall give the Owner three days' notice of its readiness for inspection.

D. The contractor shall be solely responsible for notifying the Owner and Landscape Architect where and when such work is in readiness or testing.

E. If any work should be covered up without the approval of the Owner and Landscape Architect it must be uncovered, if required, for examination at the contractor's expense.

F. No inspection will commence without “Record” drawings and without completing previously corrections, or without preparing the system for inspection.

3.18 BACKFILLING AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches.
   1. Restore all surfaces to match adjacent surfaces. Meet grades flush. Create smooth blends and transitions.

B. Granular fill corresponding with Section Earthwork shall be placed initially on all lines with a minimum of three inches cover. No foreign matter larger than one-half inch in size shall be permitted in the initial backfill.
   1. Trenches located under paving shall be backfilled with Granular Fill corresponding with the requirements of Section Planting Soil System (three inches above the pipe) compacted in layers.
   2. Backfill in lawns and planting beds shall be planting soils corresponding with the requirements of Section Planting Soil System. Coordinate backfilling of planting soils with the Landscape Contractor. Care should be taken to restore the planting soil profile in accordance with the Contract Documents. Planting soils damaged during trenching shall be discarded. The Landscape Architect shall be the sole judge as to the suitability of the planting soils for reuse.
   3. Surplus subgrade and planting soils remaining after backfilling shall be legally disposed of off-site by the contractor.

3.19 CLEANING AND DISPOSAL OF WASTE MATERIAL

A. Perform clean up during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment as fast as it accumulates.

B. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

END OF SECTION

SECTION 32 91 00 - AMENDED-IN-PLACE SOILS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section applies to testing In situ and Stockpiled soils, and the manufacturing, and delivery of the amendment materials required per testing analysis results. Refer to Section 32 20 19 – Finish Grading for subgrade preparation, placement, and final grading.

B. Coordinate Work with that of other trades affecting or affected by Work of this Section and cooperate to assure the steady progress of Work.

1.02 SUMMARY

A. Section Includes:
   1. All labor, materials, equipment, and testing requirements necessary to furnish and mix the specified amendments to in situ and redistributed stockpiled soils as shown on the drawings and specified herein, including but not necessarily limited to the following:
      a. Perform required soil analysis test to existing:
         1) In situ soils.
         2) Stockpiled soils.
      b. Test, furnish, and deliver all organic amendment (compost) materials, and any other soil amendments for use in amending existing soils or as sections shown on the drawings.
      c. Construct the amended Soil System profiles using the specified materials and techniques as recommended by the Testing Agency reports contained herein and on the drawings.

B. Related Sections:
   1. Section 31 20 00 “Earth Moving” for subgrade and drainage preparation.
   2. Section 31 20 19 “Finish Grading” for finish grading preparation.
   3. Section 32 92 00 “Turf Grass and Sod” for seeding and sod preparation.
   4. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.03 REFERENCES STANDARDS

A. ASTM D3665 - Standard Practice for Random Sampling of Construction Materials; 2024.

B. NCR221 - Recommended Chemical Soil Test Procedures for the North Central Regions; 2015.

C. USCC STA - US Composting Council STA Requirements; 2025.

D. The following references are used herein and shall mean:
   1. SSSA: Soil Science of America, Methods of Soil Analysis, Part 1 & Part 3
   2. TMECC: Test Methods for the Examination of Composting and Compost
   3. USDA: United States Department of Agriculture
   4. USEPA: United States Environmental Protection Agency

E. Standard Specifications: Regional, State or Municipal Standard Specification Documentations for the location of proposed usage.

1.04 DEFINITIONS

A. Compost: An organic material that has been aerobically composted and stabilized from feedstocks such a green waste (yard debris), biosolids or other suitable organic materials.

B. Debris or Deleterious Materials: Elements including, but not limited to, concrete, concrete masonry, wood, excavated rock and rock fragments, rubble, overburden soils, abandoned utility structures, trash, refuse, and litter.

C. Finish Grade: Elevation of finished surface of a Soil System after specified compaction and natural settling.

D. Soil System: Exclusive to this technical spec section, a profile consisting of the native topsoil blended with an approved composted material.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation or backfill of soils or other materials immediately beneath transition mix or a planting mix or other Soil System.

1.05 SUBMITTALS

A. Refer to and comply with specifications for submittal procedures and criteria.

B. Product Data: Submit technical descriptive data for each manufactured or packaged product of this Section. Include manufacturer's product testing and analysis and installation instructions for manufactured or processed items and materials.
   1. Locations: Submit locations of material sources. Submit location of mixing site(s).

C. Certificates: Submit certified analysis for each chemical soil amendment and fertilizer material specified or recommended per test results. Include guaranteed analysis and weight for packaged materials.

D. In situ and Stockpiled Native Soil Test Submittals: Engage an independent testing agency to qualify existing soil conditions. The Contractor shall submit representative samples of existing soils materials to an agricultural soil testing laboratory acceptable to the Landscape Architect.
   1. All soil tests shall be performed in accordance with the current methods provided by ASTM, SSSA or USEPA, unless otherwise noted. All reports prepared by the testing laboratory shall be sent to the Landscape Architect for approval.
   2. Deficiencies in the soil, shall be corrected by the Contractor, as directed by the Landscape Architect after review of the testing agency report.
   3. Test reports shall include the following:
      a. Date issued.
      b. Project Title and names of Contractor and supplier.
      c. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field inspector or laboratory contact.
      d. Date, place, and time of sampling or test, with record of temperature and weather conditions.
      e. Location of material source.
   4. Submit test results meeting or exceeding the specified criteria for the following:
      a. In situ Soils
      b. Stockpiled Soils
      c. Composted Organic Component

E. Compost Submittals
   1. Report (s) of analyses from producers of composted organic materials are required. The compost shall be analyzed using the USCC STA test methods and reporting format, unless otherwise noted. Submit USCC STA Compost Technical Data Sheet for the delivered compost and dated within 9 months of delivery.
      a. Contact the testing laboratory to review testing and sampling requirements before sending samples.
   2. Composted organic amendments shall be accoriding to the South Carolina Department of Environmental Services, State Law / Legislation Code: Chapter 61-107.4, Website: https://des.sc.gov/
   3. Maintain clear and concise records of testing and sampling procedures.

F. Testing Agencies: The following firms are acceptable testing agencies for the various components.
   1. Physical analysis on in-situ soils (including stockpiled) to be determined by a Regional Accredited Lab:
      a. Spectrum Analytic, Washington Court House, OH 43160-8748, Ph:800-321-1562, Website: www.spectrumanalytic.com.
      b. Certified Local Agencies may be used pending approval by Landscape Architect.
   2. Changing testing laboratories during the mix development phase or for quality assurance testing must be authorized by the Landscape Architect.

G. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications of the selected testing agencies.

H. Submit samples of all listed materials to the Landscape Architect for approval:
   1. Compost, each source, 5 lb packaged.

I. Submit for approval at least two weeks prior to installation a written plan for mixing, transporting, storing, placing, and settling installed materials.

1.06 QUALITY ASSURANCE

A. Mix component (s) will not be accepted unless it meets the submittal, testing and certification requirements specified herein.

B. Inspections and Testing
   1. In situ and Stockpiled Native Soils and Compost testing required in this Section or additionally required by the Landscape Architect shall be furnished and paid for by Contractor.
   2. The Landscape Architect reserves the right to take and analyze at any time such additional samples of materials as deemed necessary for verification of conformance to specification requirements. Contractor shall furnish samples for this purpose upon request and shall perform testing as requested.
   3. Samples that do not meet the Specifications will require the Contractor to re-submit additional samples for testing. Costs for re-testing will be the responsibility of the Contractor.
   4. Observations and periodic testing will be made by the Owner or its designated representative on materials delivered to the site. Any soil mix that does not meet the requirements of the Specifications shall be removed or amended by the Contractor at no cost to the project.

C. Qualifications
   1. Testing Laboratory: Experienced person(s) employed by public or private testing laboratory, qualified and capable of performing tests, and issuing reports as specified. The Testing Laboratory shall submit a Statement of Qualifications regarding the specified testing. The Testing Laboratory shall be as approved by the Landscape Architect.
   2. It shall be the responsibility of the Contractor to see that the specifications are being adhered to. Failure of the Landscape Architect to immediately reject unsatisfactory workmanship or to notify the Contractor of his/her deviation from the specifications shall not relieve the Contractor of his/her responsibility to repair and/or replace unsatisfactory work.

D. Pre-Installation Conferences: Person(s) responsible for soil preparation and mixes of this Section shall attend Pre-Installation Conference(s) to coordinate with work of other sections.

1.07 PROJECT CONDITIONS

A. Should the Contractor, in the course of Work, find any discrepancies between Contract Drawings and physical conditions or any omissions or errors in Drawings, or in layout as furnished by the Owner, it will be Contractor's duty to inform the Construction Manager or General Contractor and Landscape Architect immediately in writing for clarification. Work done after such discovery, unless authorized by the Landscape Architect, shall be done at the Contractor's risk.

B. Sequencing and Scheduling: Adjust, relate together, and otherwise coordinate work of this Section with other Project work as contained in all other Sections of the Project Specifications.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials to the location where soils are to be mixed, in unopened bags or containers, each bearing the name, guarantee, and trademark or the producer, material composition, manufacturer’s certified analysis, and the weight or the material. Retain packages for the Landscape Architect.

B. Store and handle packaged materials in strict compliance with manufacturer’s instructions and recommendations. Protect all materials from weather, damage, and theft.

C. Amendment materials stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All temporary storage means, and methods shall be approved by the Landscape Architect.

D. Stockpiling:
   1. On-site and Certified Mixing Facility stockpiles should be restricted to no more than the needs of what can be used in a 72 hours period. Under no circumstances shall on-site or off-site stored material exceed 1000 cu yd
   2. Stockpiles should be no more than 6 ft in height to prevent anaerobic conditions within the pile. Stockpiled composts should be turned every other week (unless otherwise instructed by the Landscape Architect) to prevent excessive water absorption and anaerobic conditions. Storage areas for soil shall be constructed on well drained land, away from the stream.

PART 2 - PRODUCTS

2.01 GENERAL

A. Contractor is responsible for collecting, handling, and testing samples from:
   1. Existing In situ Soils shall be tested and amended in place.
      a. Provide amendment recommendations for Turf Grass areas.
   2. Existing Stockpiled Soil shall be tested, redistributed, and amended as required.
      a. Provide amendment recommendations for Turf Grass and Native Grass areas.

B. Mix components shall fulfill the requirements as specified and noted in the soil lab test results.

C. Notifications:
   1. Notify Landscape Architect 3 days prior to pulling field samples. Landscape Architect to be present and observe samples being taken.
   2. Notify General Soils Lab to inform them that samples will be forthcoming, and to indicate the quantity of samples being sent, the reason for the testing, anticipated testing parameters and turnaround timeframe needed. Follow Lab instructions regarding taking of samples, drying, and bagging process, labeling each sample, general notes, etc.

D. Where organic levels need to be higher per testing results, add and blend in 3 in of approved composted organic material for every 2 percent increase to the “in-situ" and placed stockpiled soil.

2.02 IN-FIELD TESTING OF IN SITU SOILS (NON-STOCKPILED)

A. Steps:
   1. Each In situ sample shall be a composite of several small core specimens as described below. Where conditions are relatively uniform, a minimum of two composite samples per acre will be required.
   2. Visually divide the areas into sections based on variables such as:
      a. Known or observed (variations in color/texture) soil types.
      b. Different topography.
      c. Observed or known past plant communities supported.
      d. Different past usage (crops, sports field, fill area, etc.).
      e. Obvious anomalies such as bare patches (to learn causes).
      f. Do not sample areas with known hazardous material (s) contamination.
         1) If the presence of hazardous material is not known but is suspected, do not sample without ascertaining that the area poses no hazard.
   3. Provide a Soils Sample Plan identifying each area with a designation number, identifying characteristics of the area, number of samples taken and average depth of cores.

B. Within each section:
   1. Dig or probe to determine the average depth of the existing topsoil layer. If this is neither feasible nor expeditious, use a default of 6 in.
   2. Use a random number generating technique such as those described in ASTM D3665 to determine the suitable frequency and horizontal distribution of core specimens required for each composite sample.
   3. Remove surface debris, stones, etc. from sample areas.
   4. Collect as many core specimens as determined appropriate for a given composite sample (avoiding anomalies) and place them in a sample bag or other suitably sized container.

a. Typically, 5 to 15 core specimens per composite sample. Or one random sample per every 500 ft apart.
b. Do not take an excessive number of core specimens when topsoil conditions are obviously uniform.
c. Take core specimens no deeper than the depth of the topsoil layer or approximately up to 6 in (a T-shaped metal hand probe works best, which would yield approximately a 1 in diameter core; an alternative is a hand shovel).

5. Thoroughly mix the composite sample.
6. Line a plastic quart container with a clear plastic bag and place enough of this composite sample to completely fill the bag-lined container.
7. If testing of anomalies is desired, collect core specimens where the anomalies occur and keep them separate from the section composite sample(s). For each anomaly, collect enough soil to completely fill a standard bag-lined container as above.
8. Seal each container's plastic bag with the twist-tie.
9. Seal all containers, including the bagged samples.
10. Log all sample information into an Excel sheet. Include any "Remarks" as appropriate to indicate testing parameters (chose only from among those available - typically pH, organic matter (OM), texture and if needed, Nitrogen, Phosphorous and/or Potassium ("NPK") content).
11. Print and affix a label identifying the sample to the outside of the container. Keep careful track of sampling locations and label samples in a logical, meaningful manner.
12. Deliver or send all samples to the approved General Soils Lab unless approval in writing to deliver the samples to an alternate location has been obtained from the Landscape Architect.

2.03 IN-FIELD TESTING OF STOCKPILED SOILS

A. Stockpile/Salvaged soil to be tested prior to acceptance. Amend to soil test recommendations.

B. Sampling Procedures for Stockpiles:

Topsoil Stockpile Vol. (CY)	Min. Num. of Samples Req'd.
Up to 500	One
Over 500 to 1000	Two
Over 1000 to 2000	Three
Over 2000 to 3000	Four
Over 3000 to 4000	Five
Over 4000 to 8000	Six

C. Steps
1. A stockpile will be visually divided into approximately equal sections, based on the number of samples to be taken. For example, a stockpile that requires three samples will be visually divided in thirds.
2. Within each section, the Contractor/Supplier shall:
   a. Remove all frozen material prior to sampling.
   b. Using a sufficiently sized front-end loader, grade the topsoil from top to bottom to create a continuous slope. The material should not collapse and/or segregate.
   c. Fill the bucket of the front-end loader by channeling the slope, beginning 1 ft from the bottom, and continuing to the top of the slope in one operation.

d. Transport the sample to the sampling location, lower the bucket to the ground level and slowly empty it by rotating the bucket to form a small pile.

3. Collect a sample from each small pile formed by Step 2 by following these steps:
   a. Divide the small pile visually into four equal quadrants.
   b. From the middle third of each quadrant, obtain a small shovelful of material.
   c. Place the four shovelfuls together in one approved granular materials sample bag or a container of sufficient size for thorough mixing.
   d. Mix thoroughly.
   e. Line a plastic quart container with a clear plastic bag and place enough of this topsoil mixture to completely fill the bag-lined container.
   f. Seal the plastic bag with a twist-tie.
   g. Seal the containers, including the bagged samples.
   h. Log all sample information into an Excel sheet. Include any “Remarks” as appropriate to indicate testing parameters (chose only from among those available - typically pH, organic matter (OM), texture and if needed, Nitrogen, Phosphorous and/or Potassium (“NPK”) content).
   i. Print and affix a label identifying the sample to the outside of the container.

2.04 COMPOSTED ORGANIC COMPONENT

A. Organic Component :
   1. Compost Component Testing submittal results, per the Quality Assurance requirements shall meet the following characteristics:
      a. The compost shall have a man-made foreign material (hard plastics, metal, glass, etc.) content less than 1.5 percent as material retained on a U.S. Std.No.5 (0.16 in) sieve (TMECC 03.06)
      b. The compost shall be screened such that a minimum of 90 percent passes a U.S. Std. 3/4 in sieve and that no more than 10 percent passes a U.S. Std. No.10 sieve on a dry weight basis.
      c. The compost shall have a pH of 5.5 to 8.5 using USCC STA testing
      d. Compost shall have a soluble salts content, per USCC STA, of less than 6.0 dS/m 6.0 dS/m.
      e. Compost shall have an organic matter content, per USCC STA, of not less than 30 percent by dry weight.
      f. The compost shall have a carbon to nitrogen (C:N) ratio less than 36:1.
      g. The compost shall have a Solvita® Maturity Index between 6 and 7.
      h. The compost shall be tested for nitrate nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper, boron, and sodium using the SME-DTPA extraction method NCR221NCR221.
         1) The heavy metal content as determined by TMECC 04.06 shall not exceed the following limits:

Element	Concentration Limits (mg/Kg d.w.)
Arsenic	41
Cadmium	39
Chromium	1200
Copper	1500
Lead	300
Mercury	17

Molybdenum	50
Nickel	420
Selenium	36
Zinc	2800

(a) The compost shall meet all applicable state regulations based on the feedstock type.
(b) All compost testing shall be done in conformance with the U.S. Compost Council's publication Test Methods for the Examination of Composting and Compost (TMECC) unless otherwise specified above.

2.05 ORGANIC SOIL AMENDMENTS

A. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
   1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

C. Water: Potable

2.06 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
   2. Provide lime in form of ground dolomitic limestone.

B. Perlite: Horticultural perlite, soil amendment grade.

C. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

D. Peat Humus: Finely divided or granular texture with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat..

2.07 FERTILIZERS:

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. 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 soil reports from a qualified soil-testing laboratory.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

A. Section 31 22 19 – Finish Grading applies.
   1. Refer to 3.05 Amending In Situ and Redistirbuted Stockpiled Soil Article, paragraphs A and B for "Assumed" Baseline Bid Quantities when soil testing has not been completed prior to bidding submittals.

END OF SECTION

SECTION 32 91 20 - ORGANIC PLANTING SOIL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Manufactured soil mix in this section shall hereafter be referred to as Organic Planting Soil or OPS Mix.

B. This Section applies only to the manufacturing and delivery of the planting soil mix to the site. Refer to Section 32 20 19 – Finish Grading for subgrade preparation, placement, and final grading.

1.02 SUMMARY

A. Section Includes:
   1. All labor, materials, equipment, and testing requirements necessary to provide and mix soil components, as specified herein, including but not necessarily limited to the following:
      a. Construct the specified Organic Planting Soil profile using the specified materials and techniques as contained herein,.
         1) Tested and approved Imported or ‘Off the shelf’ products from authorized soil manufacturing facilities or suppliers will be permitted.
   2. Certified Local Testing Agencies may be used pending approval by Landscape Architect.

B. Related Sections:
   1. Section 31 20 00 “Earth Moving” for subgrade and drainage preparation.
   2. Section 31 20 19 “Finish Grading” for finish grading preparation.
   3. Section 32 92 00 “Turf Grass and Sod” for seeding and sod preparation.
   4. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.03 REFERENCES AND STANDARDS

A. ASTM D2974 - Standard Test Methods for Determining the Water (Moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils; 2020.

B. ASTM D5286 - Standard Test Methods for Determination of Transfer Efficiency Under General Production Conditions for Spray Application of Paints; 2020.

C. ASTM D6913/D6913M - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis; 2017 (Reapproved 2025).

D. ASTM F1815 - Standard Test Methods for Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones; 2018.

E. NCR221 - Recommended Chemical Soil Test Procedures for the North Central Regions; 2015.

F. USCC STA - US Composting Council STA Requirements; 2025.

G. The following references are used herein and shall mean:
   1. SSSA: Soil Science of America, Methods of Soil Analysis, Part 1 & Part 3
   2. TMECC: Test Methods for the Examination of Composting and Compost
   3. USCC: STA Requirements for Compost Manufacturers

4. USDA: United States Department of Agriculture
5. USEPA: United States Environmental Protection Agency

H. Standard Specifications: Regional, State or Municipal Standard Specification Documentations for the location of proposed usage.

1.04 DEFINITIONS

A. Compost: An organic material that has been aerobically composted and stabilized from feedstocks such a green waste (yard debris), biosolids or other suitable organic materials.

B. Debris or Deleterious Materials: Elements including, but not limited to, concrete, concrete masonry, wood, excavated rock and rock fragments, rubble, overburden soils, abandoned utility structures, trash, refuse and litter.

C. Soil: A mineral soil from the A Horizon or B Horizon of a well-drained site and having a USDA soil texture classification of a Clay or Clay Loam and an organic matter content of not greater than 3 percent by weight as specified below.

D. Soil System: Exclusive to this technical specification section, a profile consisting of the native topsoil blended with an approved composted material.

1.05 SUBMITTALS

A. Refer to and comply with specifications for submittal procedures and criteria.

B. Product Data: Submit technical descriptive data for each manufactured or packaged product of this Section. Include manufacturer's product testing and analysis and installation instructions for manufactured or processed items and materials.
1. Locations: Submit locations of material sources and suppliers.

C. Soil System Components and Soil Mix Suppliers
1. Soil mix suppliers shall have a minimum of 5 yearsof experience at supplying “Manufactured” type soils.
2. Submit supplier name, address, email, telephone, and fax numbers and contact name.
3. Submit certification that accepted supplier can provide enough materials and mixes for the entire project and within the limitations of the Project Schedule.

D. Certificates: Submit certified analysis for each chemical soil amendment and fertilizer material specified (specimen label) and as used (product label). Including guaranteed analysis and weight for packaged materials.

E. Soil System Testing Submittals: Engage an independent testing agency to qualify the Organic Planting Soil (OPS) components and specified final planting mixes. The Contractor shall submit representative samples of all component materials intended to be used to make the specified mix and/or mixes to an agricultural soil testing laboratory.
1. All soil tests shall be performed in accordance with the current methods provided by ASTM, SSSA or USEPA, unless otherwise noted. All reports prepared by the testing laboratory shall be sent to the Landscape Architect for approval.
2. After reviewing the Testing Agency report and as directed by the Landscape Architect, deficiencies in the sand, organic materials, mix components or final soil mix are to be corrected by the Contractor.
3. Test result submittals for each Soil Component shall include the following:

a. Date issued.
b. Project Title and names of Contractor and supplier.
c. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field inspector or laboratory contact.
d. Date, place, and time of sampling or test, with record of temperature and weather conditions.
e. Location of material source.

F. Compost Component Testing Submittals
1. Report (s) of analyses from producers of composted organic materials are required. The compost shall be analyzed using the USCC STA test methods and reporting format, unless otherwise noted. Submit USCC STA Compost Technical Data Sheet for the delivered compost and dated within 9 months of delivery
a. Contact the testing laboratory to review testing and sampling requirements before sending samples.
2. Composted organic amendments shall be accoriding to the South Carolina Department of Environmental Services, State Law / Legislation Code: Chapter 61-107.4, Website: https://des.sc.gov/
3. Maintain clear and concise records of testing and sampling procedures.

G. Submit test results meeting or exceeding the specified criteria for the following:
1. Processed Soil Component
2. Composted Organic Component
3. OPS Mix

H. Testing Agencies: The following firms are acceptable testing agencies for the various components.
1. Physical analysis on each soil component and soil mix to be determined by a Regional Accredited Lab:
a. Certified Local Agencies may be used pending approval by Landscape Architect.
2. Changing testing laboratories during the mix development phase or for quality assurance testing must be authorized by the Landscape Architect.

I. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications of the selected testing agencies.

J. Submit samples of all listed materials to the Landscape Architect for approval:
1. Soil Component, 2 lb to 4 lb, packaged.
2. Composted Organic Matter: 2 lb to 4 lb, packaged.
3. Mix, 2 lb to 4 lb, packaged.

K. Submit for approval at least two weeks prior to installation a written plan for mixing, transporting, and storing materials.

1.06 QUALITY ASSURANCE

A. The OPS mix is comprised of approved soil, additional organic amendment, and other soil amendment materials, as determined by the testing laboratory. Soil System Components of the OPS mix will not be accepted unless they meet the submittal, testing and certification requirements specified herein.

B. Inspections and Testing

1. Soil System MIx and Component testing required in this Section or additionally required by the Landscape Architect shall be furnished and paid for by Contractor.
2. The Landscape Architect reserves the right to take and analyze additional samples of materials as deemed necessary for verification of conformance to specification requirements.
3. Samples of individual components to the OPS mix shall be submitted by the Contractor for testing and analysis to the approved testing laboratory.
    a. OPS Mix Components and Soil System Mix samples that do not meet the Specifications will require the Contractor to re-submit additional samples for testing. Costs for re-testing will be the responsibility of the Contractor.
        1) When OPS mix samples do not meet specification, make the needed adjustments per the test result recommendations. Retest each new OPS mix sample, resubmit tests reports indicating amendment changes until soil specifications have been achieved.
        2) OPS soil components shall not be used until test reports from the approved testing laboratory have been received and approved by the Landscape Architect.
4. Observations and periodic testing will be made by the Owner or its designated representative on materials delivered to the site. OPS mix not meeting the requirements of the Specifications shall be removed or amended by the Contractor at no cost to the project.

C. Qualifications:
1. Testing Laboratory: Experienced person (s) employed by public or private testing laboratory, qualified and capable of performing tests, making soil recommendations, and issuing reports as specified. The Testing Laboratory shall submit a Statement of Qualifications regarding the specified testing. The Testing Laboratory shall be as approved by the Landscape Architect.
2. It shall be the responsibility of the Contractor to see that the specifications are being adhered to. Failure of the Landscape Architect to immediately reject unsatisfactory workmanship or to notify the Contractor of his/her deviation from the specifications shall not relieve the Contractor of his/her responsibility to repair and/or replace unsatisfactory work.

D. Pre-Installation Conferences: Person(s) responsible for soil preparation and mixes of this Section shall attend Pre-Installation Conference(s) to coordinate with work of other sections.

1.07 PROJECT CONDITIONS

A. Investigate the conditions of site and public thoroughfares and roads as to availability, clearances, loads, limits, restrictions, and other limitations affecting transportation to, ingress and egress of this work site. Conform to all governmental regulations regarding the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary.

B. Environmental Requirements for Soils, Soil Components and Soil System Mixes:
1. Perform both off-site mixing and on-site soil work only during suitable weather conditions. Do not work or place soil when frozen, excessively wet, or dry, or in otherwise unsatisfactory condition.
2. Soil Mixes shall not be handled, hauled, or transported during rain or wet weather.

3. When stockpiling is permitted, the Contractor shall install silt fence around the perimeter of the stockpile area and maintain the silt fence until the stockpile is removed. Soil Mix shall be kept in neat and separate piles from other excavated material.

C. Sequencing and Scheduling: Adjust, relate together and otherwise coordinate work of this Section with other Project work as contained in all other Sections of the Project Specifications.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials to the location where soils are to be mixed, in unopened bags or containers, each bearing the name, guarantee, and trademark or the producer, material composition, manufacturer's certified analysis, and the weight or the material. Retain packages for the Landscape Architect.

B. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, and theft.

C. Soil mixes or amendment materials stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All temporary storage means, and methods shall be approved by the Landscape Architect.

D. After mixing, cover the soil mix with a tarpaulin until time of actual use and protected from contamination, excessive rainfall, excess water entering the site or erosion.

E. Stockpiling
1. On-site and Certified Mixing Facility stockpiles should be restricted to no more than the needs of what can be used in a 72 hrperiod. Under no circumstances shall on-site or off-site stored material exceed 500 cu yd.
2. Stockpiles should be no more than 6 ft in height to prevent anaerobic conditions within the pile. Stockpiled composts should be turned every other week (unless otherwise instructed by the Landscape Architect) to prevent anaerobic conditions excessive water absorption and anaerobic conditions. Storage areas for topsoil, soil components or planting system mixes shall be constructed on well drained land, away from the stream.

PART 2 - PRODUCTS

2.01 GENERAL

A. Site salvaged topsoil will not be permitted for use as an OPS "Soil System Mix" component.

2.02 OPS MIX – COMPONENTS

A. Soil Component
1. A clean, loamy, friable mineral soil free from heavy or stiff clay lumps (3/4'' max dia.), stones, cinders, concrete, brick, roots, sticks brush, litter, plastics, metals, refuse or other deleterious materials in accordance with ASTM D5286.
2. The soil shall be free of herbicides, petroleum-based materials, manures, or other substances of a hazardous or toxic nature which may inhibit plant growth.
3. The soil shall be free of noxious weeds, seeds or vegetative parts of weedy plants that cannot be selectively controlled in the planting.
4. The soil shall be from the A Horizon or B Horizon of a well-drained site and have the following USDA soil texture classification and particle size distribution:

South Carolina Soils (Sand - Hilton Head)

U.S.D.A. Particle Name	Size (mm)	Allowable Limit
Gravel	2.00 - 4.75	0.00%
Sand	0.05 - 2.00	90 - 98%
Silt	0.002 -- 0.05	1 - 5%
Clay	minus 0.002	1 - 5%
pH Range		5.5 - 7.0

5. Perform the following tests and submit test reports showing the following criteria are met:
   a. The Soil Characteristics and particle size analysis shall be performed and compared to the USDA Soil Classification System per ASTM D6913/D6913M (hydrometer test). The USDA sand and gravel classifications shall be determined on material retained on the #270 sieve following a wet washing procedure..
   b. The pH shall be as defined above per NCR221.
   c. The soluble salts shall be less than 1.5 mmoh/cm per NCR221.
   d. The organic matter content shall be ASTM D2974 - Method C:
      1) Organic Matter: 3 percent to 6 percent
   e. Certified test results of bulk topsoil stored by certified suppliers must be within the last 12 months from the date of bid opening.
   f. Deleterious materials shall be determined by ASTM D5286.
   g. Saturated hydraulic conductivity shall be determined by ASTM F1815.
   h. Cation Exchange Capacity (CEC) per NCR221 using the ammonium acetate method for the soil classification specified..
   i. Agronomic Soil analysis reports to provide recommendations for soil additives, including organic and inorganic soil amendments, necessary to accomplish mix objectives for each of the follo.
   j. Analysis for nutrient levels in parts per millions or pound per acre including Nitrate Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Iron, Manganese, Zinc, Copper, Boron and Sodium as Exchangeable Sodium Percentage (ESP) per NCR221.

B. Composted Organic Component
   1. Organic Component – Non-proprietary Requirements:
      a. Compost Component Testing submittal results, per the Quality Assurance requirements shall meet the following characteristics:
         1) The compost shall be a homogeneous material essentially free of soil clods, lumps, roots, and stones.
         2) The compost shall have a man-made foreign material (hard plastics, metal, glass, etc.) content less than 1.5 percent as material retained on a U.S. Std.No.5 (0.16 in) sieve (TMECC 03.06)
         3) The compost shall be screened such that a minimum of 90 percent passes a U.S.Std. 3/4 in sieve and that no more than 10 percent passes a U.S. Std. No. 10 sieve on a dry weight basis.
         4) The compost shall have a pH of 5.5 to 8.5 using USCC STA testing.
         5) Compost shall have a soluble salts content, per USCC STA, of less than 6.0 dS/m 6.0 dS/m.

6) The compost shall have an organic matter content of not less than 35 percent by weight determined by ASTM D2974 Method C on material passing a U.S. Std. 1/4 in sieve.
7) The compost shall have a carbon to nitrogen (C:N) ratio less than 36:1.
8) The compost shall have a Solvita® Maturity Index between 6 and 7.
9) The compost shall have a moisture content of 35 percent to 65 percent.
10) The compost shall have a dry bulk density of 0.17 to 0.35 grams per cubic centimeter (g/cc).
11) The compost shall be tested for nitrate nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper, boron, and sodium using the SME-DTPA extraction method NCR221.
12) The heavy metal content as determined by TMECC 04.06 shall not exceed the following limits:

Element	Concentration Limits (mg/Kg d.w.)
Cadmium	39
Chromium	1200
Copper	1500
Lead	300
Mercury	17
Molybdenum	50
Nickel	420
Selenium	36
Zinc	2800

13) The compost shall meet all applicable state regulations based on the feedstock type.
    (a) All compost testing shall be done in conformance with the U.S. Compost Council's publication Test Methods for the Examination of Composting and Compost (TMECC) unless otherwise specified above.

2.03 ORGANIC SOIL AMENDMENTS

A. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
    1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

C. Water: Potable

2.04 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
    1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

2. Provide lime in form of ground dolomitic limestone.

B. Perlite: Horticultural perlite, soil amendment grade.

C. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

D. Peat Humus: Finely divided or granular texture with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat..

2.05 FERTILIZERS:

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. 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 soil reports from a qualified soil-testing laboratory.

2.06 ORGANIC PLANTING SOIL MIX (OPS):

A. Base for Design - Planting Mix by Daly Organics - Hardeeville, S.C.

B. OPS “Soil System” Mix – Non-proprietary Requirements:
1. For the purpose of bidding, the OPS Mix shall substantially conform to a mix of 4 parts of the approved Soil and 1 part (vol./vol.) of the approved Compost. The actual Soil:Compost ratio will be determined by the soil physical testing laboratory to meet the following required performance specification:
   a. Organic Matter Range: 4 percent to 8 percent
   b. pH Level: 5.5 percent to 7.0 percent
2. The controlling factor will be the percent (%) organic matter by weight specified for OPS mix. Note that the intended volume ratios of the Organic Amendment (compost) components will be, in large part, determined by the organic matter content of the compost.
3. Uniformly mix components using a mechanical soil blender designed for such purpose.
   a. Perform initial tests to confirm compliance with the OPS mixes organic matter content specifications.
   b. Follow the OPS System Mix recommendations provided by the soil testing laboratory to achieve the target organic matter content for OPS soil. These test results, when approved, will establish the standard to which all other test results must conform.
   c. Provide one sample test from each 500 cu yd of manufactured material using the testing as noted above.
4. Mixing of soil and compost: Add compost as recommended by the testing laboratory to achieve the specified organic matter content for the OPS mix. Other amendments shall not be added to OPS mix unless approved by the Landscape Architect and additional tests have been conducted to verify type and quantity of amendment.

C. Adequate quantities of OPS mix shall be provided to attain all design finish grades after compaction at greater than between 80 to 85 percent Proctor. Verify quantities for placement as specified to suit site conditions.

D. After OPS mix has been placed and where organic levels need to be higher for key areas, add and blend in 3 in of approved composted organic material for every 2 percent increase to the “in-place” OPS mix.

PART 3 - EXECUTION

3.01 GENERAL

A. Section 31 22 19 – Finish Grading applies.

END OF SECTION

SECTION 32 91 50 - CU STRUCTURAL SOIL®

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. The work of this section consists of all Structural Soil work and related items as indicated on the drawings or as specified herein and includes, but is not limited to, the following:
   1. CU-Soil™ is a proprietary material patented by Cornell University (US Patent #5,849,069) and marketed under the registered trademark, CU-Structural Soil®. Only licensed companies are authorized to produce this material, meeting the specifications described in this text. For a list of licensed CU-Soil™ producers, call AMEREQ, INC. at 800-832-8788.

1.02 REFERENCE STANDARDS

A. AASHTO T 99 - Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop; 2022.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

C. ASTM D1883 - Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils; 2021.

D. ASTM D4226 - Standard Test Methods for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products; 2025.

E. The following references are used herein and shall mean:
   1. USDA: United States Department of Agriculture
   2. Standard Specifications: Regional or Municipal Standard Specifications Documentation for the location of proposed usage
   3. AOAC: Association of Official Agricultural Chemists

1.03 SAMPLES AND SUBMITTALS

A. At least 30 days prior to ordering materials, the installing contractor shall submit to the engineer representative samples, certificates, manufacturer’s literature, and test results for materials specified below. No materials shall be ordered until the required samples, certificates, manufacturer’s literature, producer’s current license and test results have been reviewed and approved by the landscape architect and/or engineer. The engineer reserves the right to reject any material that does not meet CU-Structural Soil® specifications. Delivered materials shall closely match the approved samples.

B. Submit from licensed producer, one cubic foot representative sample of CU-Structural Soil® mix for approval. In the event of multiple source fields for clay loam, submit a minimum of one set of samples per source field or stockpile. The samples of all clay loam, crushed stone, and CU-Structural Soil® shall be submitted to the engineer as a record of the soil color and texture.

C. Submit soil test analysis reports for sample of clay loam from an independent soil-testing laboratory. The testing laboratory for particle size and chemical analysis may include a public agricultural extension service agency.

1. Submit a mechanical analysis of the clay loam sample and particle size analysis including the following gradient of mineral content:

USDA Description	Size in mm
Gravel	+ 2 mm
Sand	0.05 - 2 mm
Silt	0.002 - 0.05 mm
Clay	minus 0.002 mm

   a. Sieve analysis shall be performed and compared to USDA Soil Classification System.
   b. Sieve analysis shall be done by a combined hydrometer and wet sieving using sodium hexametaphosphate as a dispersant in compliance with ASTM D4226 after destruction of organic matter by hydrogen peroxide.
2. Submit a chemical analysis, performed in accordance with current AOAC Standards, including the following:
   a. pH and buffer pH.
   b. Percent organic matter as determined by the loss of ignition of oven dried samples. Test samples shall be oven dried to a constant weight at a temperature of 230 degrees Fahrenheit, plus or minus 9 degrees.
   c. Analysis for nutrient levels by parts per million.
   d. Soluble salt by electrical conductivity of a 1:2 soil/water sample measured in Millimho per cm.
   e. Cation Exchange Capacity (CEC).
   f. Carbon/Nitrogen Ratio.

D. Provide particle size analysis of crushed stone which will be used in production of CU-Soil™:

USAD Designation	Size in mm
3"	+76 mm
2 1/2"	63 - 76 mm
2"	50 - 63 mm
1 1/2"	37 - 50 mm
1"	25 - 37 mm
3/4"	19 - 25 mm
Fine Gravel	2 - 19 mm

1. Provide the manufacturers analysis of the loose and rodded unit weight.
2. Losses from LA Abrasion tests- not to exceed 40%
3. Minimum 90% with 2 or more fractured faces
4. Percent pore space analysis

E. At the engineer’s discretion, the sample of CU-Structural Soil® may be tested for the following:
   1. Compaction in accordance with ASTM D698/AASHTO T 99
   2. California Bearing Ratio in accordance with ASTM D1883- soaked CBR shall equal or exceed a value of 50.
   3. Measured dry-weight percentage of stone in the mixture.

F. The approved CU-Structural Soil® sample shall be the standard.

G. Any deviation from the specified crushed stone and clay loam specifications shall be approved by Amereq, Inc.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivered CU-Structural Soil® shall be at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D698) and should not be placed in frozen, wet or muddy sites.

B. Protect CU-Structural Soil® from exposure to excess water and from erosion. Do not store CU-Soil™ unprotected. Do not allow excess water to enter site prior to compaction. If water is introduced into the CU-Soil™ after grading, allow water to drain to optimum compaction moisture content.

1.05 EXAMINATION OF CONDITIONS

A. All areas to receive CU-Structural Soil® shall be inspected by the installing contractor before starting work and all defects such as incorrect grading, compaction, and inadequate drainage shall be reported to the engineer prior to beginning this work.

1.06 QUALITY ASSURANCE

A. Qualifications of installing contractor: The work of this section should be performed by a contracting firm which has a minimum of five years' experience. Proof of this experience shall be submitted as per paragraph, SAMPLES and SUBMITTALS, of this section.

PART 2 - MATERIALS

2.01 CLAY LOAM

A. Soil shall be a "loam" with a minimum clay content of 20 percent or a "clay loam" based on the "USDA classification system" as determined by mechanical analysis (ASTM D4226) and it shall be of uniform composition, without admixture of subsoil. It shall be free of stones, lumps, plants and their roots, debris and other extraneous matter. It shall not contain toxic substances harmful to plant growth. Clay loam shall contain not less than 2 percent or more than 5 percent organic matter as determined by the loss on ignition of oven-dried samples. Test samples shall be oven-dried to a constant weight at a temperature of 230 degree F, plus or minus 9 degrees.

B. Mechanical analysis for the loam or clay loam shall be as follows:

Textural Class	% of Total Weight
Gravel	less than 5%
Sand	20 - 45%
Silt	20 - 50%
Clay	20 - 40%

C. Chemical analysis: Meet, or be amended to meet the following criteria:
1. pH between 5.5 to 6.5
2. Percent organic matter 2% - 5% by dry weight
3. Adequate nutrient levels
4. Soluble salt less than 1.0 mmho/cm
5. Cation Exchange Capacity (CEC) greater than 10
6. Carbon/Nitrogen ratio less than 33:1

D. Loam or clay loam shall not come from USDA - classified prime farmland.

2.02 FERTILIZER (IF NEEDED)

A. Should nutrient analysis suggest that the loam or clay loam need additional nutrients, it shall be amended by Amereq's licensed producer.

2.03 SULFUR (IF NEEDED)

A. Sulfur shall be a commercial granular, 96 percent pure sulfur, with material and analysis appearing on the labeled container.

B. Sulfur used to lower pH shall be a ferrous sulfate formulation.

C. Application rates shall be dependent on soil test results.

2.04 LIME (IF NEEDED)

A. Agricultural lime containing a minimum of 85 percent carbonates.

B. Application rates shall be dependent on soil test results.

2.05 CRUSHED STONE

A. The size of the crushed stone shall be 3/4 in to 1 1/2 inallowing for 5 to 10 percent being greater than 1 1/2 in, and 5 to 10 percent less than 3/4 in.

B. Acceptable aggregate dimensions will not exceed 2.5:1.0 for any two dimensions.

C. Minimum 90 percent with two or more fractured faces.

D. Results of Aggregate Soundness Loss test shall not exceed 18 percent.

E. Losses from LA Abrasion tests shall not exceed 40 percent.

2.06 HYDROGEL

A. Hydrogel shall be a coated potassium propenoate-propenamide copolymer (Gelscape® Hydrogel Tackifier) as manufactured by Amereq, Inc. 800-832-8788.

2.07 WATER

A. The installation contractor shall be responsible to furnish his own supply of water (if needed) free of impurities, to the site.

2.08 CU-STRUCTURAL SOIL®

A. A uniformly blended urban tree mixture of crushed stone, clay loam and Gelscape® Hydrogel Tackifier, as produced by an Amereq-licensed company, mixed in the following proportion:

Material	**Unit of Weight**
Specified Crushed Stone	100 units dry weight
Specified Clay Loam	20 - 25 units (to achieve min. 50 CBR)
Gelscape® Hydrogel Tackifier	0.035 units dry weight
Moisture	ASTM D698 / AASHTO T 99 optimum moisture

PART 3 - EXECUTION: PRODUCTION AND INSTALLATION GUIDELINES

3.01 CU-SOIL™ MIXING AND QUALITY CONTROL TESTING

A. All CU-Structural Soil® mixing shall be performed at the licensed producer's yard using appropriate soil measuring, mixing, and shredding equipment of sufficient capacity and capability to assure proper quality control and consistent mix ratios. No mixing of CU-Structural Soil® at the project site shall be permitted.
   1. Maintain adequate moisture content during the mixing process. Soils and mix components shall easily shred and break down without clumping. Soil clods shall easily break down into a fine crumbly texture. Soil shall not be overly wet or dry. The licensed producer shall measure and monitor the amount of soil moisture at the mixing site periodically during the mixing process.

B. Raw materials shall be mixed off-site, only at the licensed producer's facility, on a flat asphalt or concrete paved surface to avoid soil contamination.

C. Should the independent laboratory test results of the clay loam reveal a need to amend it, to meet specifications, the amending materials should be added to the clay loam following the rates and recommendations provided by Amereq.

3.02 UNDERGROUND UTILITIES AND SUBSURFACE CONDITIONS

A. The installing contractor shall notify the engineer of any subsurface conditions which will affect the contractor's ability to install the CU-Soil™.

B. The installation contractor shall locate and confirm the location of all underground utility lines and structures prior to the start of any excavation.

C. The installing contractor shall repair any underground utilities or foundations damaged during the progress of this work.

3.03 SITE PREPARATION

A. Do not proceed with the installation of the CU-Structural Soil® material until all walls, curb footings and utility work in the area have been installed. For site elements dependent on CU-Structural Soil® for foundation support, postpone installation of such elements until immediately after the installation of CU-Structural Soil®.

B. Install subsurface drain lines as shown on the plan drawings prior to installation of CU-Structural Soil® material.

C. Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the drawings. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.

D. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

E. Clear the excavation of all construction debris, trash, rubble, and any foreign material. If fuels, oils, concrete washout silts or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Fill any over excavation with approved fill and compact to the required subgrade compaction.

F. Do not proceed with the installation of CU-Structural Soil® until all utility work in the area has been installed. All subsurface drainage systems shall be operational prior to installation of CU-Structural Soil®.

G. Protect adjacent walls, walks and utilities from damage. Use 1/2 in plywood and/or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
   1. 1. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.
   2. 2. Any damage to the paving or architectural work caused by the installation contractor shall be repaired, as directed by the engineer.

H. Maintain all silt and sediment control devices required by applicable regulations. Provide adequate methods to assure that trucks and other equipment do not track soil from the site onto adjacent property and the public right of way.

3.04 INSTALLATION OF CU-STRUCTURAL SOIL® MATERIAL

A. Install CU-Structural Soil® in 6-inch lifts and compact each lift.

B. Compact all materials to at least 95 percent Proctor Density from a standard compaction curve AASHTO T 99 (ASTM D 6ASTM D698). No compaction shall occur when moisture content exceeds maximum as listed herein. Delay compaction if moisture content exceeds maximum allowable and protect CU-Structural Soil® during delays in compaction with plastic or plywood as directed by the engineer.

C. Bring CU-Structural Soil® to finished grades as shown on the drawings. Immediately protect the CU-Structural Soil® from contamination by toxic materials, trash, debris, water containing cement, clay, silt, or materials that will alter the particle size distribution of the mix with plastic or plywood as directed by the engineer.

D. The engineer may periodically check the material being delivered, prior to installation for color and texture consistency with the approved sample provided by the installing contractor as part of the submittal for CU-Structural Soil®. If the engineer determines that the delivered CU-Soil™ varies significantly from the approved samples, the engineer shall contact the licensed producer.

E. Engineer shall ensure that the delivered structural soil was produced by the approved CU-Soil™ licensee by inspecting weight tickets showing source of material.

F. CU-Soil™ should not be stockpiled long-term. Any CU-Soil™ not installed immediately should be protected by a tarp or other waterproof covering.

3.05 FINE GRADING

A. After the initial placement and rough grading of the CU-Structural Soil® but prior to the start of fine grading, the installing contractor shall request review of the rough grading by the engineer. The installation contractor shall set sufficient grade stakes for checking the finished grades.

B. Adjust the finish grades to meet field conditions as directed.

C. Provide smooth transitions between slopes of different gradients and direction.

D. Fill all dips with CU-Soil™ and remove any bumps in the overall plane of the slope.

1. The tolerance for dips and bumps in CU-Structural Soil® areas shall be a 3 inx deviation from the plane in 10 ft.
2. All fine grading shall be inspected and approved by the engineer prior to the installation of other items to be placed on the CU-Structural Soil®.

E. The engineer will inspect the work upon the request of the installing contractor. Requests for inspection shall be received by the engineer at least 10 days before the anticipated date of inspection.

3.06 ACCEPTANCE STANDARDS

A. The engineer will inspect the work upon the request of the installing contractor. Requests for inspection shall be received by the engineer at least 10 days before the anticipated date of inspection.

3.07 CLEAN-UP

A. Upon completion of the CU-Structural Soil® installation operations, clean areas within the contract limits. Remove all excess fills, soils and mix stockpiles and legally dispose of all waste materials, trash, and debris. Remove all tools and equipment and provide a clean, clear site. Sweep, do not wash, all paving and other exposed surfaces of dirt and mud until the paving has been installed over the CU-Structural Soil® material. Do no washing until finished materials covering CU-Structural Soil® material are in place.

END OF SECTION

SECTION 32 92 00 - TURF GRASS AND SOD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Hydroseeding.
   3. Sodding.
   4. Maintenance

B. Related Requirements:
   1. Section 31 20 19 “Finish Grading” for finish grading preparation.
   2. Section 32 84 00 “Planting Irrigation”.
   3. Section 32 91 20 - Planting Prep and Soils for soil preparation.

1.02 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Backfill: Soil material or controlled low-strength material used to fill an excavation.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. Soil preparations vary. See Sections 32 91 00 through 32 91 20 – Planting Prep and Soils for soil preparation and drawing designations for planting soils.

G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site prior to beginning seedbed preparations. Construction Manager, Owner and Landscape Architect should be notified at least one week prior to the intended meeting date.

1.04 INFORMATIONAL SUBMITTALS

A. Copy of valid license or authorization certificate from the grower confirming permission to cultivate and distribute Celebration® Bermudagrass.

1. Certified Sod Material: Provide only state-certified sod grown from a certified turfgrass farm licensed by the patent/trademark owner (Sod Solutions, Inc.).

B. Certificate of Genetic Purity: Each shipment must be accompanied by an official State Crop Improvement Association certificate or standard blue certification tag verifying the varietal purity of Celebration® Bermudagrass (Cynodon dactylon)

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before "Substantial Completion" acceptance.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
   1. Experience: Five years' experience in turf installation.
   2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   3. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Lawn Care Manager.
      c. Landscape Industry Certified Lawn Care Technician.
   4. Pesticide Applicator: State licensed, commercial.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.
   1. Source Control: Sourcing from unlicensed producers or substituting generic "Bermudagrass" or unauthorized hybrids will result in immediate rejection of the material.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Accompany each delivery of bulk materials with appropriate certificates.

1.08 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion Insert starting time.
   1. Optimal Window: Late Spring - May to June
   2. Acceptable Windows:

a. Mid-Summer - July to August (requires frequent watering)
b. August 15 - October 15 (must be fully rooted before the first season frost or prior to soil temperature reaching 55 - 60 degree F).

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

C. Work notification: Notify the Landscape Architect at least seven working days before installation of lawn materials.

D. Verify location and extent of underground utilities. Protect existing utilities, irrigation, paving and other facilities from damage caused by lawn work operations.

E. Perform lawn work only after planting and other work affecting ground surface has been completed.

F. Restrict traffic from lawn areas until grass is established. Erect temporary signs and barriers as required by the Landscape Architect.

G. Locate, protect and maintain newly installed irrigation system during lawn work operations. Repair irrigation system components, damaged during lawn work operations, at Contractor's expense.

H. Provide necessary hose and watering equipment as required for lawn maintenance.

PART 2 - PRODUCTS

2.01 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
2. Quality, Non-State Certified: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed.

C. Turfgrass Seed Species: Common Burmuda.

2.02 TURFGRASS SOD

A. Turfgrass Sod: Distinct deep blue-green color, high stolon density, structural integrity capable of supporting a 2-foot lift without tearing, and a minimum of 99% varietal purity. Sods must be completely free of noxious weeds, Poa annua, and off-type grasses.
1. Species: Celebration® Bermudagrass "Certified Sod" distributed by Licensed Producers.
a. Contractor to source material exclusively from Sod Solutions - authorized and licensed turfgrass farms.

2.03 PRE-PLANT AMENDMENTS AND FERTILIZERS (BEFORE/AT INSTALLATION)

A. Soil pH Correctors: Agricultural limestone or elemental sulfur as determined by the pre-installation soil report to achieve an optimal pH between 6.0 and 7.0.

B. Pre-Plant Starter Fertilizer: High-phosphorus and high-potassium starter formulation to accelerate deep lateral root anchoring.
   1. Active Green/Growing Sod (Spring/Summer): Complete analysis N-P-K formulation such as 18-24-12.
   2. Dormant Sod (Late Fall/Winter): Low-nitrogen formulation such as 5-10-30 to protect dormant tissues while feeding roots.

2.04 POST-INSTALLATION AND ESTABLISHMENT FERTILIZERS (WEEKS 2 TO 6)

A. Initial Rooting Feed: Fast-acting macro-nutrient liquid or granular formula applied at Day 14–21 to push rapid canopy coverage.

B. Sustained Density Feed (Week 4+): Slow-release, high-nitrogen complete turf fertilizer (e.g., 16-4-8 or 24-0-11 ratios).

C. Iron Supplementation: Foliar or granular iron (Chelated Iron or Iron Sulfate) to prompt Celebration’s characteristic blue-green aesthetic.

2.05 MULCHES

A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.06 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.02 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

3.03 TURF AREA PREPARATION

A. Subgrade Prep: Clear all active weeds, grade to smooth uniform finish, and rototill top 4 inches.

B. General: Prepare planting area for soil placement, mix planting soil and finish grades according to Sections 32 91 00 – through 32 91 20 Planting Preparation specifications.

C. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade
1. Reduce elevation of planting soil to allow for soil thickness of sod.

D. Pre-Plant Fertilizer Application Rate:
1. Apply starter fertilizer evenly over the prepared bed right before laying sod.
2. Application Rate: 0.5 to 1.0 lb of actual Phosphorus (P) per 1,000 sq. ft. (Example: Apply 18-24-12 at a rate of 4.1 lbs of total product per 1,000 sq. ft.).

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 APPLICATION OF FERTILIZER

A. Pre-Plant Fertilizer Application Rate:
1. Apply starter fertilizer evenly over the prepared bed right before laying sod.
2. Application Rate: 0.5 to 1.0 lb of actual Phosphorus (P) per 1,000 sq. ft. (Example: Apply 18-24-12 at a rate of 4.1 lbs of total product per 1,000 sq. ft.).

B. Mixing with planting soil:
1. Fertilizer and conditioners shall be spread over the entire lawn areas at the application rates indicated above.

3.05 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
   1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   2. Do not use wet seed or seed that is moldy or otherwise damaged.
   3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 2 to 3 lbs./ sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

3.06 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer Insert type, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
   1. Mix slurry with nonasphaltic tackifier.
   2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre Insert values dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
   3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre

3.07 SODDING

A. Harvest, deliver, store, and lay sod within 12 hours of harvesting unless a suitable preservation method is accepted by Landscape Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

D. No heavy equipment to be allowed on the amended soil during installation of sod. All equipment for sodding and maintenance should be either track type or utilize high flotation turf type tires

3.08 POST-INSTALLATION FERTILIZATION AND ESTABLISHMENT TIMELINE

A. Phase I (Days 1 to 14): Do NOT apply heavy granular nitrogen during the first two weeks. Focus entirely on overhead watering.

B. Phase II (Days 15 to 21 - First Post-Fertilizer): Once roots begin tacking into the subgrade, apply a secondary nitrogen boost to advance uniform density.
   1. Application Rate: 0.5 lbs of actual Nitrogen per 1,000 sq. ft. using a quick-release source like ammonium sulfate. Water in with 0.25 inches of water immediately.

C. Phase III (Week 4 to Week 6 - Secondary Post-Fertilizer):Application Rate: Apply a complete slow-release fertilizer at a rate of 1.0 lb of actual Nitrogen per 1,000 sq. ft. (Example: Apply 16-4-8 at a rate of 6.25 lbs of product per 1,000 sq. ft.).

3.09 TURF MAINTENANCE - ESTABLISHMENT PERIOD

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
   1. Sodded Turf: 45 days from date of planting completion

B. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
   3. Treat infestation of weeds or crabgrass by hand weeding or herbicidal control. Furnish and install weed chemical control as recommended by manufacturer. Herbicidal controls, including renovation before seeding or sodding operations, shall be acceptable to the Landscape Architect.

C. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
   1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
   2. Watering Schedule by Week:
      a. Days 1 to 14 (Daily Watering): Apply 0.25 to 0.5 inches every morning. Run a second short misting cycle in the early afternoon if the sun is very hot and the grass looks dry.
      b. Days 15 to 28 (Tapering Off): Cut back to 2 or 3 waterings per week, giving about 0.5 inches each time. This forces the roots to grow deeper into the soil to find moisture.
      c. Week 5 and Beyond (Normal Routine): Water 1 to 2 times per week, providing about 1 inch of water total for the week. Water deeply and less often to build a strong lawn.

D. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
   1. Mow bermudagrass to a height of 1/2 to 1.5 inch.

3.10 WEED CONTROL RESTRICTIONS DURING ESTABLISHMENT PERIOD

A. Pre-Emergent Restriction: Do NOT apply any pre-emergent chemical barriers (e.g., prodiamine or dithiopyr) directly to the subgrade or onto the sod during the first 6 weeks of establishment, as this chemically halts crucial root splitting and tacking.

B. Post-Emergent Restriction: Avoid post-emergent broadleaf herbicides until the Celebration® sod has successfully transitioned through at least 3 to 4 mowing cycles.

3.11 ACCEPTANCE CRITERIA / SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:
   1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding
   2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

C. Conditions: Established turf that is free of dead or dying patches and shows vigorous growth of foliage of normal density, size, and color.

3.12 SUBSTANTIAL COMPLETION / FINAL ACCEPTANCE

A. Substantial Completion: Upon the completion of the Planting Installation and Establishment Period the Contractor's work shall be considered Substantially Complete.
   1. The Contractor is to request an initial site review with Owner and Landscape Architect. Contractor shall prepare and submit a comprehensive written punch list of items to be completed.
   2. Comprehensive list to be submitted 7 days prior to the initial site walk review.
   3. Any additional items noted during the walk-through by the Owner or Landscape Architect to be added to the punch list and addressed within 30 days of the initial site visit.
   4. Maintain all turf grass items and areas during the Punch List review and corrective phase until Final Acceptance is provided by the Landscape Architect.

B. Final Acceptance: The date of final acceptance shall be when the Landscape Architect verifies that all the items on the punch list have been completed and / or corrected by the Contractor and the Establishment Period maintenance period has expired.

3.13 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

3.14 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
   1. Sodded Turf: Minimum 30 days from date of installation until Substantial Completion and acceptance of project.

END OF SECTION

SECTION 32 93 00 - PLANTS AND LANDSCAPE ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plants including trees, shrubs, groundcovers, perennials, and bulbs.
   2. Tree stabilization.
   3. Tree-watering devices.
   4. Maintenance of all specified plants prior to substantial completion.
   5. Plant Warranty
   6. Maintenance "By Contractor" of all specified plants during warranty period.

B. Related Requirements:
   1. Section 31 22 19 “Finish Grading” for finish grading preparation.
   2. Section 32 91 20 - Planting Prep and Soils for soil preparation.
   3. Section 32 92 00 "Turf Grass and Sod" for sodding turf (lawn) type grasses.

1.02 REFERENCES

A. ANSI A300 Part 6 - Tree, Shrub, and Other Woody Plant Management--Standard Practices (Planting and Transplanting); 2012 (Reapproved 2018).

B. ANSI Z60.2 - American Standard for Nursery Stock; 2025.

C. Federal, State and local laws and regulations governing this Work are hereby incorporated into and made part of this Section. When this Section calls for certain materials, workmanship, or a level of construction that exceeds the level of Federal, State, or local requirements, provisions of this Section take precedence.

D. American Nursery & Landscape Association (ANLA).

1.03 DEFINITIONS

A. Acceptance, Acceptable, or Accepted: Acceptance by the Landscape Architect in writing.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation.

C. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than sizes indicated; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the trunk flare / root crown visible at the surface of the ball as recommended by ANSI Z60.2.

D. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.2. for type and size of plant required.

F. Debris or Deleterious Materials: Elements including, but not limited to, concrete, concrete masonry, wood, excavated rock and rock fragments, rubble, overburden soils, abandoned utility structures, trash, refuse and litter.

G. End of Warranty Final Acceptance: The date when the Landscape Architect accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrent with each other.

H. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.2 for type and size of plant.

I. Finish Grade: Elevation of finished surface of planting soil.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

K. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted.

M. Plant Spread: Measurement of main body diameter, not measurement from branch tip to branch tip.

N. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. Soil preparations vary. See Sections 32 91 00 through 32 91 40 – Planting Prep and Soils for soil preparation and drawing designations for planting soils.
   1. Planting Soil Mix: A sand/soil/compost material produced off-site by homogeneously blending topsoil and sand with compost to produce the specified planting mix type.
   2. “Planting Soil Mix” and “Planting Soil” are interchangeable terms used throughout this specification.

O. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

P. Root Flare (root collar, trunk flare, root crown): The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots, the area of transition between the root system and the stem or trunk.

Q. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

R. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

S. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

T. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Landscape Architect accepts that all work in these sections is complete, and the Warranty period (aka “Contractor’s Warranty Period”) has begun. This date may be different than the date of substantial completion for the other sections of the project.

U. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.04 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
   2. Plant Photographs: Include color photographs, two (2) minimum per species, in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than twenty (20) plants are required, include a minimum of three (3) photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
   3. Tree Selection Approvals:
      a. Acceptable trees will meet the following health and structure requirements: single dominate leader, branching and root structure appropriate for species, caliper size or height per plans, pest, and disease free, damage free and other ANSI requirements. Acceptable trees will also meet the following aesthetic requirements straight trunk, symmetry, uniformity and fullness of branching, general form, and overall uniformity of all trees of a species. No trees shall be delivered to the site without documentation.

B. Samples for Verification: For each of the following:
   1. Organic Mulch: 1-pint volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
   2. Proprietary Root-Ball-Stabilization Device: One unit.
   3. Slow-Release, Tree-Watering Device: One unit of each size required.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis of standard products.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Close out submittals: Submit to the Landscape Architect for approval.
   1. Plant maintenance data, requirements and recommended maintenance schedules and procedures for Owner to establish during the Warranty Period.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Meet requirements of applicable laws, codes, and regulations required by authorities having jurisdiction over the Work.
   2. Provide for inspections and permits required by federal, state, and local authorities in furnishing, transporting, and installing materials.

B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
   1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or the American Nursery and Landscape Association.
   2. Experience: Three years' experience in landscape installation.
   3. Submit reference list of at least five completed representative projects indicating project name, address, telephone number, contract amount, Landscape Architect’s, and Facilities Manager's name.
   4. Landscape Contractors submitting bids shall be pre-qualified before award of contract. Each reference shall be contacted to verify workmanship and general business practices.
   5. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   6. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
      a. Landscape Industry Certified Exterior Technician
      b. Landscape Industry Certified Horticulture Technician
      c. Landscape Industry Certified Lawn Care Technician
   7. Pesticide Applicator: State licensed, commercial.

C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.2.

D. Measurements: Measure according to ANSI Z60.2. Do not prune to obtain required sizes.
   1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 in above the root flare for trees up to 4 in caliper size, and 12 in above the root flare for larger sizes.
   2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

E. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
   1. Notify Landscape Architect of sources of planting materials 7 days in advance of delivery to site.

F. Plant Quantity Verification: All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities and shall immediately inform the Landscape Architect of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Landscape Architect.
   1. In the case of a discrepancy in the plant quantities between the plan drawings and the plant call outs, list or plant schedule, the number of plants or square footage of the planting bed drawn on the plan drawings shall be deemed correct and prevail.

G. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

F. Handling Plants:
   1. Handle ball and burlap plants by root ball.
   2. Pad trunk and branches where hoisting cables or straps contact.
   3. Handle container plants by containers, not by tops, stems or trunks.
   4. Do not bind or handle plants with wire or rope.

G. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
   1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   2. Do not remove container-grown stock from containers before time of planting.
   3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.09 FIELD CONDITIONS

A. Work notification: Notify the Landscape Architect at least seven working days before installation of plant material.

B. All trees must be evaluated and approved by the Landscape Architect prior to planting.

C. Verify location and extent of underground utilities. Protect existing utilities, paving and other facilities from damage caused by landscaping operations.

D. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

E. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
   1. Do not proceed with interruption of services or utilities without Landscape Architect’s written permission.

F. Install plant materials during time periods indicated. Planting operations conducted at other times only at option and full responsibility of Contractor and without additional compensation, except as otherwise acceptable to the Landscape Architect. Do not plant in frozen ground.

G. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
   1. Spring Planting: March 1 to June 1.
   2. Fall Planting: September 1 to Nov. 15.

H. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

I. Coordination with Turf Areas: Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.10 ACCEPTANCE FOR SUBSTANTIAL COMPLETION

A. Substantial Completion Acceptance - Acceptance of the work prior to the start of the warranty period:
   1. Once the Contractor completes the installation of all items in this section, the Landscape Architect will observe all work for Substantial Completion Acceptance upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of the observation.
   2. Substantial Completion Acceptance by the Landscape Architect shall be for general conformance to specified size, character and quality and not relieve the Contractor of responsibility for full conformance to the contract documents, including correct species.
   3. Any plants that are deemed defective as defined under the provisions below shall not be accepted.

B. The Landscape Architect will provide the Contractor with written acknowledgment of the date of Substantial Completion Acceptance and the beginning of the warranty period and plant maintenance period (if plant maintenance is included).

C. Acceptance in Part:
   1. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
   2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

1.11 WARRANTY

A. Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
         1) Inspection Reports and Maintenance Logs per “Closeout Submittals” apply.
      b. Structural failures including plantings blowing over.
      c. Faulty performance of tree stabilization.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Periods: From date of Substantial Completion unless noted otherwise.
      a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months .
      b. Ground Covers, Perennials, and Other Plants: 12 months.
      c. Annuals: 3 months.
   3. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.
   4. Include the following remedial actions as a minimum:
      a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
      b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

c. A limit of one replacement of each plant is required, except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

B. End of Warranty Final Acceptance - Acceptance of plants at the end of the warranty period.
1. At the end of the warranty period, the Landscape Architect shall observe all warranted work, upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date for final observation.
2. End of Warranty Final Acceptance will be given only when all the requirements of the work under this specification and in specification sections Planting Soil and Irrigation have been met.

PART 2 - PRODUCTS

2.01 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, sizes, grades, and ball or container sizes and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.2; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
1. Growing Practices: Nursery grown in accordance with best horticultural industry practices.
2. Nomenclature: Plant nomenclature shall meet requirements of ICBN and ICNCP.
3. Climatic Growing Conditions: Grown under climatic conditions (same USDA hardiness zone) of the like those of the project and within 150 miles of the project site for at least 2 years unless otherwise accepted by Landscape Architect.
4. Container Growth Limitations: Container stock shall have been grown in the containers in which delivered for at least 6 months, but not over 2 years.
5. Specimen Quality: Structurally strong, able to stand upright without stakes or guys, exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number or branches, compactness, and symmetry.
6. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 in in diameter; or with stem girdling roots will be rejected.
7. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
8. Pruning: Do not prune, thin, or shape plants before delivery without acceptance by the Landscape Architect.

B. Substitutions: Accepted substitute plants shall be true to species and variety and shall meet requirements of this Section except those plants larger than specified may be used, if accepted in writing by the Landscape Architect. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.2 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

1. Substitutions will only be accepted up to 60 days post bid submittal. Contractor is responsible to identify availability of materials and inform Landscape Architect of any stock shortages prior to the 60 days post bid submittal deadline.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.2 . Root flare shall be visible before planting.

D. Labeling: Label each plant for each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

F. No tree wrap is to be used.

2.02 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.2 for type of trees required.
   1. Provide balled and burlapped or container-grown trees.
   2. Branching Height: One-third to one-half of tree height.
   3. Street Trees: Street trees must be limbed to 8 ft minimum.
   4. Forked Trunks on trees are not acceptable; each tree must have one string central leader.

B. Small Upright and Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.2 stem form as follows:
   1. Stem Form: Single stem.
   2. Multi-Stem: Unless noted otherwise, tree shall have 3 - 5 trunks forked at or above root flair collar. Overall height determines size of tree.
   3. Provide balled and burlapped trees.
   4. Forked Trunks on trees are not acceptable; each tree must have one string central leader.

2.03 SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.2 for type, shape, and height of shrub.
   1. Provide balled and burlapped or container-grown shrubs.

2.04 GROUND COVER / PERENNIAL / ANNUAL PLANTS

A. Ground Covers / Perennials: Provide ground cover of species indicated, established and well rooted in pots or similar containers and complying with ANSI Z60.2. Sections 1 and 13 apply.

B. Annuals: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

2.05 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: Shredded hardwood
   2. Size Range: 3 in max, 1/2 in min
   3. Processed: Double
   4. Color: Natural.

2.06 FERTILIZERS

A. Fertilizer amendments for specified soil mixes apply. Refer to project specification 32 91 20.

B. Fertilizer for Maintenance
   1. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
      a. Composition: (high phosphorus, low nitrogen ratio)

2.07 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.08 TREE-STABILIZATION MATERIALS

A. Below Grade - Root-Ball Stabilization Materials:
   1. Proprietary at or below-grade stabilization systems to secure each new planting by root ball and that do not encircle the trunk; sized according to manufacturer's written recommendations unless otherwise indicated.
      a. Arbor Stake System: 99.9% biodegradable wooden stake with lock caps.
         1) Basis of Design Product -Stone Source: Arbor Stakes, LLC, Ph: 214-810-6678, Website: arborstakes.com

2.09 TREE-WATERING DEVICES

A. Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period ; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

2.10 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

C. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D448 for Size No. 8

D. Planter Filter Fabric: Woven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

2.11 SOURCE QUALITY CONTROL

A. Advanced Tree Procurement:
   1. Within 60 days of award of contract, notify Landscape Architect in writing of the availability or lack thereof the specified plant material.
   2. Procure trees and arrange for contract growing as required to ensure that plant material is available in the quantities, sizes, and quality specified at the time of installation.
   3. Verify plant branching requirements with Landscape Architect prior to contract growing.
   4. Landscape Architect will review advance-procured trees prior to initial purchase at the place of growth.
   5. Coordinate and schedule a review by the Landscape Architect of advanced procured plant material at the place of growth prior to delivery to the project site.
   6. Review and acceptance of the advance-procured plant material at the place of growth does not preclude rejection at the project site if damage or unacceptable conditions are found that were not detected at the place of growth.
   7. Before changes or substitutions can be considered due to unavailability of plant material, the contractor shall submit written evidence that he has advertised for at least a one-month period in a trade journal such as the "Landscape Materials Information Service", with no response, or has undertaken other methods of locating plant material acceptable to the Landscape Architect.

B. Plant Material Review and Tagging:
   1. Trees will be reviewed, photographed, and tagged using irremovable tags by the Contractor at the place of growth prior to delivery to the project site.
   2. Tagging of plant material at the place of growth does not preclude rejection of at the project site if damage or unacceptable conditions are found that were not detected at the place of growth or in submitted photographs.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
   3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   4. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   5. Uniformly moisten excessively dry soil that is not workable, or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

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

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Use every possible precaution to prevent excessive compaction of planting area soil within or adjacent to the areas of Work.

C. Do not store materials or equipment or operate or park vehicles under the drip line of existing or newly planted trees. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees. Outline planting bed area edges.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.03 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to the requirements of Planting Soil Mixes, Sections 32 91 00 through 32 91 20.

B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade .

C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.
   1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
   2. Refer to soil plans and planting details for specified tree ball excavation widths and planting soil depths.
   3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected overnight.

B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6 in diameter holes, 24 in apart, into free-draining strata or to a depth of 10 ft, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

3.05 TREE, SHRUB, AND VINE PLANTING

A. General: Install plant material in accordance with detailed drawings and recommendations of ANLA.

B. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

C. Root Pruning:
1. If stem girdling roots are encountered at root ball sides, notify the Landscape Architect for field review.
2. Upon Landscape Architect’s acceptance, remove stem girdling roots and kinked roots by cutting cleanly; do not break. Cut roots on 4 sides of root ball 90 degree to root ball.

D. Root Ball Scarification:
1. After removing plant from container, scarify side of root ball to prevent root-bound condition.
2. Loosen root ball soil surface to depth of 1/8 in to 1/4 in without damaging roots or breaking root ball.

E. Balled and Burlapped Stock: Set each plant plumb and in center of planting bed or trench with root flare 2 in above adjacent finish grades.
1. Backfill: Planting soil . For trees, use excavated soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove upper 1/3 burlap (ANSI A300 Part 6), rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. Container-Grown Stock and Perennials in Containers: Set each plant plumb and in center of planting bed or trench.
   1. Container Stock greater than 1 gal container, place root flare 1 in to 2 in above finish grade.
   2. Perennials or plant stock in 1 gal and less containers, place top of root ball 1 in above finish grade.
   3. Backfill: Planting soil {CH#50673}. For trees, use excavated soil for backfill.
   4. Carefully remove root ball from container without damaging root ball or plant.
   5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
   6. Continue backfilling process. Water again after placing and tamping final layer of soil.

G. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.06 GROUND COVER AND PLANT PLANTING

A. Set out and space in even rows ground cover and plants, other than trees, shrubs, and vines, as indicated on the Planting Plan drawings. Spacing and layout may vary pending species and sizes of plant material specifi

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.07 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Landscape Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.08 TREE STABILIZATION

A. Proprietary Root-ball Stabilization: Install stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
   1. Proprietary Tree Root Ball Stabilization System: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.
      a. Arbor Stake Installation:
         1) Install specified quantity of stakes vertically through root ball mass (minimum 3, soil conditions vary, and upon approval of landscape architect, quantity of stakes may be increased when minimum penetration depth cannot be achieved).
         2) Spacing, or Angular distance between stakes shall not exceed 120 degree and shall be equally proportionate to the quantity of stakes specified.
         3) Lateral distance shall not be less-than 6 in from the trunk, root flare, or outer edge of root mass.
         4) Do not drive stake completely flush with root mass. Maintain stake position to a minimum amount of 1.5 in to 2 in for lock installation (below)
         5) Remove excessive splintered and/or mushroomed material from top of stake.
      b. Locks
         1) Place (1) lock on each stake.
            (a) Lock shall be oriented perpendicular to the trunk, root flare, and outer edge of root mass.
            (b) Ensure placement does not restrict performance of irrigation emitters and/or components.
            (c) Ensure neck / collar placement as to minimize gaps and/or distorted relationship between components.
            (d) Remove excess stake material keeping 1 in minimum +/- above the lock.

3.09 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 2 in average thickness, with 12 in radius around trunks or stems. Do not place mulch within 3 in of trunks or stems.
   2. Organic Mulch in Planting Areas: Apply 2 in average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 in of trunks or stems.

3.10 INSTALLING SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.12 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
   1. Submit details of proposed pruning and repairs.
   2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
   3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size as those being replaced for each tree.
   2. Species of Replacement Trees: Same species being replaced

3.13 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.14 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and decide if the work is substantially complete.
   1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.

B. The date of substantial completion of the planting shall be the date when the Landscape Architect accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. The Plant Warranty period begins at date of written notification of substantial completion from the Landscape Architect. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.15 PLANT MAINTENANCE PRIOR TO SUBSTANTIAL COMPLETION ACCEPTANCE

A. Maintenance during the period prior to Substantial Completion Acceptance shall consist of the following:
   1. Pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting, and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices, when possible, to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.16 MAINTENANCE DURING THE WARRANTY PERIOD (BY THE PLANT INSTALLER)

A. During the warranty period, provide all maintenance for all plantings to keep the plants in a healthy state and the planting areas clean and neat.

B. General requirements:
   1. All work shall be undertaken by trained planting crews under the supervision of a foreman with a minimum of 5 years experience supervising commercial plant maintenance crews.
   2. All chemical and fertilizer applications shall be made by licensed applicators for the type of chemicals to be used. All work and chemical use shall comply with all applicable local, provincial and federal requirements.
   3. Assure that hoses and watering equipment and other maintenance equipment does not block paths or be placed in a manner that may create tripping hazards. Use standard safety warning barriers and other procedures to always maintain the site in a safe manner for visitors.
   4. All workers shall wear required safety equipment and apparel appropriate for the tasks being undertaken.
   5. The Contractor shall not store maintenance equipment at the site at times when they are not in use unless authorized in writing by the Landscape Architect.
   6. Maintenance vehicles shall not park on the site including walks and lawn areas at any time without the Landscape Architect’s written permission.
   7. Maintain a detailed log of all maintenance activities including types of tasks, date of task, types and quantities of materials and products used, watering times and amounts, and number of each crew. Periodically review the logs with the Landscape Architect and submit a copy of the logs at the end of each year of the maintenance agreement.

8. Meet with the Landscape Architect a minimum of three times a year to review the progress and discuss any changes that are needed in the maintenance program. At the end of the warranty period attend a hand over meeting to formally transfer the responsibilities of maintenance to the Landscape Architect. Provide all information on past maintenance activities and provide a list of critical tasks that will be needed over the next 12 months. Provide all maintenance logs and soil test data. Make the Contractor's supervisor available for a minimum of one year after the end of the warranty period to answer questions about past maintenance.

C. Provide the following maintenance tasks:
   1. Watering: Provide all water required to keep soil within and around the root balls at optimum moisture content for plant growth.
      a. Maintain all watering systems and equipment and keep them operational.
      b. Monitor soil moisture to provide sufficient water. Check soil moisture and root ball moisture with a soil moisture meter on a regular basis and record moisture readings. Do not over water.
   2. Soil nutrient levels: Take a minimum of 4 soil samples from around the site in the spring and fall and have them tested by an accredited agricultural soil testing lab for chemical composition of plant required nutrients, pH, salt and % organic matter. Test results shall include laboratory recommendations for nutrient applications. Apply fertilizers at rates recommended by the soil test.
      a. Make any other soil test and/or plant tissue test that may be indicated by plant conditions that may not be related to soil nutrient levels such as soil contaminated by other chemicals or lack of chemical uptake by the plant.
   3. Plant pruning: Remove cross over branching, shorten or remove developing co dominant leaders, dead wood, and winter-damaged branches. Unless directed by the Landscape Architect, do not shear plants, or make heading cuts.
   4. Restore plants: Reset any plants that have settled or are leaning as soon as the condition is noticed.
   5. Guying and staking: Maintain plant guys in a taught position. Remove tree guys and staking after the first full growing season unless directed by Landscape Architect.
   6. Weed control: Keep all beds free of weeds. Hand-remove all weeds and any plants that do not appear on the planting plan. Chemical weed control is permitted only with the approval of the Landscape Architect. Schedule weeding as needed but not less 12 times per growing season.
   7. Trash removal: Remove all trash and debris from all planting beds and maintain the beds in a neat and tidy appearance. The number of trash and debris removal visits shall be no less than 12 times per year and may coincide with other maintenance visits.
   8. Plant pest control: Maintain disease, insects, and other pests at manageable levels. Manageable levels shall be defined as damage to plants that may be noticeable to a professional but not to the average person. Use least invasive methods to control plant disease and insect outbreaks.
      a. The Landscape Architect must approve in advance the use of all chemical pesticide applications.
   9. Plant replacement: Replace all plants that are defective as defined in the warranty provisions as soon as the plant decline is obvious and in suitable weather and season for planting as outlined in above sections. Plants that become defective during the maintenance period shall be covered and replaced under the warranty provisions.

10. Mulch: Refresh mulch once a year to maintain complete coverage but do not over mulch. At no time shall the overall mulch thickness be greater than 3 in. Do not apply mulch within 6 in of the trunks or stems of any plants. Replacement mulch shall meet the requirements of the original approved material. Mulch shall be no more than one inch on top of the root ball surface.
11. Bed edging: Check and maintain edges between mulch and lawn areas in smooth neat lines as originally shown on the drawings.
12. Leaf, fruit, and other plant debris removal: Remove fall leaf, spent flowers, fruit and plant part accumulations from beds and paved surfaces. Maintain all surface water drains free of debris. Debris removal shall be undertaken at each visit to weed or pick up trash in beds.
13. Damage from site use: Repair of damage by site visitors and events, beyond normal wear, are not part of this maintenance. The Landscape Architect may request that the Contractor repair damage beds or plantings for an additional cost. All additional work shall be approved in advance by the Landscape Architect.

3.17 END OF WARRANTY FINAL ACCEPTANCE / MAINTENANCE OBSERVATION

A. At the end of the Warranty and Maintenance period the Landscape Architect shall observe the work and establish that all provisions of the contract are complete, and the work is satisfactory.
   1. If the work is satisfactory, the maintenance period will end on the date of the final observation.
   2. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Landscape Architect.

B. FAILURE TO PASS OBSERVATION: If the work fails to pass final observation, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owners Representative.

END OF SECTION

SECTION 33 41 00 – STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Refer to Section 718, Section 719 and supplemental SC-M-714 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Refer to Section 718, Section 719 and supplemental SC-M-714 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

PART 3 - EXECUTION

A. Refer to Section 718, Section 719 and supplemental SC-M-714 of “South Carolina Department of Transportation 2025 Standard Specifications for Highway Construction”.

END OF SECTION

SECTION 33 42 00 – WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers materials and construction of a water distribution system.

PART 2 - PRODUCTS

2.01 GENERAL

A. All design criteria, materials, and construction shall be in accordance with DHEC regulations, AWWA and ASTM standards.

B. Unless otherwise noted or approved by the Hilton Head all materials shall be manufactured in the United States.

C. All material or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components - Health Effects. The certifying party shall be accredited by the American National Standards Institute.

D. Materials Standards - Pipe, fittings, packing, jointing materials, valves, and fire hydrants shall conform to Section C of the American Water Works Association (AWWA) Standards. All materials or products which come into contact with drinking water shall be certified as meeting the specifications of the American National Standard Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute. In the absence of AWWA Standards, materials meeting applicable Product Standards and acceptable to the Department may be selected. SD 26 Class 160 and SD 21 Class 200 PVC pipe meeting ASTM Standard D1785 or D2241 are acceptable in size twelve (12) inches and smaller. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines.

E. Used Materials - Water mains which have been previously used for conveying potable water may be reused provided they meet the above standards and have been thoroughly cleaned and restored practically to their original condition.

F. Asbestos cement pipe shall not be used.

G. Thermoplastic pipe shall not be used above grade.

H. Steel pipe will not be used.

I. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water.

J. Lubricants which will support microbiological growth shall not be used for slip- on joints.

K. The use of vegetable shortening is prohibited.

L. Gaskets and Joints - Gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water shall comply with the requirements of R.61-58.4(D)(1) and shall not be made of natural rubber or any other material which will support microbiological growth. Lubricants which will support microbiological growth shall not be used for slip-on joints. The use of vegetable shortening to lubricate joints is prohibited. The use of solvent-weld PVC pipe and fittings in water mains four (4) inches and larger is prohibited.

M. Metallic pipe and fittings shall be lead free in accordance with DHEC Reg.61-58.4(F). Thermoplastic pipe shall not be used above grade.

2.02 DUCTILE IRON PIPE (DIP):

A. Provide for twelve (12) inches and larger pipe.

B. Comply with ANSI/AWWA C151/A21.51.

C. Wall thickness in accordance with Table 51.1 of ANSI/AWWA C151/A21.51 with working pressure of one hundred fifty (150) pounds per square inch, depth of cover indicated and Type 2 bedding conditions, minimum thickness Class 50.

D. Use cement mortar lining: ANSI/AWWA C104/A21.4, standard thickness.

E. Use mechanical or push-on joints: ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.

F. Use rubber gaskets and lubricant: ANSI/AWWA C111/A21.11.
    a. Natural rubber gaskets are not acceptable.

2.03 PLASTIC PIPE

A. General:
    a. Use integral bell or coupling type with elastomeric gaskets.

    b. Integral bells: ASTM D2672.

    c. NSF approved.

    d. Couplings: ANSI/AWWA C900.

    e. Gaskets: ASTM F477

        1) Natural rubber gaskets are not acceptable.

    f. Gaskets to be factory installed and integral with the pipe.

    g. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents.

        1) NSF approved.

B. PVC four (4) inches and larger:

a. Comply with ANSI/AWWA C900, Table 2, Pressure Class 150.

C. PVC three (3) inches and smaller:

a. Comply with ASTM D 1785 for PVC 1120.

b. Schedule 40 with solvent weld joints.

c. Mark with National Sanitation Foundation approval at eighteen (18) inch intervals.

D. Service pipe:

a. Minimum size – one (1) inch"
b. Provide PVC as specified above for services one and a half (1½) inches and larger.

c. Provide high molecular weight flexible polyethylene pipe.

1) ASTM D1248 and AWWA C901, Type III, SDR 9, copper tubing size (CTS).

d. Mark with National Sanitation Foundation approval at eighteen (18) inch intervals.

2.04 FITTINGS AND SPECIALS

1. General:

a. Cast iron fittings are not acceptable.
2. Ductile iron pipe:

a. Use two hundred fifty (250) pounds per square inch pressure rated ductile iron fittings or specials unless otherwise indicated.
1) ANSI/AWWA C110/A21.10.
2) ANSI/AWWA C153.

b. Fittings for use with push-on joint pipe.
1) ANSI/AWWA C111/A21.11.

c. Compact fittings for piping three (3) to sixteen (16) inches may be provided in accordance with ANSI/AWWA C153/A21.53.88.

d. Use cement mortar lining: ANSI/AWWA C104/A21.4, Standard thickness.

3. Plastic pipe four (4) inches and larger:

a. Use one hundred fifty (150) pounds per square inch pressure rated ductile iron fittings or specials unless otherwise indicated.

1) ANSI/AWWA C110/A21.10.

b. Provide adapter glands, gaskets, etc. as required to accommodate any differences in pipe and fitting dimensions.

4. Plastic pipe three (3) inches and smaller:

a. Use PVC fittings, one hundred sixty (160) pounds per square inch at 73F pressure rating, joint design to conform to pipe joints, solvent weld.

B. RESTRAINED JOINT PIPE AND FITTINGS

1. Provide restrained joint pipe and fittings on all piping at each fitting, including valve connections and on the pipe joints to a distance of thirty six 936) feet on each side of the fitting.

2. Ductile iron pipe and fittings:

a. Fittings:

1) Provide for use with mechanical joint pipe and fittings.
2) Provide "MEGALUG" as manufactured by EBAA Iron Sales, Inc. of Eastland, Texas, ROMAGRIP, or other approved equal.

b. Pipe:
1) Provide retainer gaskets with stainless steel locking elements on the inner surface, for use with slip joint pipe.
(a) Provide gaskets for two hundred fifty (250) pounds per square iinch minimum working pressure.
(b) Provide gaskets conforming to ANSI/AWWA C111/A21.11.
(c) Approved gaskets are the Field Lok Gasket manufactured by U.S. Pipe and Fast-Grip Gasket manufactured by American Ductile Iron Pipe, or approved equal.

3. PVC pipe and fittings:

a. Fittings:
1) Provide for use with mechanical joint fittings and PVC pipe.
(a) Provide "Series 2000 PV" as manufactured by EBAA Iron Sales, Inc. of Eastland, Texas.

b. Pipe:
1) Provide for use with PVC pipe bells.
(a) Provide "Series 1600" as manufactured by EBAA Iron Sales, Inc., of Eastland, Texas.

C. COUPLINGS - 4" AND LARGER

1. Provide couplings where needed to make piping connections.

2. Provide full-length mechanical joint ductile iron sleeve, twelve (12) inches minimum length.

3. Provide cutting-in sleeve where installing fittings in an existing line.

   a. Provide ductile iron with mechanical joint.

4. Provide restrained joint couplings: where restrained joints are indicated on the plans or when coupling is located within eighteen (18) feet for twelve (12) inch piping and less and thirty six (36) feet for larger piping of a bend, tee or valve.

5. Compact fittings are not acceptable.

6. Acceptable product – Transition Coupling: Viking Johnson*
   *Note: Fittings must be manufactured in USA

D. PLUGS OR CAPS – FOUR (4) INCHES AND LARGER

1. Provide at all pipe ends and unused branches of fittings.

2. Tap and provide with two (2) inch plug.

3. Provide restrained joint.

E. METALLIC DETECTION TAPE

1. Provide 2-inch wide metallic detection tape on all buried PVC and polyethylene piping.

   a. Provide 5.0 mil overall thickness with no less than a 50-gauge solid aluminum foil core.
   b. Foil to be visible from both sides.

   c. No inks or printing extended to the edges of the tape.

   d. Encase printing to avoid ink rub-off.

   e. Tensile strength - 28 lbs/inch.

   f. Use heat set mylar inks.

2. Color to be Safety Precaution Blue.

3. Wording on tape to indicate “Potable Water” at no greater than 24" on center.

F. COPPER TRACER WIRE

1. Provide a continuous 12 gauge insulated copper tracer wire on all buried PVC and polyethylene piping.

2. Tracer wire is to be approved for direct burial by the manufacturer.

G. VALVES

1. General:

   a. 2½” and smaller: Use ball valves.
   b. 3" through 12": Use gate valves.

   c. 14" and larger: Use gate valves.

   d. Open by turning counterclockwise.

   e. End connections as required for the piping in which they are installed.

   f. Two (2) inch metal operating nut with arrow indicating direction of opening.

   g. Use valves designed for a working pressure of not less than 150 psi unless otherwise specified herein.

   h. Provide stem extensions on all valves where the top of the operator nut is located greater than 36 inches below the top of the valve box.

2. Ball valves, two and a half (2½) inches and smaller:

   a. Use all bronze ball valves, quarter (¼)-inch turn with stop.

   b. Provide two (2)-inch square nut.
   c. Acceptable Products: Ford Model B11-QT67 or Mueller Model B- 20200.

3. Gate valves:

   a. Use resilient seated wedge valves: ANSI/AWWA C500/C509.

   b. Internal ferrous metal surfaces to be fully coated with two part thermosetting epoxy.

   c. Provide two-part thermosetting epoxy coating on valve exterior.

   d. Provide integrally cast bronze stem nut.

   e. Design for external stem failure when excessive closing torque is applied with no failure of the pressure retaining parts.

   f. Double disc valves to have bevel gears with grease case, provide all necessary appurtenances for horizontal installation.
   g. Provide double disc valves on fourteen (14)-inches and larger with valved bypass.

   h. Provide valves for two hundred fifty (250)pounds per square inch maximum working pressure and five hundred (500) pounds per square inch static test pressure.

   i. Provide stainless steel fasteners.

j. Acceptable product: Mueller, AVK or American Flow Control

4. Butterfly valves:

a. Provide butterfly valves conforming to AWWA Standard C504, latest revision, for Class 150B, unless otherwise specified.
b. Resilient seats are to be synthetic rubber (BUNA N).

c. Shafts to be turned, ground and polished, constructed of 18-8 Type 304 stainless steel.

1) Shafts to be of one piece design.
2) Attach disc to shaft with stainless steel tapered pins and locking nuts.

d. Spray coat all interior wetted ferrous surface with two component epoxy applied to a nominal thickness of 3 to 4 mils.

1) Coating material to be AWWA and U.S. Food and Drug Administration approved for use with potable water.

e. Provide operators with not less than maximum operator torque, as determined in accordance with Appendix A of AWWA C504, to operate valves under actual line pressures and velocities.

1) Provide worm and gear, or traveling nut type, self-locking to prevent the valve disc from creeping or fluttering when it is in any intermediate position between open and closed.

2) Gear operators to be permanently lubricated, totally enclosed, with adjustable stops for the open and closed position, and except on units for buried service, shall have a valve disc position indicator.

f. Provide position indicator and extension shaft for all valves and operators.

1) Position indicator shall be hermetically sealed for installation in a C.I. valve box.

2) Show valve disc position, direction of rotation and number of turns from full open to full close.

3) Shaft extension and pins to be stainless steel.

4) Base plate and housing to be aluminum.
5) Provide all bronze gearing.

6) Provide two (2)-inch AWWA square nut.

7) Approved manufacturer: Dyna-Torque, Inc. of Mukegon, Michigan.

g. Acceptable product: DeZurik

H. VALVE OPERATOR

1. Provide one T-handle operator for each ten buried valves with nut operator.

2. Operator to be epoxy coated.

I. FIRE HYDRANTS

1. Comply with ANSI/AWWA C502.

2. Waterway valve opening, 5¼".

3. Six inch bell connection, two 2½" hose connections, one 4½" steamer connection with cap chain on all connections.

4. National Standard screw threads on outlet nozzles.
5. Open by turning counterclockwise, with arrow cast in top indicating direction of opening.
6. Two part breakable safety flange shall be an integral part of barrel casting.
7. Depth of bury, three (3) feet six (6) inches.
8. Install with break away flange at least two (2) inches above grade.
9. Finish coat with industrial enamel, yellow color ("old yeller") to match the District's standard.
10. Provide one hydrant wrench for each ten hydrants.
11. Acceptable product: Mueller Model Super Centurion, AVK Series 2780, American Darling B-84-B
12. See valve box section below for color requirement.

J. FIRE HYDRANT REFLECTOR

1. Provide industry standard blue hydrant reflector for paved roadway.

K. FIRE HYDRANT OFFSET FITTING

1. Locate between the shut-off valve and each hydrant.
2. Provide a twelve (12)-inch offset.
3. Provide Grade Lok as manufactured by Assured Flow Sales, Inc., or approved equal.

L. VALVE BOXES

1. Provide at each buried valve.
2. Cast iron extension type, suitable for minimum cover of three (3) feet six (6)-inches over the pipe.
3. Minimum inside diameter at the top of five (5) inches, minimum wall thickness 3/16 inches.
4. Have the word "WATER" cast into the cover.
5. Coat box and cover with two (2) shop coats of bitumastic paint.
6. Acceptable product: Tyler Model 461S.

7. Fire hydrant valve boxes shall be painted the same color as the hydrant.

M. VALVE BOX PROTECTION RING

1. Provide at each valve box a precast concrete protection ring.
2. Provide two (2) rings of #3 reinforcing steel, one 21" in diameter, and one 15" in diameter; or one (1) ring of #3 reinforcing steel, 22" in diameter with fibermesh concrete.
3. Inside dimensions to be 9¼”.
4. Outside diameter to be 27".
5. Provide 5" thickness at interior with a continuous slope to 2" thickness at the outside.
6. Minimum weight of 110 lbs.

N. SERVICE AND TAPPING SADDLES

1. Provide of the following materials:
   a. Body - Ductile Iron ASTM-A536.
   b. Bales and straps - Type 304 stainless steel.
   c. Studs - Type 304L stainless steel.
   d. Hardware - Type 304 stainless steel.
2. Provide double strap for sizes 5" and larger. One strap is acceptable if width of the strap matches the width of the saddle.
3. Finish - Provide fusion bonded nylon to an average thickness of 12 mils.
4. Provide a 6" long brass nipple on the outlet for PVC pipe outlet connections
5. Acceptable products: Smith Blair (Rockwell) 317, JCM 406, or Romac style 202N, Ford.

O. TAPPING SLEEVE AND VALVE

1. Tapping sleeve:
   a. Provide Type 304 stainless steel sleeve with stainless steel flanged outlet.
   b. Provide full circumferential gasket.
   c. Provide for maximum working pressure of 150 psi.
   d. Provide Type 304 stainless steel nuts and bolts.
   e. Provide ¾” NPT test plug.
   f. Acceptable Products: JCM 432, Romac SST III, or approved equal.

2. Tapping valve:

    a. Construct of material compatible with tapping sleeve.

    b. Valve to conform to gate valve specifications above.

    c. Joints - Flange to tapping sleeve, for pipe end.

3. Tie rods:

    a. Provide steel rods complying with ASTM Designation A242, galvanized in accordance with ASTM Designation A123.

    b. Acceptable products: Super Star Tie Rod Figure No. SS12 and Tie Bolt Figure No. SST7 as manufactured by Star National Products or approved equal.

P. AIR RELEASE VALVES

1. Provide cast iron body with stainless steel internal trim and float.

2. Provide stainless steel seat with BUNA-N rubber valve.
3. Provide Crispin Type “N” Model PL10.

    a. ¼” orifice.

    b. 0 to 150 psi working pressure.

    c. 1" NPT connection.

4. Provide a heavy duty cast iron meter box to house valve.

Q. BLOW-OFF HYDRANT

1. Provide non-freezing, self-draining type.

2. Provide all working parts of bronze-to-bronze design.
3. Hydrant shall be lockable.

4. Provide Eclipse No. 78 as manufactured by Kupferle Foundry Company.

    a. 2" FIP inlet.

    b. Bronze 2½" NST outlet.

    c. Non-turning operating rod.

    d. Open left.

5. Set below grade in a cast iron meter box.

a. Coat meter box with two (2) coats of bitumastic paint.

b. Minimum opening in meter box of 10".

R. CORPORATION STOPS

1. Acceptable product:

a. Ford Model F1000, CCxCTS.

b. Mueller Model H-15008.

S. CURB STOPS

1. Acceptable product:

a. Ford Model B41-444W CTS x female IPS.

b. Mueller Model B25170.

T. REPAIR COUPLINGS

1. Pipe 2½” and smaller: PVC

2. Pipe larger than 2½":

a. Full length mechanical joint ductile iron couplings, 12" minimum length, or mechanical sleeve.
b. Ductile iron transition couplings for joining plain end pipe, as manufactured by JCM, or equal.

U. MISCELLANEOUS PARTS AND ACCESSORIES

1. Use standard commercial grade suitable for the type of installation or system involved, and conforming to the applicable standards and specifications of the AWWA.

PART 3 - EXECUTION

This section covers construction procedures normally required for work within the District. It does not cover any special construction procedures which may be encountered for abnormal conditions.

Special construction procedures are to be presented to the District by the Developer’s Design Engineer.

All design criteria, materials, and construction shall be in accordance with DHEC regulations, AWWA and ASTM standards.

A. SHIPPING OF PVC PIPE

1. Protect pipe from exhaust fumes during shipping.

B. HANDLING OF MATERIALS

1. Handle pipe so as to ensure delivery to the trench in sound, undamaged condition:

   a. Carry pipe into position - do not drag.

   b. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.

   c. Use care not to injure pipe linings.

2. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during layout operations by plugging or other approved method.

3. Before installation, inspect each piece of pipe and each fitting for defects:

   a. Replace material found to be defective before or after laying with sound material meeting the specified requirements.

4. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

C. PIPE CUTTING

1. Cut pipe neatly and without damage to the pipe.

2. Unless otherwise recommended by the pipe manufacturer, cut pipe with mechanical cutter only.

   a. Use wheel cutters when practicable.

   b. Cut plastic pipe square and remove all burrs.

D. LOCATING

1. Where possible, locate water line at least ten (10) feet away, horizontally, from sewer pipes.
2. Should ten (10) foot separation not be practical, then the water main may be located closer provided:

   a. It is laid in a separate trench.

   b. It is laid in the same trench with the main water located at one side on a bench of undisturbed earth.

   c. In either of the above cases, crown elevation of the sewer shall be at least 18" below invert elevation of water line.

3. Where water lines cross over sewers, maintain 18" minimum clearance between crown of sewer and invert of water lines.

4. Where water lines cross under sewers, each line shall be ductile iron.

    a. A full length of water line shall be located over the sewer so that joints will be equal distance from the sewer.

5. No water pipe shall pass through or come in contact with any part of a sewer manhole.

6. Service lines:

    a. Provide a separate service to each subdivision lot.
    b. Install service lines from the distribution main to the property lines at each lot, or at each location indicated or directed by the Engineer.

    c. Locate service line on new lots 5' from one front corner property pin.
        1) The sewer service is to be installed 5' from the other front property pin.

7. Force Mains – There shall be at least a ten (10) foot horizontal separation between water mains and sanitary sewer force mains. There shall be an eighteen (18) inch vertical separation at crossing as required in R.61- 58.4(D)(12)(a) and (b).

8. Drain-fields and Spray-fields – Potable water lines shall not be laid less than twenty-five (25) feet horizontally from any portion of a waste-water tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by the Department.

E. ALIGNMENT OF PIPE

1. Pipe lines intended to be straight shall be so laid.

2. Where vertical or horizontal alignment requires deflection from straight lines or grade, do not exceed maximum deflection recommended by the pipe manufacturer.

3. If alignment requires deflection exceeding recommended limits, furnish special blends to provide angular deflections within the allowable limits.

F. PLACING AND LAYING

1. General:

    a. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the manufacturer.

    b. Do not dump or drop any of the materials into the trench.

    c. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.

    d. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
    e. Take up and relay pipe that has the grade or joint disturbed after laying.

f. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.

g. Securely close open ends of pipe, fittings, and valves when work is not in process.

h. Replace pipe where any part of coating or lining is damaged.

i. Bell pipe using manufacturer's approved leverage bar.

1) Do not use machinery to bell pipe.
2) Home line is to be clearly visible when pipe is joined.

2. Installation of Mains –

a. Standards – Construction specifications shall incorporate the provisions of Section C of the American Water Works Association (AWWA) Standards and/or manufacturer's recommended installation procedures.

b. Bedding – A continuous and uniform bedding shall be provided in the trench for all buried pipe. Back-fill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones, other than crushed bedding, shall not come in contact with the pipe and shall be within six
(6) inches of the pipe.

c. Cover – All water mains shall be provided with a minimum thirty (30) inches of cover. Where this is not possible, pipe shall be concrete, ductile iron, or approved material and method approved by the Department, and when necessary, insulated to prevent freezing.

3. Ductile iron pipe:

a. Mechanical and push on joints, install in accordance with ANSI/AWWA C600.
b. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations.

4. Plastic pipe:

a. Clean gasket, bell or coupling interior, especially groove area.

b. Lubricate gasket as recommended by manufacturer.

c. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.

d. Push pipe "home" until reference mark is at proper location.

5. Restrained joints:
a. Install in accordance with manufacturer's instructions.

b. Tighten set screws to the manufacturer's rated torque using a torque wrench.
   1) If twist-off nuts are provided, tighten screws until nut breaks loose.

6. Underwater crossings:

   a. Underwater crossings – A minimum of two (2) feet of cover shall be provided over the pipe. When crossing water courses that are greater than fifteen (15) feet in width, the following shall be provided:

      1) The pipe material and joints shall be designed appropriately.

      2) Valves shall be located so the section can be isolated for testing or repair; the valves shall be easily accessible and not subject to flooding;

      3) A blow-off shall be provided on the side opposite the supply service sized in accordance with Section R.61-58.4(D)(7).

      4) Blow-offs shall not be directed toward creeks or other water bodies without proper precaution being taken to dechlorinate prior to discharge.

7. Surface Water Crossings –

   a. Above-water crossings – The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair and replacement.

8. Blocking – All tees, bends, plugs and hydrants on lines two and one-half (2.5) inches in diameter and larger shall be provided with reaction blocking, tie rods, or other approved methods to prevent movement.

G. SERVICE LINES

1. Locate service lateral within five (5) feet from property corner on opposite corner of sewer lateral.
2. Install flexible service lines in one continuous piece from main to curb stop.

3. Depth of the service connection shall be no less than the top of the main connection to and shall be 12" deep at the curb stop.
4. Do not exceed an angle of 45° to the horizontal on the top.

5. Connections to ductile iron mains:

   a. Drill and tap pipe barrel and install corporation stop therein.

6. Connections to PVC mains, 4" and larger:

   a. Provide factory tapped coupling sleeve in new mains, located within 3½' of designated service location.

b. Use approved tapping saddle on existing mains.

7. Connections to mains, 3" and smaller.

   a. Provide tees and tapped couplings in new mains.

   b. Use approved tapping saddle on existing mains.

8. Provide corporation stops on all mains.

9. Terminate each service line with curb stop and cap.

   a. Mark with a steel rod flush with the ground and blue PVC stake surrounding the rod installed to 16" above grade.

H. METALLIC DETECTION TAPE

1. Provide on all buried PVC and polyethylene pipe.

2. Locate 12" below the ground surface in the pipe trench.

I. COPPER TRACER WIRE

1. All mains shall be detectable within three (3) feet with electronic loading equipment. Non-metallic pipes shall be installed with copper wire or other means of detection.
2. Provide on all buried PVC and polyethylene pipe.

3. Tracer wire shall be taped to the top of the water main.

4. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves and meters.

J. SETTING VALVES AND VALVE BOXES

1. Center valve boxes on the valves, setting plumb.

2. Tamp earth fill around each valve box to a distance of 4' on all sides, or to the undisturbed trench face if less than 4'.

3. Install shaft extensions plumb without any binding.

4. Fully open and close each valve to assure that all parts are in working condition.

K. VALVE BOX PROTECTION RING

1. Place valve box protection ring around top of valve box as detailed.

   a. Install ring level with top 1" above finished grade.

b. Top of ring to be level with or no more than 1" above the top of the valve box.

L. INSTALLATION OF HYDRANTS

1. General:

a. Inspect carefully, insuring that all foreign material is removed from the barrel.

b. Rotate Grade Lok fitting so hydrant is plumb and at the elevation detailed.

c. Install stone drainage bed and thrust blocking.
d. Fully open and close each hydrant to assure that all parts are in working condition.

e. Install blue hydrant reflector on centerline of paved roadway marking the perpendicular location of hydrant with reference to the road centerline.

f. Color of fire hydrant is to be "Old Yeller" to match the District's standards.

g. Install with breakaway flange at a minimum of 2" above finished grade.

h. Hydrants shall be covered by a black bag prior to system acceptance to insure they will not be mistaken by Fire Department officials as active hydrants.

M. BLOW-OFF HYDRANT

1. Set below grade in a cast iron meter box.

2. Hydrant should be serviceable from above grade with no digging.

N. THRUST BLOCKS

1. Provide thrust blocks, on plugs, caps, tees, hydrants and bends deflecting 11¼" or more either vertically or horizontally, and on water lines 2.5" in diameter or larger.

2. Thrust blocking is not required where restrained joints are provided unless shown on the details.

3. Provide concrete thrust blocking with a compressive strength of 3000 psi in 28 days.

4. Size of the blocking as detailed. For soil bearing capacities less than 2000 psf or water pressures greater than 150 psi, design for specific soil and water pressure conditions.

5. Locate thrust blocking between solid ground and the fitting to be anchored.

6. Provide 8 mil polyethylene film between the thrust block and fitting.
7. Place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.

8. Sides of thrust blocking not subject to thrust may be placed against forms.

9. Place thrust blocking so the fitting joints will be accessible for repair.

O. CONNECTION OF WATER MAINS

1. Any physical connection of untested water mains with existing water mains is prohibited, except when a District approved and inspected backflow prevention device has been installed.

    a. Water for filling or flushing new water mains will be obtained through a temporary jumper connection to the existing water main.

    b. The District will provide the backflow prevention device and water meter required to make the temporary connection.

    c. Physically disconnect the temporary jumper connection from the existing system after sufficient water for hydrostatic testing, disinfection and flushing are obtained.

    d. A hydrant meter may also be used for construction water supply. The District will supply the meter and backflow prevention device for this connection.

P. HYDROSTATIC TESTING

1. General:

    a. Conduct tests on each line or valved section of line.

        1) Tapping sleeves are to be tested at 150 psi for a minimum of 15 minutes prior to making tap. No leakage is allowed.

    b. Clean and flush line of dirt and foreign material. The Contractor shall be responsible for the cost of the water used for flushing if it is obtained from District sources. In lieu of metering, the Contractor may pay an amount equal to normal District rates using ten (10) times the volume of the entire new water system.

    c. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.

    d. Test pressures shall be 150 psi based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.

    e. Tests are to be conducted in the presence of a representative of the District.

2. Pressure tests:

    a. After the pipe is laid, the joints completed, fire hydrants permanently installed and the trench backfilled, subject the newly laid pipe and valved sections to a hydrostatic pressure of 150 psi.

    b. Open and close each valve within the section being tested several times during the test period.

c. Replace cracked pipe, defective pipe, and cracked or defective joints, fittings and valves with new material and repeat the test until results are satisfactory.

3. Leakage test:

a. Conduct leakage test after the pressure test has been satisfactorily completed.
b. Duration of each leakage test: at least two hours.

c. Pressure and leakage testing – All newly installed pipe shall be pressure tested and leakage tested in accordance with American Water Works Association (AWWA) Standard C600.

d. The pressure must be at least 1.5 times the maximum working pressure and the duration of this test must be at least two (2) hours. (R.61-58.4.D.(11)(e)). The formulas to be used for calculating the allowable leakage per hour shall be:

Ductile Iron:	**PVC:**
$L = [SD(P)^{½}] \div 133{,}200$	$L = [ND(P)^{½}] \div 7{,}400$
L = allowable leakage (gals./hr.)	L = allowable leakage (gals./hr.)
S = length of the pipeline tested (feet)	N = # of joints in pipeline being tested
D = diameter of pipe (inches)	D = diameter of pipe (inches)
P = average test pressure (psig)	P = average test pressure (psig)

1) All visible leaks shall be repaired regardless of the amount of leakage.
2) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance.

Q. DISINFECTION

1. Disinfection of all new water mains shall be in accordance with current American Water Works Association (AWWA) Standard C651 for the disinfection of water mains.

a. In general, one approved method referred to as “continuous feed method” is as follows:
1) Before being placed in service, all new mains shall be thoroughly flushed then chlorinated with not less than twenty- five (25) milligrams per liter of available chlorine.

2) Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine.

3) The solution shall be retained in the pipeline for not less than twenty-four (24) hours and then flushed thoroughly with a potable water of satisfactory bacteriological quality before starting the sampling program.

b. The contractor or owner shall collect a minimum of two (2) samples from each sampling site for total coliform analysis. The number of sites depends on the amount of new construction but must include all dead-end lines and be representative of the water in the newly constructed mains.

c. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating. These samples must be collected at least twenty-four (24) hours apart and must show the water line to be absent of total coliform bacteria. The chlorine residual must also be measured and reported.

d. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.

e. If the non-coliform growth is greater then eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.

f. All samples must be analyzed by a certified laboratory. The Department may request that heterotrophic plate count analyses be conducted on a case-by-case basis where disinfection problems are suspected.

R. DECHLORINATION OF CHLORINATED DISINFECTION WATER

1. Dechlorinate the chlorinated water used for disinfected water lines to meet requirements of the South Carolina Department of Health and Environmental Control.

S. NOTICE OF CONSTRUCTION ACTIVITY

1. Immediately prior to the beginning of construction the “Notice of Construction Activity” form as included in the appendix is to be completed and mailed to the District Representative with a copy mailed to the District’s Engineering Representative.

T. CROSS CONNECTION CONTROL (Backflow Prevention Devices):

1. Cross Connections and Interconnections –

a. Cross connections – There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contamination materials may be discharged or drawn into the system.

2. No by-passes shall be allowed, unless the bypass is also equipped with an equal, approved back-flow prevention device.

3. High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventer.

4. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground's surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into the pit.
5. All piping up to the inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on the inlet side of the device.
6. Fire line sprinkler systems and dedicated fire lines, except those in the high hazard category shall be protected by an approved double check valve assembly.

END OF SECTION

SECTION 33 43 00 – SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers materials and construction of a water distribution system.

PART 2 - MATERIALS

2.01 GENERAL

A. Unless otherwise noted or approved by the Hilton Head No. 1 Public Service District all materials shall be manufactured in the United States.

B. Materials and installation for all gravity sewer lines and force mains shall comply with commonly accepted design standards such as ASTM (American Society for Testing and Materials), ANSI (American National Standard), AWWA (American Water Works Association) or other design standards as approved by the Department.

C. All design criteria, materials, and construction shall be in accordance with DHEC regulations, AWWA, and ASTM standards.

2.02 PIPE AND FITTINGS

A. Ductile-iron pipe and fittings (DIP):
   1. Comply with ANSI/AWWA C151/A21.51.
   2. Use mechanical or push-on joints: ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
   3. Use rubber gaskets and lubricant: ANSI/AWWA C111/A21.10.
   4. Use wall thickness in accordance with Section XI for depth and bedding conditions.
   5. Use fittings with pressure rating of 150 psi: ANSI/AWWA C110/A21.10.
   6. Lining: Amine cured Novalac Epoxy polymeric lining, 40 mils nominal thickness. Acceptable products: Protecto 401 by Vulcan Painters, Birmingham, Alabama.

B. Polyvinyl chloride pipe and fittings (PVC):
   1. Wall, bell and spigot, minimum of SDR26: ASTM 3034.
   2. For pipe 8” in diameter and greater, provide elastomeric gasket joints, providing watertight seal.
   3. For pipe smaller than 8”, provide solvent weld joints.
   4. 12.5 or 20 foot lengths.

2.03 MANHOLES

A. Use precast manholes:
   1. Comply with ASTM C478.
   2. Portland cement: ASTM C150, Type II.
   3. Monolithic base slab with walls.
   4. Flat slab top sections: HS-20 traffic loadings.
   5. Provide tongue and groove with vulcanized butyl rubber sealant or “O” ring rubber gasketed joints.
   6. Cast or factory cut pipe opening in manholes:

a) Flexible pipe boot: ASTM C923M.
b) Attach boot to piping with dual stainless steel straps.
c) All other hardware to be stainless steel.
d) Acceptable product: Kor-N-Seal or equal.

7. Size lift holes and inserts for a precision fit with the lift devices.
   a) Do not penetrate through the manhole wall.
   b) Comply with OSHA Standard 1926.704.
8. Provide flat slab tops where manhole depth is less than 4'-0".

B. Coatings:
1. Coat interior of standard manholes with 21 dry mils coal tar epoxy, Tnemec “Tneme-Tar” or equal. Do not coat joints.
2. Coat existing manholes where a new force main enters and in the next manhole down stream with HDPE Protective Liner or Raven Systems Epoxy Coating.

C. Lining:

1. Provide lining system in pump stations, wetwells, valve pits, pressure sewer receiving manholes, the next manhole downstream of receiving manholes, air release valve manholes and drop manholes. Approved Systems:
   a) Agru Sure Grip HDPE concrete protective liner
   b) Raven Systems Epoxy Coating System

D. Steps:
1. Polypropylene plastic steps reinforced with _” diameter steel rod.
   a) Acceptable product: M.S.A. Industries, Inc. Model PS-K, or equal.
2. Ladder rungs cast into the units.
   a) Embed a minimum of 3".
   b) Maximum spacing - 16".

E. Exterior joint collar:
1. Install an exterior joint collar on all manhole joints.
2. Provide a 12" wide band.
3. Acceptable product: Seal Wrap Exterior Joint Sealer by Mar-Mac Manufacturing Company.

F. Frames and covers:
4. Provide gray iron castings, ASTM A48, Class 30 iron.
5. Machine all bearing surfaces.
6. Covers to have the words “SANITARY SEWER” cast in the metal.
7. Coat frames and covers with two (2) shop coats of bitumastic paint.
8. Provide watertight covers, where indicated, conforming to above requirements and with frame tapped for four bolts, countersunk in cover.
   a) Provide rubber gasket between frame and cover.
9. Acceptable products: Sumter Machinery Company Model MC-18 and MF-11 or US Foundry Model 680.

2.04 CLEANOUTS

A. Acceptable products: Smith #4253 or Josam #58860, with XH cast iron top.

B. Provide ABS cleanout plugs.

2.05 SEWER SERVICE SADDLES

A. Provide sewer service saddle for new gravity sewer service lines tapping into gravity main lines greater than 8”.

B. Acceptable product: Romac – Style CB Sewer Saddle

PART 3 - CONSTRUCTION PROCEDURES

3.01 GENERAL

A. This section covers construction procedures normally required for work within the District. It does not cover any special construction procedures which may be encountered for abnormal conditions.

B. Special construction procedures are to be presented to the District by the Developer’s Design Engineer.

C. All design criteria, materials, and construction shall be in accordance with DHEC regulations, AWWA, and ASTM Standards.

3.02 HANDLING OF MATERIALS

A. Storage of PVC pipe:
   1. Store in unit packages as received from manufacturer until just prior to use.
   2. Stack units to prevent deformation to pipe barrel and bells.
   3. Protect from direct sunlight by covering with opaque material.

B. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

C. Handle pipe so as to ensure delivery to the trench in sound, undamaged condition.
   1. Carry pipe into position - do not drag.
   2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.
   3. Use care not to injure pipe linings.

D. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during layout operations by plugging or other approved method.

E. Before installation, inspect each piece of pipe and each fitting for defects:
   1. Replace material found to be defective before or after laying with sound material meeting the specified requirements.

F. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

3.03 PIPE CUTTING

A. Cut pipe neatly and without damage to the pipe.

B. Unless otherwise recommended by the pipe manufacturer, cut pipe with mechanical cutter only.
   1. Use wheel cutters when practical.
   2. Cut plastic pipe square and remove all burrs.

3.04 LOCATING

A. Sewer lines in relation to water lines must conform to “Ten State Standards.”

B. Where possible, locate sewer pipe at least ten (10) feet away, horizontally, from water lines.

C. Should ten (10) foot separation not be practical, then the sewer pipe may be located closer provided:
   1. It is laid in a separate trench.
   2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.
   3. In either of the above cases, the sewer pipe must be a minimum of 18” below the water pipe measured outside to outside.

D. Where water lines cross over, maintain 18" minimum clearance between crown of sewer and invert of water lines.

E. Where sewer lines cross over water lines, provide ductile iron pipe.
   1. Concrete encase the sewer pipe fully for a distance of ten (10) feet on each side of the crossing.
      a) Not less than 4" thickness, including that on pipe joints.
   2. Use pressure pipe with no joint closer, horizontally, than three (3) feet from the crossing.
      a) Pressure test pipe prior to backfilling.

3.05 INSTALLATION

A. Trench, backfill and compact for the work of this Section in strict accordance with pertinent provisions of Section XXIII of these specifications, and the following requirement.
   1. Maximum trench widths, depths and bedding methods.
      a) Install all sewers complying with tables for depths of cut and class of bedding included hereinafter.
   2. Ductile-iron pipe:

MAXIMUM DEPTHS IN FEET						
			CLASS OF BEDDING			
			D	C	B	A
	MAX.		FLAT		TYPE 1	SPECIAL
PIPE SIZE	TRENCH WIDTH	CLASS OF PIPE	BOTTOM TRENCH	TYPE 1 OR TYPE 2	OR TYPE 2	CONCRETE BEDDING
8"	2'2"	50	24	28	32	35
10"	2'4"	50	15	24	32	35
10"	2'4"	51	24	32	35	35
12"	2'6"	50	16	20	32	35
12"	2'6"	51	20	24	35	35
12"	2'6"	52	28	32	35	35
14"	2'9"	50	14	16	32	35
14"	2'9"	51	16	20	35	35
14"	2'9"	52	24	28	35	35
16"	3'0"	50	13	17	32	35
16"	3'0"	51	17	21	35	35
16"	3'0"	52	21	25	35	35
18"	3'2"	50	11	15	32	35
18"	3'2"	51	15	17	35	35
18"	3'2"	52	17	21	35	35
20"	3'6"	50	11	15	32	35

20"	3'6"	51	13	17	35	35
20"	3'6"	52	17	21	35	35
24"	3'10"	50	10	14	30	35
24"	3'10"	51	12	16	34	35
24"	3'10"	52	14	18	35	35
30"	4'7"	50	0	12	26	35
30"	4'7"	51	0	14	30	35
30"	4'7"	52	0	16	34	35
36"	5'5"	50	0	13	27	35
36"	5'5"	51	0	19	31	35
36"	5'5"	52	0	19	35	35
36"	5'5"	53	0	13	35	35
42"	6'1"	50	0	15.5	27.5	35
42"	6'1"	51	0	17.5	27.5	35
42"	6'1"	52	0	19.5	31.5	35

3. Polyvinyl chloride pipe (SDR35):

MAXIMUM DEPTHS IN FEET					
			CLASS OF BEDDING		
		D	**C**	**B**	**A**
PIPE SIZE	**MAX. TRENCH WIDTH**	**FLAT BOTTOM TRENCH**	**TYPE 1 OR TYPE 2**	**TYPE 2* ONLY**	**SPECIAL CONCRETE BEDDING**
4"	2'0"	**	**	30	30
8"	2'2"	**	**	30	30
10"	2'4"	**	**	30	30
12"	2'6"	**	**	30	30
15"	2'10"	**	**	30	30
18"	3'2"	**	**	30	30
21"	3'6"	**	**	30	30
* Class B Bedding (Type 2) shall extend to the top of the pipe.					
** Do not use this Class of bedding for this pipe size and trench width.					

4. Bedding and tamping:

   a) Class A Bedding: Excavate trench to one-fourth of nominal pipe diameter below pipe grade; lay pipe to grade on concrete blocking; place 2500 psi concrete around pipe for full width of trench up to one-fourth nominal pipe diameter above the invert.
   b) Class B (Type 1) Bedding (Ductile iron pipe only): Shape bottom of trench to a level 2" below bottom of pipe; bring bed to proper level by spreading and thoroughly tamping fine granulated moist earth and sand to conform accurately to one-fourth circumference of pipe barrel; provide suitable material if not available from trench excavation; lay pipe, backfill and hand tamp in thin layers to height three-fourths of pipe diameter, using material same as bedding material; complete trench backfill complying with Section XXIII. In lieu of Class B (Type 1) bedding for ductile iron pipe, Class B (Type 2) bedding may be used.
   c) Class B (Type 2) Bedding:
      - Undercut 4" below pipe barrel, full width of trench; bring to grade with compacted

crushed stone complying with SCHD Aggregate No. 5, except for PVC sewers, use SCHD Aggregate No. 57, then:

i) For pipe other than PVC, place stone in 6" layers to mid-point of pipe, compacting by slicing with shovel.

ii) For PVC pipe, place stone (Aggregate No. 57) in 6" layers to the top of the pipe, compacting by slicing with shovel.

- In lieu of Class B (Type 2) bedding, fine granulated material may be used from the excavation provided that the trench is dewatered prior to excavation and a dry trench is maintained until the pipeline is completely backfilled.
- Trench backfill complying with Section XXIII.

d) Class C (Type 1) bedding (Ductile iron pipe only):

- Shape trench bottom by hand to conform accurately to bottom one-quarter of pipe barrel circumference.

i) Use Class C (Type 2) bedding if unable to properly shape trench bottom.

e) Class C (Type 2) Bedding (Ductile iron pipe only):

- Undercut 4" below bottom of pipe barrel; full width of trench; bring to grade with compacted crushed stone complying with SCHD Aggregate No. 5; lay pipe; place stone in 6" layers to quarter-point of pipe, compacting by slicing with shovel.
- Trench backfill complying with Section XXIII.

f) Class D Bedding (Ductile iron pipe only):

- Excavate bell holes in flat-bottomed trench; lay pipe.
- Trench backfill, comply with Section XXIII.

B. Pipe laying:

1. General:
   a) Protect pipe during handling against shocks and free fall. Remove extraneous material from the pipe interior.
   b) Lay pipe by proceeding upgrade with the spigot ends of bell- and-spigot pipe pointing in direction of flow.
   c) Lay each pipe accurately to the indicated line and grade, aligning so the sewer has a uniform invert.
   d) Continually clean interior of the pipe free from foreign material.
   e) Before making pipe joints, clean and dry all surfaces of the pipe to be joined.
   f) Use gasket lubricants as recommended by the pipe manufacturer.
   g) Place, fit, join and adjust the joints to obtain the degree of water tightness required.
2. Polyvinyl chloride pipe:
   a) Select proper bedding class from preceding table as determined by pipe size and depth of cut.
   b) Use Class B (Type 2) or Class A for all PVC sewers.
   c) Comply with ASTM D2321, except as otherwise specified herein.
3. Ductile-iron pipe:
   a) Select proper bedding class from proceeding table as determined by pipe size and depth of cut.

- Class D bedding limited to maximum pipe size of 24", Class 52 at fourteen (14) foot depth.

   b) Comply with ANSI/AWWA C600, except as otherwise specified herein.

3.06 MANHOLES

A. Set bases level so that walls will be plumb.

B. Clean bells and spigots.

C. Apply joint sealer, or ring gasket to wall section(s), set firmly in place to assure watertight joints.

D. Set risers and cones so steps align.

E. Connect pipe boot to piping with dual stainless-steel straps.

F. Grout lift holes from the outside using non-shrink grout.

G. Install exterior joint collar.
1. Follow manufacturer's recommendations.
2. Clean the surface.
3. Remove the protective paper and place the band around the manhole, mastic side to the manhole and spanning the joint.

H. Form the invert channels directly in the concrete of the manhole base, with mortar, or by laying a full section of sewer pipe through the manhole and breaking out the top half after surrounding concrete has hardened. Smooth the floor of the manhole outside the channels, and slope toward the channels at not less than 1" per foot nor more than 2" per foot.
4. Shape the invert channels to be smooth and semi-circular, conforming to the inside of the adjacent sewer section.
5. Make changes in direction of flow with a smooth curve of as large a radius as the size of the manhole will permit.
6. Make changes in size and grade of channels smoothly and evenly.
7. Slope invert uniformly from invert of inlet to invert of outlet.

I. Match manhole top to grade utilizing brick, maximum height 8".

3.07 MANHOLE COATINGS: SAUEREISEN SYSTEM

A. Provide in existing manholes where a new force main enters and in the next manhole down stream.
8. Coat with Sauereisen coating.
9. Temperature of working area.
   a) Must be between 65F and 80F.
   b) Store materials within the 65F to 80F range for 48 hours prior to use.
   c) Do not apply in direct sunlight or where rising surface temperatures may result in blistering of the materials.
   d) Shade new concrete surfaces that have been in direct sunlight for 24 hours prior to application and keep shaded until the initial set has taken place.
   e) When the surface temperatures are rising, postpone the application or apply during cooler hours.
10. Surface preparation.
   c) Old concrete:
   - Concrete must be dry, firm and structurally sound.
   - Utilize mechanical methods to remove laitence, old paints, protective coatings and attached or deteriorated concrete.
   - Concrete surfaces that have been cured with conventional curing compounds or are contaminated with form oils or grease must be chemically cleaned or scarified to remove the contaminants prior to abrasive blasting or hydroblasting.
   - Abrasive blast or high-pressure water blast concrete to remove laitance and

obtain uniform sound substitute.

- Suitably finished concrete must have a uniform surface texture, exposing fine aggregate and resembling coarse sandpaper.
- If surface texture is not uniform in appearance, repeat abrasive blasting or hydroblasting until the desired surface is obtained.
- After surface preparation, fill all voids with underlayment grout.
- Follow all manufacturer's recommendations for surface preparation.

a) All surfaces must be free of dust, loose particles, oils, grease, chemical contaminants and previously applied paints or protective coatings.
b) All surfaces are to be dry after completion of surface preparation.

11. Application of underlayment grout
    a) Mix grout in accordance with manufacturer's directions:
        - Voids greater than ½":
            iii) Trowel onto surface at a minimum thickness of 1".
        - Voids less than ½":
            iv) To maximize working time, spread grout onto a plasterer's hawk upon completion of the mixing.
            v) Apply grout to concrete with a smooth plasterer's rubber float.
            vi) After application, remove excess material by using the edge of the float or squeegee.
12. Application of finish coat
    a) Mix in accordance with manufacturer's directions.
    b) Trowel finish at a minimum _" thickness.
    c) Provide a pinhole and trowel mark free surface.
    d) Test surface for pinholes after 24-hour cure using a Tinker Razor Holiday Detector, San Gabriel, CA, Model AP/W or an approved similar model.

3.08 MANHOLE LINER:

A. Provide in pump stations, wetwells, pressure sewer receiving manholes, the next manhole downstream of receiving manholes, air release valve manholes and drop manholes.
4. Install in accordance with Manufacturer's published directives and procedures.
5. Welding:
    d) Perform by welders certified by the Manufacturer.
    e) Provide a one-piece monolithic concrete protective liner system.
    f) Acceptable welding techniques:
        - Extrusion welding.
        - Wedge welding.
        - Butt welding.
        - Hot air welding.
6. Testing and supervision of the installation and welding.
    a) Perform by qualified staff only.
    b) Visually check when completed.
    c) Spark test all welded joints.

3.09 CONNECTIONS TO EXISTING SYSTEM

A. Construct new manhole breaking upper half of existing pipe after base of manhole is completed so as not to obstruct flow of the existing pipe.

B. At existing manhole tie-ins, temporarily block and/or divert sewage flows, perform other miscellaneous work.

7. Use high-early strength cement for mortar, forming proper channels with minimum interruption to service of the existing sewer.

3.10 SERVICE LINES

A. Connect to street sewers using wye branches and bends not greater than 45.

B. Do not stack service lines vertically over the sewer main.

C. Comply with details in Section XII.

D. Locate service lateral within five (5) feet from property corner on opposite corner of water lateral.

3.11 CLEANOUTS

A. Secure the District's approval of cleanout locations prior to installation.

B. Pour a concrete protection pad around cleanouts.

C. Install cleanout and concrete protection pad level with finished grade.

3.12 INSPECTIONS AND TESTING

A. General:

1. Perform all tests on all PVC pipe in the presence of the Developer's Design Engineer.
2. Visually inspect, test, and gauge all sewers for infiltration and/or exfiltration.
3. All visible leaks shall be repaired.
4. Broken and cracked pipe, mislaid pipe and other defects shall be corrected.

B. Inspection:

1. Each section between manholes shall show a full circle of light when viewed from either end.

C. Deflection tests:

1. No pipe to exceed a deflection of 5%.
2. Conduct deflection testing after the final backfill, and compaction thereof, has been in place at least thirty (30) days and prior to placing the sewer lines into operation.
3. Conduct the deflection tests using a rigid ball or mandrel having a diameter equal to 95% of the inside diameter of the pipe.
4. Do not use mechanical pulling devices for the deflection tests.

D. Infiltration tests:

8. Conduct tests using V-notch weir, or by direct measurement prior to allowing sewage flows in the line.
9. Close the end of the sewer at upstream structure sufficiently to prevent the entrance of water.
10. Discontinue use of well points or other groundwater pumping operations at least three days prior to testing.
11. Infiltration into the entire system of new sewers or any one trunk, interceptor or outfall sewer, including connecting laterals, or any stretch of sewer shall not exceed:

a) All gravity sewers shall be designed and specified such that the leakage outward (exfiltration) or inward (infiltration) shall not exceed two hundred (200) gallons per inch

of pipe diameter per mile per day. An air test may be utilized in lieu of an infiltration/exfiltration test, if approved by the Department.

E. Air testing:

1. All gravity sewer must be air tested per ASTM F1417 after dry utility installation is completed.

3.13 NOTICE OF CONSTRUCTION ACTIVITY

A. Immediately prior to the beginning of construction the “Notice of Construction Activity” form as included in the appendix is to be completed and mailed to the District Representative with a copy mailed to the District’s Engineering Representative.

3.14 GRAVITY SEWER LINES/COLLECTION SYSTEMS

A. Excluding service connections less than fifty thousand (50,000) gpd, sewer connections to gravity sewer lines shall be constructed such that the internal angle of deflection is equal to or greater than ninety (90) degrees, including connections at manholes. Angles less than the required ninety (90) degrees may be considered on a case-by-case basis, when there is adequate justification (e.g., drop through the manhole) provided.

B. For all domestic wastewaters and for industrial wastewaters with solids which are similar in size and nature to solids in domestic wastewater, no gravity sewer line conveying raw sewage shall be less than eight (8) inches in diameter. In cases where the flow and number of taps are limited to less than ten (10) percent of the design capacity of the receiving sewer line, as determined by the Department, and the line cannot be reasonably extended, the Department may consider the use of six (6) inch diameter lines.

C. For all domestic wastewaters and for industrial wastewaters with solids which are similar in size and nature to solids in domestic wastewater, all gravity sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than two (2) feet per second, based on Manning’s formula using an “n” value of thirteen thousandths (0.013). Slopes slightly less than those required for the two (2) feet per second velocity, when flowing full, may be permitted. Such decreased slopes shall only be considered where the depth of flow shall be three tenths (0.3) of the diameter or greater for average flows. Whenever such decreased slopes are selected, the design engineer shall furnish with the report design computations of the anticipated flow velocities of average and peak flows. The report shall indicate the actual velocity in the sewer lines at the proposed slope and the actual velocity at the required slope in order to achieve two (2) feet per second, when flowing full. The pipe diameter and slope shall be selected to obtain the greatest practical velocities to minimize settling problems. Oversized sewers shall not be approved to justify using flatter slopes. The operating authority of the sewer system shall give written assurance to the Department that any additional sewer maintenance required by reduced slopes shall be provided.

D. Sewers shall be designed with a uniform slope between manholes.

E. Sewers on twenty (20) percent slopes or greater shall be anchored securely with concrete anchors or equal, spaced as follows:

12. Not over thirty six (36) feet center-to-center on grades twenty
13. (20) percent and up to thirty five (35) percent;
14. Not over twenty four (24) feet center-to-center on grades thirty five (35) percent and up to fifty (50) percent; and
15. Not over sixteen (16) feet center-to-center on grades exceeding fifty (50) percent.

F. Sewers twenty four (24) inches or less in diameter shall be laid with straight alignment between manholes. Consideration for curvilinear sewers in excess of twenty four (24) inches in diameter shall be evaluated on a case-by-case basis.

G. Manhole top elevations shall be greater than or equal to the fifty (50) year flood elevation, unless watertight covers are provided.

H. Manholes shall be installed: at the end of each line; at all changes in grade, size, or alignment; at all intersections of piping; and at distances not greater than four hundred (400) feet for sewers fifteen (15) inches or less, and five hundred (500) feet for sewers eighteen (18) inches to thirty (30) inches. Distances up to six hundred (600) feet may be approved, for sewers equal to or greater than eight (8) inches in diameter, in cases where adequate cleaning equipment for such spacing is provided. Greater spacing may be permitted in larger sewers. Cleanouts may be used only for special conditions and shall not be substituted for manholes except when installed at the end of laterals not greater than one hundred fifty (150) feet in length. A drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty four (24) inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than twenty four (24) inches, the invert shall be filleted to prevent solids deposition. Manholes may not be required on sewer lines transporting special waste (e.g., volatile organic compounds) or effluent wastewater from a treatment facility.

I. The minimum inside diameter of manholes shall be forty eight (48) inches unless using an inside drop connection where a minimum inside diameter of sixty (60) inches shall be required for all new manholes. For modifications to existing manholes, a minimum diameter of forty eight (48) inches, for inside drop connections, may be provided if justified and approved by the Department. A minimum manhole access diameter of twenty two (22) inches shall be provided.

J. Each section of sewer pipe shall be specified to be laid to the appropriate line and grade, as designed, working in the upstream direction with the bell end laid upgrade.

K. All gravity sewers shall be designed and specified such that the leakage outward (exfiltration) or inward (infiltration) shall not exceed two hundred

L. (200) gallons per inch of pipe diameter per mile per day. An air test may be utilized in lieu of an infiltration/exfiltration test, if approved by the Department. Refer to DHEC Reg. 61-67.3.B.

3.15 GREASE TRAPS

A. Any new food service facilities permitted under R.61-25, Retail Food Establishments, and served by an onsite wastewater system that is permitted after the effective date of this regulation shall be required to have a properly sized grease trap. This requirement may also apply to new facilities not requiring a food service permit under R.61-25. Exception may be granted in cases where a permitted retail food service establishment performs limited food preparation and/or cooking.

B. Any existing food service establishment that does not have a grease trap, but experiences an onsite wastewater malfunction as a result of grease accumulation, shall be required to immediately comply with all portions of Section 201 as if it were a new food service facility.

C. Any food service facility requiring a grease trap shall provide two (2) separate plumbing stub-outs, one serving the food preparation area and the other serving the restrooms. The stub-out from the restrooms shall discharge directly into the main building septic tank. The stub-out from the food preparation area shall discharge directly into the grease trap with the effluent then directed to the main building septic tank. In order to enhance grease separation while the liquids are hot, the grease trap shall be placed as close as possible to the source of wastewater. Garbage grinders shall not be allowed to discharge to such systems.

D. All grease traps must be directly accessible from the surface, and must be equipped with an extended outlet sanitary tee terminating six (6) to twelve

E. (12) inches above the tank bottom. The minimum access opening shall be eighteen (18) inches in diameter.

F. All grease traps serving facilities from which the peak sewage flow exceeds fifteen hundred (1500) gpd shall either be dual chambered or individual tanks in series. If dual chambered, both the dividing wall and the second chamber must be equipped with a sanitary tee terminating six (6) to twelve (12) inches above the tank bottom.

G. It shall be the responsibility of the owner/manager to ensure that the grease trap(s) is cleaned by a licensed septage pumper at frequent intervals to prevent the carryover of grease into other parts of the onsite wastewater system.

H. Determination of Minimum Net Liquid Capacity

16. No grease trap used as part of an onsite wastewater system shall have a net liquid capacity of less than one thousand (1000) gallons. Commercial interior-type grease interceptors shall not be utilized in lieu of a properly sized exterior grease trap.
17. Minimum net liquid capacities of grease traps shall be determined as follows:

Where,

NLC = GPD x LF x RF

NLC = Net Liquid Capacity of Grease Trap (gallons) GPD = Total Maximum Estimated Sewage Flow (gpd)

LF = Loading Factor (the approximate portion of the total maximum daily flow generated in food preparation areas)

0.3 - Schools and Other Institutions

0.4 - Restaurants

0.5 - Retail Food Stores

RF = Minimum Retention and Storage Factor of 2.5 for Onsite Wastewater Systems

END OF SECTION