

BID SPECIFICATIONS
City of Canton
Centennial Plaza

Project Location:
Market Square
Canton, Ohio 45702

MKSK
462 South Ludlow Alley
Columbus, OH 43215
Ph. 614-621-2796

Project No. c18514

BID OPENING DATE
2:00 PM Local Time
June 28, 2019

CLEARLY MARK ENVELOPE
“BID ENCLOSED – CENTENNIAL PLAZA
CONSTRUCTION PROJECT”

TABLE OF CONTENTS – Appendix C

DIVISION 01 – GENERAL REQUIREMENTS

01 10 00	Summary of Work
01 21 00	Allowances
01 22 00	Unit Pricing Form
01 25 00	Substitution Procedures
01 29 00	Payment Procedures
01 31 00	Project Management and Coordination
01 32 00	Construction Progress Documentation
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 42 00	References
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 73 00	Execution
01 77 00	Closeout Procedures
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 79 00	Demonstration and Training

DIVISION 02 – EXISTING CONDITIONS

02 41 19	Selective Demolition
----------	----------------------

DIVISION 03 – CONCRETE

03 30 00	Cast-In-Place Concrete (Café)
03 30 00	Cast-In-Place Concrete (Stage/Pavilion/Rotunda)
03 30 53	Misc. Cast-In-Place Concrete

DIVISION 04 – MASONRY

04 05 13	Masonry Mortaring
04 05 16	Masonry Grouting
04 05 19	Masonry Anchorage & Reinforcing
04 05 23	Masonry Accessories
04 20 00	Unit Masonry

DIVISION 05 – METALS

05 12 00	Structural Steel Framing (Café)
05 12 00	Structural Steel Framing (Stage/Pavilion/Rotunda)
05 12 13	Architecturally Exposed Structural Steel Framing
05 31 00	Steel Decking
05 40 00	Cold Formed Metal Framing

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

- 06 10 00 Rough Carpentry
- 06 61 16 Solid Surfacing Fabrications

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

- 07 21 00 Thermal Insulation
- 07 26 30 Spray Foam Insulation Air Barrier
- 07 27 26 Fluid Applied Membrane Air Barrier
- 07 54 23 Thermoplastic-Polyolefin Roofing
- 07 62 00 Sheet Metal Flashing and Trim
- 07 62 01 Pre-Finished Gutters & Downspouts
- 07 65 26 Self-Adhering Flexible Flashing
- 07 92 00 Joint Sealants
- 07 96 00 Extensive Green Roof Assembly

DIVISION 08 – OPENINGS

- 08 11 13 Hollow Metal Doors and Frames
- 08 31 00 Access Doors & Frames
- 08 44 13 Glazed Aluminum Curtain Walls
- 08 63 00 Skylight
- 08 71 00 Door Hardware
- 08 71 13 Automatic Door Operators
- 08 80 00 Glazing

DIVISION 09 – FINISHES

- 09 22 00 Non-Load Bearing Steel Framing
- 09 28 13 Cementitious Backing Boards
- 09 29 00 Gypsum Board
- 09 30 00 Tiling
- 09 54 01 Lineal Wood Ceiling
- 09 54 23 Lineal Metal Ceiling
- 09 65 13 Resilient Base and Accessories
- 09 77 01 FRP Wall Liner Panel
- 09 90 00 Paints & Coatings

DIVISION 10 – SPECIALTIES

- 10 28 13 Toilet Accessories
- 10 81 11 Electric Hand Dryers
- 10 82 00 Louvered Roof Top Equipment Screens

DIVISION 20 - MECHANICAL

- 20 05 00 General Requirements

20 05 10	Basic Material and Methods
20 05 23	Piping and Valves
20 05 93	Testing, Adjusting and Balancing
20 07 00	Insulation

DIVISION 22 – PLUMBING

22 40 00	Plumbing Fixtures and Equipment
----------	---------------------------------

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

23 09 00	Instrumentation and Controls
25 70 00	Air Handling Systems and Equipment

DIVISION 26 – ELECTRICAL

26 01 00	General Provisions
26 05 00	Basic Electrical Materials and Methods
26 05 00	Common Work Results for Electrical
26 05 05	Electrical Demolition
26 05 13	Wiring and Cable
26 05 19	Conductors
26 05 26	Grounding and Bonding (Café)
26 05 26	Grounding and Bonding (Stage/Pavilion/Rotunda)
26 05 33	Raceways and Boxes
26 09 61	DMX Lighting Controls
26 21 16	Electrical Services
26 24 16	Panelboards (Café)
26 24 16	Panelboards (Stage/Pavilion/Rotunda)
26 27 26	Wiring Devices (Café)
26 27 26	Wiring Devices (Stage/Pavilion/Rotunda)
26 28 13	Fuses (Café)
26 28 13	Fuses (Stage/Pavilion/Rotunda)
26 28 16	Safety and Disconnect Switches (Stage/Pavilion/Rotunda)
26 28 16	Safety Switches (Cafe)
26 29 13	Motor Starters
26 50 00	Lighting Systems (Stage/Pavilion/Rotunda)
26 51 00	Lighting Fixtures (Café)
26 60 00	Fault Current Study
26 61 00	Telephone System

DIVISION 27 – COMMUNICATIONS

27 05 00	Technology General Provisions
27 41 00	Audio Systems

DIVISION 31 – EARTHWORK

- 31 20 00 Earth Moving (Café)
- 31 20 00 Earth Moving (Site Work)

DIVISION 32 – EXTERIOR IMPROVEMENTS

- 32 13 13 Concrete Paving
- 32 13 73 Concrete Paving Joint Sealant
- 32 14 00 Unit Paving
- 32 15 45 Stabilized Decomposed Granite Aggregate
- 32 18 13 Synthetic Grass Surfacing
- 32 18 16 Playground Protective Surfacing
- 32 33 00 Site Furnishings
- 32 84 00 Irrigation
- 32 91 20 Planting Preparation – Manufactured Standard Topsoil
- 32 91 40 Planting Preparation – Sand Based Structural Soil
- 32 93 00 Plants, Trees and Shrubs

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Owner-furnished products.
9. Contractor-furnished, Owner-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and Drawing conventions.
14. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.02 PROJECT INFORMATION

A. Project Identification: Centennial Plaza, Project No. c18514.

1. Project Location:
Canton, OH at the block of 3rd St NW and 4th St. NW, Market Ave. N, and Court Ave NW.

B. Owner: City of Canton, Ohio .

1. Owner's Representative:
Donn Angus, Project Manager and City Planning Director.

C. Engineer / Landscape Architect: MKSK, 462 S. Ludlow Alley, Columbus Ohio 43215.

1. Landscape Architect's Representative:
Brian P. Kinzleman, CEO. Ph. No. 614-621-2796.
2. MKSK is also referred to as: Construction Oversight Administrator.

D. Landscape Architect's Consultants: Landscape Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Design Architect:
Tim Lai ArchitecT
401 W Town Street
Columbus OH 432215
2. Architect of Record & Structural Engineer: Café / Restrooms
SoL Harris / Day Architects, Inc.

6677 Frank Ave NW
North Canton, OH 44720

3. Architect of Record & Structural Engineer: Rotunda Sculpture, Pavilion, Stage
ARUP USA Inc.
77 Water Street
New York, NY 10005
 4. Civil Engineering:
Atwell Engineering
7100 E. Pleasant Valley Rd., Suite 220
Independence, OH 44131
 5. Lighting Design and Electrical Engineer:
TEC Studio
7510 Slate Ridge Blvd.
Columbus, OH 43068
 6. Fountain Design:
Southern Aquatics, Inc
150 Hilden Road, Suite 305
Ponte Vedra Beach, FL 32081
- E. Construction Manager: The contractor entering into signed agreement with the Owner.
1. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.
- F. Web-Based Project Software: Project software administered by the Contractor will be used for purposes of managing communication and documents during the construction stage.
1. See Section 01 31 00 "Project Management and Coordination." for requirements for establishing, administering and using web-based Project software.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
1. Centennial Plaza project site is located in downtown Canton, OH. at the block of 3rd St NW and 4th St. NW, Market Ave. N, and Court Ave NW. All buildings and structures have been removed from the site. Minor site elements to be removed have been designated on the drawings. Plans indicate areas of granite curb and brick cobble to be salvaged and turned over to the City.
 2. The main structural site components consist of the following: Small café with restroom facilities, performance stage / pavilion structure and iconic rotunda.
 3. Site work includes central plaza with clay unit pavers, event lawn with synthetic turfgrass, decorative gravel, gardens, architectural finished concrete walks and walls, icon signage, ornamental landscaping, landscape irrigation and site furnishings: including environmental lighting, handrails, tables, chairs and benches.
 4. Streetscape work to include new granite curbs, clay paver pedestrian walks, clay paver vehicular roads, seat wall benches, trees in grates and street lighting.
 5. Technical components include programmable performance level audio/video and lighting components to be integrated into the stage /pavilion and rotunda structures.
 6. Commercial grade fog system producing a 4 -5 ft high lingering low-level fog zone to include in-ground vault, high pressure pump, valves and nozzles and radial trench drain.
 7. Work within the City right of ways is required and to comply with all local and State requirements.

8. There are no Alternates.
9. There are two Allowances.
10. Concurrent utility work within the City right-of-way will be performed under separate contract. Coordination between projects will be required.

B. Type of Contract:

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

1.04 WORK BY OWNER

- A. General: Cooperate fully with Owner so work associated with the project but outside of this contract may be carried out smoothly, without interfering with or delaying work by Owner or utility companies (or their contractors). The following concurrent work is anticipated by the City:
1. City of Canton Water Department intends to resolve water main issues on Court Ave NW before the project begins.
 2. City of Canton Water Department will have to make water service tap during construction.
 3. Additional duct bank work and gas line extension work may extend into project area during the project's schedule.
 4. Dominion Gas line relocation project on 3rd Street from Cleveland to Market with extension on Court from 3rd Street.

1.05 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. 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.
1. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.06 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: As per the Modified Standard General Conditions of the Construction Contract.
- 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 Landscape Architect and Owner not less than three days in advance of proposed utility interruptions.
 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Landscape Architect and Owner not less than three days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- F. Employee Screening: Comply with State of Ohio requirements for drug and background screening of Contractor personnel working on Project site.
1. Maintain list of approved screened personnel with Owner's representative.

1.07 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. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. This Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order
- C. Types of allowances include the following:
 - 1. Lump-sum allowances.
- D. Related Requirements:
 - 1. Section 01 22 00 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
 - 2. Section 01 40 00 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.
 - 3. Division 02 through 49 Sections for items of Work covered by allowances.

1.02 DEFINITIONS

- A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.03 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Landscape Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Landscape Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Landscape Architect from the designated supplier.

1.04 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.05 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.06 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Landscape Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Landscape Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Landscape Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.07 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
 - 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit must be submitted within 30 days of initial change order authorizing work to proceed on that allowance, otherwise, such claims will be rejected.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Lump-Sum Allowance – includes the sum of \$30,000.00 for one (1) Transit Shelter as shown on Drawings.
 - 1. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.
- B. Allowance No. 2: Production Equipment – includes the sum of \$250,000.00 for the Production Equipment as shown on Drawings.
 - 1. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.

END OF SECTION 01 21 00

SECTION 01 22 00 - UNIT PRICES FORM

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 01 21 00 "Allowances" for procedures for using unit prices to adjust quantity allowances.
 - 2. Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 3. Section 01 40 00 "Quality Requirements" for field testing by an independent testing agency.

1.02 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as an installed price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.03 PROCEDURES

- A. Unit prices include all necessary materials such as but not limited to: base material for pavements, re-bar in walls/foundations, sealants, expansion joint material, etc. plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: All associated materials, equipment and labor to install. Contractor to assume standard equipment on site.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 BID INFORMATION

- A. Bidder: _____
- B. Project Name: Centennial Plaza
- C. Project Location: Canton, OH
- D. Owner: City of Canton
- E. Landscape Architect: MKSK Design, Columbus, OH
- F. Landscape Architect Project Number: c18514

3.02 BID FORM SUPPLEMENT

- A. This form is required to be attached to the Bid Form.
- B. The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work and for adjustment of the quantity given in the Unit-Price Allowance for the actual measurement of individual items of the Work.
- C. If the unit price does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

3.03 SCHEDULE OF UNIT PRICES

- A. Unit Pavers: Installation to include excavation, compaction, base, setting beds and unit paver with sand joints as per specifications and drawings.
 - 1. Pavement Type P1: Pedestrian \$ _____ per sq. ft.
 - 2. Pavement Type P1.2: Vehicular \$ _____ per sq. ft.
 - 3. Pavement Type P2: Vehicular \$ _____ per sq. ft.
 - 4. Pavement Type P3: Promenade \$ _____ per sq. ft.
 - 5. Pavement Type P4: ADA Band \$ _____ per sq. ft.
 - 6. Pavement Type P5: Pavement Markings \$ _____ per sq. ft.
 - 7. Pavement Type P12: Vehicular \$ _____ per sq. ft.
- B. Decorative Aggregate: Installation to include excavation, compaction, edging and placement of decomposed granite aggregate with stabilizer as per specifications and drawings.
 - 1. Pavement Type P6: Decomposed Granite w/stabilizer \$ _____ per sq. ft.
- C. Concrete Pavement – Placement of new concrete including excavation, form-work, aggregate base and finish work as per specifications and drawings.
 - 1. Pavement Type P7: Pedestrian Architectural Concrete Walk \$ _____ per sq. ft.
 - 2. Pavement Type P9: Pedestrian Duty Concrete \$ _____ per sq. ft.
 - 3. Pavement Type P10: City Standard Crosswalk \$ _____ per sq. ft.
- D. Asphalt Pavement
 - 1. Asphalt Cutting and Removal:
 - a. Saw cutting and removal of existing asphalt in City Right of Ways. Prep areas to receive new asphalt – Pavement Type P8. \$ _____ per sq. ft.
 - 2. Pavement Type P8:
 - a. Placement of new asphalt-on-grade including excavation, compaction, aggregate base and asphalt pavements as per City of Canton Engineer's Standard Drawing No. 32. \$ _____ per sq. ft.
- E. Walls: Installation to include excavation, compaction, sub-base, drainage, backfill and wall with reinforcement and finish as per specifications and drawings.
 - 1. Wall Type W1: 4" CIP Conc. Curb w/sandblast finish \$ _____ per ln. ft.
 - 2. Wall Type W2: 6" CIP Conc. Curb w/sandblast finish \$ _____ per ln. ft.
 - 3. Wall Type W3: 18" CIP Conc. Seatwall/Retaining Wall w/sandblast finish \$ _____ per ln. ft.
 - 4. Wall Type W5: Flush Granite Curb \$ _____ per ln. ft.
 - 5. Wall Type W5: Standard 6" Granite Curb \$ _____ per ln. ft.
- F. Furnishings – Provide and install as per plans and manufacturers specifications.

1.	F1 – Landscape Forms Parc Centre Table	\$ _____	ea
2.	F2 – Landscape Forms Harpo Chair	\$ _____	ea
3.	F3 – Multiplicity Table and Benches (1T / 2B = 1 unit)	\$ _____	per unit
4.	F4 – Pebble Bench	\$ _____	ea
5.	F5 – Bike Rack	\$ _____	ea
6.	F6 – Waste Receptacle	\$ _____	ea
7.	F7 – Recycling Receptacle	\$ _____	ea
8.	F8 – 17"W x 60L" CIP Concrete Bench (on piers w/sandblast finish)	\$ _____	ea
9.	F9 – 48"W x 60L" CIP Concrete Bench (on piers w/sandblast finish)	\$ _____	ea
10.	F10 – Paver Grate	\$ _____	ea
G. Landscape / Misc. – Provide and install as per plans and specifications.			
1.	Planting Soil – Type: Manufactured Planting Mix	\$ _____	per cy
2.	Planting Soil – Type: Sand Base Structural Soil Mix	\$ _____	per cy
3.	4" Perforated Drain Pipe w/aggregate backfill	\$ _____	per ln ft
H. Signage – Provide and install as per plans and specifications.			
1.	Digital Kiosk (Turnkey)	\$ _____	per unit
2.	Canton Signage	\$ _____	per unit
I. Lighting – Provide and install w/electric as per plans and specifications.			
1.	Street Pole w/concrete base and single fixture	\$ _____	per unit
2.	Street Pole w/concrete base and double fixture	\$ _____	per unit

END OF SECTION 01 22 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for post-bid substitutions.
- B. Related Requirements:
 - 1. Section 01 21 00 "Allowances" for products selected under an allowance.
 - 2. Section 01 23 00 "Alternates" for products selected under an alternate.
 - 3. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.02 DEFINITIONS

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

1.03 ACTION SUBMITTALS

- A. Substitution Requests: Submit one electronic copy in PDF format of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of form provided in 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. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.

- i. 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. Landscape Architect's Action: If necessary, Landscape Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Landscape Architect will notify Contractor of acceptance or rejection of proposed substitution within seven days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Landscape Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Landscape Architect does not issue a decision on use of a proposed substitution within time allocated.

1.04 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.

1.05 PROCEDURES

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

1.06 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: Landscape Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Landscape 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.

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 21 00 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 01 22 00 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 3. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 4. 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 at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
- 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 Architect.
 - c. Architect's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of EJCDC Document C-620.
 - 3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.

- d. Name of manufacturer or fabricator.
- e. Name of supplier.
- f. Change Orders (numbers) that affect value.
- g. Dollar value 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.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
5. 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.
6. 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.
7. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
8. 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.
9. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements.
10. 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. Comply with Owner/Contractor Agreement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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. Administrative and Supervisory Personnel.
 - 3. Coordination drawings.
 - 4. RFIs.
 - 5. Digital project management procedures.
 - 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, 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 seven 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 and issue to Client and Landscape Architect electronically by email. 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 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 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.

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- B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format or PDF format.
 3. 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 DWG.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to 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.
 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. Software-Generated RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Landscape Architect.
1. Attachments shall be electronic files in PDF format.
- D. Landscape Architect's Action: Landscape Architect will review each RFI, determine action required, and respond. Allow five working days for Landscape Architect's response for each RFI. RFIs received by Landscape Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of 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 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 in writing within 3 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Landscape Architect.
 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 response was received.
 8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Landscape Architect'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 Adobe, Revit, and 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 Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Landscape Architect.

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- 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, 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.
 - l. Mobile device compatibility, including smartphones and tablets.
 2. Provide up to seven web-based Project software user licenses for use of Owner, Construction Manager, Landscape Architect, and Landscape Architect's consultants.
 3. 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.
 4. Provide one of the following web-based Project software packages under their current published licensing agreements:
 - a. Autodesk; Buzzsaw / Constructware.
 - b. Corecon Technologies, Inc.
 - c. Meridian Systems; Prolog.
 - d. Newforma, Inc.
 - e. Procore Technologies, Inc.
 - f. Viewpoint, Inc.; Viewpoint for Project Collaboration.
- 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 10 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 and Landscape Architect, within three days of the meeting.
- B. Preconstruction Conference: 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. 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 conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. First aid.
 - z. Security.
 - aa. Progress cleaning.
 3. 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

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- installations that have preceded or will follow, shall attend the meeting. Advise Landscape Architect, and Owner's Commissioning Authority 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. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to 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, 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.

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- c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. 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 biweekly or at intervals as determined by the Construction schedule, progress of work and agreed to by the Owner and Landscape Architect.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner 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) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.

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- 14) Status of RFIs.
 - 15) Status of Proposal Requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) 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.
- F. Coordination Meetings: Conduct Project coordination meetings at regular intervals to be determined by Owner and schedule demands. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority 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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Status of RFIs.

- 15) Proposal Requests.
 - 16) Change Orders.
 - 17) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

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

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- 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. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
 - D. 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.
 - E. 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.
 - F. Construction Schedule Updating Reports: Submit with Applications for Payment.
 - G. Daily Construction Reports: Submit at weekly intervals.
 - H. Material Location Reports: Submit at weekly intervals.
 - I. Site Condition Reports: Submit at time of discovery of differing conditions.
 - J. Unusual Event Reports: Submit at time of unusual event.
 - K. Qualification Data: For scheduling consultant.

1.04 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work stages, area separations and interim milestones.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.05 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. 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 the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- 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 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 under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.

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- c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 7. 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.
 - n. Commissioning.
 8. 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 to provide for the following:
 - 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.
 9. Other Constraints: .
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- F. 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.
- G. 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.

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- H. Distribution: Distribute copies of approved schedule to Landscape Architect and 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 the Notice to Proceed.
- 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. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events.
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Work Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.

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20. 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 01 32 00

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 accessing project Digital Data files, submitting coordination drawings and subcontract list and for web-based Project software requirements.
 - 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.
 - 9. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

1.02 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Landscape Architect'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 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 FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Landscape Architect.
 - 4. Name of Contractor.
 - 5. Name of subcontractor.
 - 6. Name and address of supplier.
 - 7. Name and address of manufacturer.

8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 9. Category and type of submittal.
 10. Submittal purpose and description.
 11. Submittal number or other unique identifier, including revision identifier.
 - a. Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
 12. Number and title of appropriate Specification Section.
 13. Drawing number and detail references, as appropriate.
 14. Location(s) where product is to be installed, as appropriate.
 15. Other necessary identification.
- B. 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 on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- C. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- D. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.04 SUBMITTAL PROCEDURES

- A. General: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination" for Digital Project Management Procedures related to accessing and using Landscape Architectural Cad documents.
- B. 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 will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 2. Web-Based Project 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.
 3. Paper: Prepare submittals in paper form, and deliver to Landscape Architect.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Landscape Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

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- D. Submittals Schedule: Comply with requirements in Section 01 32 00 "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- E. Processing Time: Allow enough 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 7 days for the Landscape Architect 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 7 days for the Landscape Architect for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Landscape Architect's consultants, Owner, or other parties is indicated, allow 14 days for initial review of each submittal.
- F. 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.
- G. Use for Construction: Use only final submittals with mark indicating "Reviewed" by Landscape Architect.
- H. Additional Copies: Unless additional copies are required for final submittal, and unless Landscape Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Landscape Architect.
 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Landscape Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name.
 - b. Date.
 - c. Destination (To:).
 - d. Source (From:).
 - e. Names of subcontractor, manufacturer, and supplier.
 - f. Category and type of submittal.
 - g. Submittal purpose and description.
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Transmittal number, numbered consecutively.
 - k. Submittal and transmittal distribution record.
 - l. Remarks.
 - m. Signature of transmitter.
 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Landscape Architect on previous submittals, and deviations from requirements in the Contract

Documents, including minor variations and limitations. Include same label information as related submittal.

- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked "Reviewed."

1.05 ACTION SUBMITTAL REQUIREMENTS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Number of Copies: Unless noted, submit three opaque hard copies of each submittal or deliver one copy electronically through email or web-based file systems.
 - 2. Submit five hard copies where copies are required for operation and maintenance manuals. Landscape Architect will retain one copy; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
 - o. Availability and delivery time information.
 - 4. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.

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- h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
 - m. Relationship and attachment to adjoining construction clearly indicated.
 - n. Seal and signature of professional engineer if specified.
 - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Project name and number
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of appropriate Specification Section.
 - 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Landscape Architect will return submittal with options selected.
 - 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Unless noted otherwise in each Sections, submit three sets of Samples.. 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.
- E. Submittals Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

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- F. 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. Use CSI Form 1.5A. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
 4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Landscape Architect will return two copies.
 - a. Mark up and retain one returned copy as a Project Record Document.

1.06 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit one copy of each submittal, unless otherwise indicated. Landscape Architect will not return copy.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 3. Test and Inspection Reports: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Landscape Architects and owners, and other information specified.
- E. 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.
- F. 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 Welding

Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

- G. 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 primers and substrate preparation needed for adhesion.
 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.
- H. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 32 "Operation and Maintenance Data."
- I. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- J. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- K. Construction Photographs: Comply with requirements specified in Section 01 32 33 "Photographic Documentation" when required.
- L. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Landscape Architect.
1. Landscape Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

1.07 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Landscape Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three 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. 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.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
1. Landscape Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.09 LANDSCAPE ARCHITECT'S REVIEW

- A. General: Landscape Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Landscape Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Landscape Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Informational Submittals: Landscape Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Landscape Architect will forward each submittal to appropriate party.

- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 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, 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 21 00 "Allowances" for testing and inspection allowances.
 - 2. Section 01 32 00 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 3. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.02 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. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
 2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as part of permanent construction, consisting of multiple products, assemblies, and subassemblies.
 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
- F. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- G. 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.
- H. 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.
- I. 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.
- J. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- K. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.03 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.

1.04 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.

1.05 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior and laboratory 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.

1.06 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.
 - a. Project title and number.
 - b. Name, address, and telephone number of testing agency.
 - c. Dates and locations of samples and tests or inspections.
 - d. Names of individuals making tests and inspections.
 - e. Description of the Work and test and inspection method.
 - f. Identification of product and Specification Section.
 - g. Complete test or inspection data.
 - h. Test and inspection results and an interpretation of test results.
 - i. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

- j. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - k. Name and signature of laboratory inspector.
- 2. 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.

1.07 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 7 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.

1.08 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.

1.09 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 E 329; 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; 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, 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.
 - 3. Notify Landscape Architect seven 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 approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow three 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.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
- M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

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

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6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 - a. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 - 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.
 1. 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
 - D. Testing Agency Responsibilities: Cooperate with Landscape Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Landscape Architect 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.
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1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Comply with Engineer's Drawings: Structural General Notes - Testing and Inspections.

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 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 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.01 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.

1.02 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.03 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 in the following list. Abbreviations and acronyms not included in this list 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." The

information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.

47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>.
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csagroup.com.
65. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.

97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. IAS - International Approval Services; (See CSA).
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
113. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
114. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
115. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
116. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
117. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
118. ISO - International Organization for Standardization; www.iso.org.
119. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
120. ITU - International Telecommunication Union; www.itu.int/home.
121. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
122. LMA - Laminating Materials Association; (See CPA).
123. LPI - Lightning Protection Institute; www.lightning.org.
124. MBMA - Metal Building Manufacturers Association; www.mbma.com.
125. MCA - Metal Construction Association; www.metalconstruction.org.
126. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
127. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
128. MHIA - Material Handling Industry of America; www.mhia.org.
129. MIA - Marble Institute of America; www.marble-institute.com.
130. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
131. MPI - Master Painters Institute; www.paintinfo.com.
132. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
133. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
134. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
135. NADCA - National Air Duct Cleaners Association; www.nadca.com.
136. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
137. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
138. NBI - New Buildings Institute; www.newbuildings.org.
139. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
140. NCMA - National Concrete Masonry Association; www.ncma.org.
141. NEBB - National Environmental Balancing Bureau; www.nebb.org.
142. NECA - National Electrical Contractors Association; www.necanet.org.
143. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
144. NEMA - National Electrical Manufacturers Association; www.nema.org.
145. NETA - InterNational Electrical Testing Association; www.netaworld.org.

146. NFHS - National Federation of State High School Associations; www.nfhs.org.
147. NFPA - National Fire Protection Association; www.nfpa.org.
148. NFPA - NFPA International; (See NFPA).
149. NFRC - National Fenestration Rating Council; www.nfrc.org.
150. NHLA - National Hardwood Lumber Association; www.nhla.com.
151. NLGA - National Lumber Grades Authority; www.nlga.org.
152. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
153. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
154. NRCA - National Roofing Contractors Association; www.nrca.net.
155. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
156. NSF - NSF International; www.nsf.org.
157. NSPE - National Society of Professional Engineers; www.nspe.org.
158. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
159. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
160. NWFA - National Wood Flooring Association; www.nwfa.org.
161. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
162. PDI - Plumbing & Drainage Institute; www.pdionline.org.
163. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
164. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
165. RFCI - Resilient Floor Covering Institute; www.rfci.com.
166. RIS - Redwood Inspection Service; www.redwoodinspection.com.
167. SAE - SAE International; www.sae.org.
168. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
169. SDI - Steel Deck Institute; www.sdi.org.
170. SDI - Steel Door Institute; www.steeldoor.org.
171. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
172. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
173. SIA - Security Industry Association; www.siaonline.org.
174. SJI - Steel Joist Institute; www.steeljoist.org.
175. SMA - Screen Manufacturers Association; www.smainfo.org.
176. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
177. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
178. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
179. SPIB - Southern Pine Inspection Bureau; www.spib.org.
180. SPRI - Single Ply Roofing Industry; www.spri.org.
181. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
182. SSINA - Specialty Steel Industry of North America; www.ssina.com.
183. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
184. STI - Steel Tank Institute; www.steeltank.com.
185. SWI - Steel Window Institute; www.steelwindows.com.
186. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
187. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
188. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
189. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
190. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
191. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
192. TMS - The Masonry Society; www.masonrysociety.org.
193. TPI - Truss Plate Institute; www.tpinst.org.
194. TPI - Turfgrass Producers International; www.turfgrassod.org.

195. TRI - Tile Roofing Institute; www.tilerroofing.org.
 196. UL - Underwriters Laboratories Inc.; www.ul.com.
 197. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 198. USAV - USA Volleyball; www.usavolleyball.org.
 199. USGBC - U.S. Green Building Council; www.usgbc.org.
 200. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 201. WA - Wallcoverings Association; www.wallcoverings.org.
 202. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 203. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 204. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 205. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 206. WI - Woodwork Institute; www.wicnet.org.
 207. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 208. WWPA - Western Wood Products Association; www.wwpa.org.
- 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. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and

regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. ODOT; Ohio Department of Transportation; www.dot.state.oh.us.
 2. COCED: City of Canton Engineering Department; www.cantonohio.gov/engineering.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.02 USE CHARGES

- A. General: Installation and removal of 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, Owner's construction forces, Landscape Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Provide connections and extensions of services as required for construction operations.
 - 1. Water service is available with no use charge from the Canton Water Dept. for water. Point of Connection to be determined.
- C. Electric Power Service from Existing System. Provide connections and extensions of services as required for construction operations.
 - 1. Contact local provider (AEP) for temporary service.
- D. Contractor to provide Port-a-Jons.

1.03 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. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, type styles, graphic elements, and message content.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.04 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.

PART 2 - PRODUCTS

2.01 TEMPORARY FACILITIES

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

- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Landscape 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 12-15 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.

2.02 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION, GENERAL

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

3.03 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, 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. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
- 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. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.

3.04 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Landscape Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
 - 1. Space maybe limited and require Contractor to make other arrangements.
 - 2. Construction parking on Cleveland and Market Streets will not be permitted.
 - 3. City recommends using lot located on south side of 3rd NW, between Cleveland and Court Streets.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.

- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.05 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.
- 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. 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.
- F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations and as indicated on Drawings.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.06 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: 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 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.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.07 OPERATION, TERMINATION, AND REMOVAL

- A. 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.
- B. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

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 21 00 "Allowances" for products selected under an allowance.
 - 2. Section 01 23 00 "Alternates" for products selected under an alternate.
 - 3. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
 - 4. Section 01 40 00 "Quality Requirements"
 - 5. Section 01 42 00 "References" for applicable industry standards for products specified.
 - 6. 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. Landscape 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 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.
- 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 21, 22, 23, and 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.
- 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 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 not 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 not 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 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 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. Cutting and patching.
 7. Coordination of Owner-installed products.
 8. Progress cleaning.
 9. Starting and adjusting.
 10. Overhead Attachments.
 11. Protection of installed construction.
 12. Prohibited Methods.
- B. Related Requirements:
1. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.
 2. Section 01 10 00 "Summary" for limits on use of Project site.
 3. Section 01 33 00 "Submittal Procedures" for submitting surveys.
 4. Section 01 45 00 "Quality Control".
 5. Section 01 60 00 "Product Requirements".
 6. 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.

1.02 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.03 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional land surveyor.
- B. Certificates: Submit certificate signed by professional land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: For work within public right of ways, submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- D. Certified Surveys: Submit two copies signed by professional land surveyor for all new underground "as-built" utility installation.
- E. Final Property Survey: Submit four (4) copies showing the Work performed and record survey data.

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. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 1. Structural Elements: When cutting and patching structural elements, notify Landscape Architect of locations and details of cutting and await directions from Landscape Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Landscape Architect's opinion, reduce aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- D. 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.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Landscape Architect for the visual and functional performance of in-place materials.

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.
- 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 and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents 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 promptly.
- B. General: Engage a professional 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 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.

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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Landscape Architect 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.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property and new underground utilities) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 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.
 - a. Where pipes occur in partitions, furred-out spaces and chases, determine exact location and size and fit entirely concealed into allotted space. Report conflicts to Landscape Architect prior to installation.
 - b. Where two or more pipes are to be installed in parallel, or parallel to the piping of other trades, the piping shall be installed with sufficient space between the pipes to allow for the proper application of pipe covering, painting, and servicing.
 - c. Furnish advance information on locations and sizes of frames, boxes, sleeves and openings needed for the Work to installers.
 4. Install work to allow for installation of future work identified on drawings.
 5. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- 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. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. 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.
- H. 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 Landscape 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 or masonry. Deliver such items to Project site in time for installation.
- I. 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.
- J. 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 CUTTING AND PATCHING

- A. Cutting and Patching within Public Right of Ways, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. 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.
 - 4. 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 or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: 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.

3.08 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.
- D. 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.
- E. Protect finish of installed products until Substantial Completion of the Project by use of wrappings, covers or other approved protective devices. Remove such protection immediately prior to final cleaning.
- F. Limiting Exposures: Coordinate and supervise construction activities 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. Maintain exposures within the manufacturers recommended limits.

END OF SECTION 01 73 00

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.
 - 5. Repair of the Work.
- 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 10 days 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 changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days 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 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 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 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.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Landscape Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in one of the following formats:
 - a. MS Excel electronic file. Landscape Architect will return annotated file.

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 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.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

- installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 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 and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Sweep concrete floors broom clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

- m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
 - o. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.
- D. 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.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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 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 PDF file 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 one (1) hard copy and one (1) digital PDF file 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.

1.04 **FORMAT OF OPERATION AND MAINTENANCE MANUALS**

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
 - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 - 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.05 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 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.

2.02 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.

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- D. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
 - E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
 - F. Piped Systems: Diagram piping as installed, identifying color coding where required for identification.

2.03 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.

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- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
 - F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
 - G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
 - H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
 - I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
 - J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of maintenance manuals.

2.04 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.

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- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
 - F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
 - G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

- A. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- B. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- C. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

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.
 - 4. Miscellaneous record submittals.
- 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 two paper-copy set(s) of marked-up record prints.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

- b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Work Change Directive.
 - k. Changes made following Landscape Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Landscape Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: DWG, Version , Microsoft Windows operating system.
 3. Format: Annotated PDF electronic file with comment function enabled.
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Landscape Architect for resolution.
 6. 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.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.

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.
 - 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.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

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

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 reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 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.
 - 2. Demonstration and training video recordings.
- B. Allowances: Furnish demonstration and training instruction time under the demonstration and training allowance as specified in Section 01 21 00 "Allowances."
- C. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Section 01 22 00 "Unit Prices."

1.02 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. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator or instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.03 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Landscape Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
 - 3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to

corresponding training components. Include name of Project and date of video recording on each page.

4. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.04 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.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 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 Landscape Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.

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- e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.

8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Landscape Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 3. Owner will furnish Contractor with names and positions of participants.
- C. 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 Landscape Architect, with at least seven days' advance notice.
- D. 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.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and performance-based test.
- F. 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.

3.03 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 1. Submit video recordings on CD-ROM or thumb drive or by uploading to web-based Project software site.
 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.

3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- B. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- C. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- D. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected site elements.
 - 2. Salvage of existing items, palettize and handover to Client.
 - 3. Protect existing small site elements.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for restrictions on use of the premises.
 - 2. Section 01 73 00 "Execution" for cutting and patching procedures.

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.03 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.04 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 4. Review areas where existing construction is to remain and requires protection.

1.05 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.
- D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.06 CLOSEOUT SUBMITTALS

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

1.07 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Landscape Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Landscape Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.

3.03 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- B. Remove temporary barricades and protections where hazards no longer exist.

3.04 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 2. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.06 CLEANING

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

END OF SECTION 02 41 19

**SECTION 03 30 00 - CAST-IN-PLACE CONCRETE
(CAFÉ BUILDING ONLY)**

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Division 32 Section "Concrete Paving" and "Decorative Concrete Paving" for concrete pavement and walks.

1.03 DEFINITIONS

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

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.05 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Curing compounds.

5. Floor and slab treatments.
 6. Bonding agents.
 7. Adhesives.
 8. Vapor retarders.
 9. Joint filler.
 10. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates.
- C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- D. Field quality-control reports.

1.06 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 Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency shall be retained by the owner, shall be acceptable to authorities having jurisdiction, and shall be qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI117.

2.02 FORM-FACING MATERIALS

- A. General: Formwork and accessories shall conform to ACI 301, Section 2.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.03 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars (weldable): ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, 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:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 CONCRETE MATERIALS

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

- B. Cementitious Materials: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I or Type III.
 - 2. Fly Ash: ASTM C 618, Class F or C.
 - 3. Ground Granulated Blast-Furnace Slag: ASTM C 989/C 989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: as indicated on the drawings.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.06 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260/C 260M.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.07 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class C, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

2.08 CURING MATERIALS

- A. General: As per ACI 301, Section 5, Article 5.2, with selections and supplements as specified herein.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1 D, Class B, dissipating (sodium silicate type not permitted) having a fugitive dye to facilitate visual check of coverage.

2.09 RELATED MATERIALS

- A. Premolded Joint Filler: Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork. ½" thick x full depth of slab.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyuria with a Type A shore durometer hardness range of 90 to 95 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: The use of fly ash or ground granulated blast-furnace slag to reduce the total amount of portland cement, which would otherwise be used is permitted. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 20 percent.
 2. Ground Granulated Blast-Furnace Slag: 15 percent.
 3. Flyash shall not be used in combination with GGBFS.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and high-range 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.

2.12 FABRICATING REINFORCEMENT

- A. General: Reinforcement shall conform to ACI 301, Section 3.
- B. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces exposed to view.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces intended to receive plaster, stucco or wainscoating.
 - 3. Class C, 1/2 inch for permanently exposed surfaces where finishes are not specified
- 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. All exterior corners and edges of permanently exposed concrete shall be chamfered where shown on the drawings.
- 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.

3.02 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."

3.03 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.04 STEEL REINFORCEMENT

- A. General: Reinforcement shall conform to ACI 301, and shall comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. **[Weld reinforcing bars according to AWS D1.4, 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. General: Joints shall conform to ACI 301, Section 5. Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth as shown in the drawing details.
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting

action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks (0-2 hours after the final finish at each joint location) using the early-entry dry-cut process per ACI 302.1R. The saw shall employ the use of a skid plate to prevent spalling and raveling of the slab.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.06 CONCRETE PLACEMENT

- A. General: As per ACI 301, Section 5, except as noted.
- B. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed, including cleaning of reinforcing steel and forms.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- D. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average 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 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- E. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- F. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- G. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.07 FINISHING FORMED SURFACES

- A. General: As per ACI 301, Section 5, Article 5.3.3.
- B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. **[For floors less than or equal to 10,000 sf, finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.]**

- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on the architectural drawings [**where ceramic or quarry tile is to be installed by either thickset or thin-set method**]. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.09 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inchlap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least **[one] [six]** month(s). Do not fill joints until construction traffic has permanently ceased.
- 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. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

- Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- D. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- E. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Concrete testing shall be in accordance with ACI 301, Section 1, Article 1.6 except as noted herein.
- C. Required special inspection and verification as outlined in the applicable building code including but not limited to:
1. Steel reinforcement and placement.
 2. **[Steel reinforcement welding.]**
 3. Embedded bolts and studs to be installed in concrete prior to concrete placement.
 4. Verification of use of required design mixture.
 5. At the time concrete is sampled for test cylinders, perform slump and air content tests and temperature of concrete.
 6. Concrete placement, including conveying and depositing.
 7. Curing procedures and maintenance of curing temperature.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture of less than 25 cu. yd. plus one set for each additional 50 cu. yd. or fraction thereof, unless authorized otherwise by the engineer.
 - a. When frequency of testing will provide 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. All samples shall be taken after any addition of water at the job site is complete. When pumping or pneumatic equipment is used, samples shall be taken at discharge end. This is for both cylinders and slump tests.
 3. Slump: ASTM C 143/C 143M; 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.
 4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - a. Air content tests shall be made on all concrete whether the concrete is designated as air-entrained or not.
 - b. Additional air contents tests, for concrete specified as air-entrained, shall be made when any of the following conditions occur:

- 1) A change in appearance or consistency of concrete.
- 2) Possible reduction of air content due to time delays of truck and/or hot weather.
- 3) When air temperature is over 80 deg F, check each truck load.
- c. Inform Engineer immediately of any slump and/or air content tests that do not meet these specifications. If strength, durability or aesthetics of the structure would be impaired, that concrete shall not be used.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure either 6" x 12" or 4" x 8" standard cylinder specimens for each composite sample as follows:
 - 1) Four cylinders, each 6 inches diameter by 12 inches tall, or
 - 2) Five cylinders, each 4 inches diameter by 8 inches tall.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days (2 days for post-tensioned concrete) and one set of specimens at 28 days. Retain one specimen for possible 56 day test if required.
 - a. The 28-day compressive-strength test shall be the average compressive strength from a set of laboratory-cured specimens obtained from same composite sample and tested at age indicated.
 - b. Each set of 28-day laboratory-cured specimens shall consist of one of the following, at a minimum. Cylinder sizes shall remain consistent for each concrete mixture for the duration of the project.
 - 1) Two cylinders, each 6 inches diameter by 12 inches tall.
 - 2) Three cylinders, each 4 inches diameter by 8 inches tall.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive 28-day compressive-strength tests equals or exceeds specified compressive strength and no 28-day compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to the Structural Engineer, Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Verbal information on any concrete not meeting these specifications shall be communicated to the engineer immediately by phone.
11. 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.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M by other methods as directed by Architect.
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.

E. [Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.]

END OF SECTION

**SECTION 03 30 00 - CAST-IN-PLACE CONCRETE
(Stage/Pavilion/Rotunda Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Foundations.
- B. Related Sections include the following:
 - 1. Division 05 Section "Structural Steel Framing" for steel framing and anchors.

1.03 DEFINITIONS

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

1.04 SUBMITTALS

- A. General:
 - 1. Review of submittals is of a general nature only, and the responsibility for conformance with intent of drawings shall remain with the Contractor. Review does not imply or state that the fabricator has correctly interpreted the construction documents.
 - 2. All submissions shall be in accordance with the submission schedule developed and agreed between the Architect and Contractor at the commencement of the project. Submission shall include dates of order and delivery of materials to the shop and the site.
 - 3. Shop drawing schedule shall allow adequate time for reviews. Reinforcing steel shall not be fabricated or placed before the shop drawings have been reviewed by the Architect and returned.
- B. Product Data: For each type of product indicated, including ICC-ES for mechanical couplers.
- C. Design Mixtures: Each concrete mix design to be used on the project shall be reviewed and approved by the Testing Agency and Architect prior to concrete being delivered to site. Submit proposed mix designs for each class of concrete on the Mix Design submittal form included at the end of this specification. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. For each concrete mixture, the following information shall be included: where the mix is to be used, all materials and admixtures including their source and proportions in the mix; Water content, water-to-cement ratio, slump, and aggregate grading; whether the mixture is appropriate for pumping; and total chloride content.

2. Provide shrinkage test results for mixes with shrinkage criteria showing that mix meets performance criteria. The mix design number must match with the mix design number shown on the test data.
 3. Indicate compressive strength and method used to determine strength. The compressive strength of the concrete shall be proportioned per ACI. Include all calculations and tests required by ACI 318 Section 5.3 and 5.4. Laboratory test data must be submitted along calculations that show with each mix design meets the strength requirement. Mix design number must match the mix design number shown on the test data. Include all test results or past history back up data specific as part of the submittal. Test results within the past two years shall be used to indicate performance in accordance with past history.
 4. Indicate amounts of mixing water to be withheld for later addition at Project site.
 5. Each mix shall be stamped and signed by a Professional Engineer licensed in the State of Ohio.
- D. Steel Reinforcement Shop Drawings: Placing drawings in accordance with SP 66 that detail fabrication, bending, and placement. Direct copies of the contract documents are not acceptable as a submission from the Contractor.
1. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include any welding to be done.
 2. Shop drawings shall make it clear where each bar is located. Beams, grade beams and walls shall be shown in elevation. On elevations show locations of sleeves and penetrations.
 3. Check architectural, structural, mechanical, and electrical and other contract documents for anchor bolt schedules and locations, anchors, inserts, conduits, sleeves, and any other items which are required to be cast in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
 4. Show all areas of congestion. Identify where reinforcing steel will interfere with the placement of embedded items such as anchor bolts, anchors, inserts, conduits, sleeves and any other items which are required to be cast in concrete.
- E. Submit schedule of concrete placement operations before commencing Work.
- F. Show on one or more plans and/or elevations, locations of construction joints, slab edges anchors and sleeves.
- G. Formwork: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
1. Design Criteria:
 - a. Design of concrete formwork, shoring, reshoring and bracing shall be the sole responsibility of the Contractor and shall conform to Code requirements and shall be in accordance with the recommendations of ACI 347. Forms shall provide the required shape and dimensions specified on the Documents.
 - b. Provide forms complete and of such strength and adequately braced so as to prevent any spreading, shifting or settling when concrete is placed to ensure finished concrete surfaces of the required tolerances.
 - c. Forms shall be tight to prevent leakage or washing out of cement mortar from concrete.

- d. Bolts, rods, and other devices when used for internal ties and spreaders shall be of such construction that when the forms are removed, no metal shall be within 1 inch of the exterior concrete surfaces or within 1/2 inch of interior concrete surfaces.
2. Shop Drawing Requirements:
 - a. Shop Drawings shall show location and layout of construction joints, reveals, slab edges, form joints, sleeves, openings, locations of tie holes or plugs, location of embedded items and blockouts, and all related details affecting Architectural quality.
 - b. Formwork details affecting Architectural finish quality shall be reviewed by the Architect.
 - c. Indicate where formwork release agent will be used, as applicable.
- H. Mill Test Reports: Submit steel producer's certificates of mill analysis for each heat or melt of reinforcing steel, including steel source, description, heat number, yield point, ultimate tensile strength, elongation percent, bend test and the chemical composition of each heat as determined by ladle analysis, before delivery of steel to site. Where steel is required to be welded, mill reports shall be used to help verify the weldability of the steel.
- I. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 1. Normal weight aggregate (per ASTM C33 .Include evaluation of reactivity and the following:
 - a. Abrasion Resistance: ASTM C131; Los Angeles Machine.
 - b. Cleanness Value: Test Method NO. C 227; coarse aggregate only.
 - c. Fineness: ASTM C117.
 - d. Organic Impurities: ASTM C40.
 - e. Potential Reactivity: ASTM C289.
 - f. Sieve Analysis: ASTM C136.
 - g. Soundness: ASTM C88.
 - h. Absorption for lightweight aggregate: Maximum 15%.
- J. Product Test Reports and Certificates: For each of the following, signed by manufacturers:
 1. Cementitious materials, per ASTM C150,
 2. Admixtures. Where more than one admixture is used, include certification that admixtures are compatible. Per ASTM C494 for each type used; include chloride ion content.
 3. Steel reinforcement and accessories.
 4. Non-shrink grout, per ASTM C1107.
 5. Bonding agents.
 6. Adhesives.
 7. Repair materials.
- K. Field quality-control test reports.
- L. Submit an affidavit identifying cementitious material used, including manufacturer's lot number, date of shipment by manufacturer, date of receipt by the concrete supplier, place of storage and date of use. If such information is not available, a sample of cementitious material used on the Project shall be taken for each day's pour and shall be tested as directed by the Architect.

- M. Transit-Mix Delivery Slips
1. Keep record at the Site showing time and place of each pour of concrete, together with transit mix delivery slip certifying contents of the pour per ASTM C94. Include the time water was added to dry mix.
 2. Make the record available for inspection at the Site and to the Architect for his review upon request.
 3. Upon completion of this portion of the Work, deliver the record and the delivery slips to the Architect.

1.05 QUALITY ASSURANCE

- A. Standards: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 3. ACI SP-66, "Detailing Manual"
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548..
- D. Testing Agency: Shall be selected and paid for by the Owner, unless otherwise specified; re-testing paid for by the Contractor.
- E. Contractor's Quality Control Plan: Quality Control includes the functions performed by the Contractor to ensure that the material and workmanship of concrete construction meets the project specifications and applicable standards. The Contractor shall submit a Quality Control Plan that addresses all inspection issues, including testing and inspection per ACI. The verification testing and inspection carried out by the Testing Agency does not relieve the contractor of the responsibility for conducting their own quality control/inspection program to ensure the requirements of the Contract Documents have been met. The Contractor's Quality Control Plan will be reviewed by the Testing Agency.
- F. Quality Control Inspector Qualifications: Along with Quality Control Plan, Contractor shall submit written qualifications for all inspectors to be assigned Quality Control functions for concrete work.
- G. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- H. Unidentifiable Reinforcing Steel: Tested by testing agency; paid for by Contractor:
1. Test reinforcing delivered to site which cannot be properly identified by heat number and mill mark for compliance with ASTM A615 as follows:
 - a. No. 8 Bar and Smaller: One tensile test and one bend test of each size per 7-1/2 tons, or portion thereof.
 - b. No. 9 Bar and Larger: One tensile test of each size per 10 tons, or portion thereof.
- I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to test concrete mixtures. When mixes, are proportioned by trial batch

method, engage a Laboratory conforming to ASTM E329 and under direction of a Professional Engineer licensed in Ohio.

- J. Prefabrication and Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Laboratory responsible for field quality control.
 - f. Admixture manufacturer (s)
 - g. Concrete pumping subcontractor
 2. During meeting, review special inspection and testing and inspecting agency procedures for field quality control, cold- and hot-weather concreting procedures, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.
 3. The concrete contractor shall confirm that the proposed mix designs will enable him to properly place, pump, finish and achieve the required concrete quality specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement:
1. Deliver, store, and handle steel reinforcement to prevent bending and damage
 2. Deliver reinforcing to Site properly bundled and tagged. Use tags that indicate bar size, lengths and marks corresponding to markings shown on shop drawings. Segregate so as to maintain identification after bundles are broken.
 3. Store reinforcement in a manner that will prevent excessive rusting or fouling with/grease, oil, dirt, and other bond weakening materials.
 4. Do not use damaged, reworked, or deteriorated material.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- C. Formwork: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
- D. Concrete Materials:
1. Protect cement from moisture and rotate stock to ensure fresh materials.
 2. Protect aggregates as necessary to maintain saturated condition when batched.
 3. Storage methods should comply with ACI 301 4.1.4.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FORM-FACING MATERIALS

- A. A minimum of 50% of the wood materials used for formwork (e.g., dimensional lumber, plywood) shall be "FSC Certified" products which have been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC) of Reston, VA.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form Sealer (Wood Forms): All form sealers shall be of a type which will not harmfully affect the appearance and/or utility of the concrete surface or the application of sealers, paint, vinyl fabric or any other finishes. In addition, form sealer shall prevent the development of bond or adhesion to concrete.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface and permit neat and solid patching at every hole.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- G. Foundation Formwork – Leave in Place: Ribbed mesh fabricated from galvanized sheet steel; stay-form, or equal.

2.03 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Concrete reinforcement shall contain a minimum of 25% combined post-industrial and post-consumer recycled content where the percentage of recycled content is based on the weight of the component materials.
- B. Reinforcing Bars:
 - 1. ASTM A615, Grade 60, deformed, unless noted otherwise.
- C. Tie Wire: American Wire 16 gauge or heavier black annealed wire.
- D. Spiral Reinforcement: Use Plain-Steel Wire if specified as wire or ASTM A615 Grade 60 if specified by bar size.

2.04 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775.
- B. Zinc Repair Material: ASTM A780, zinc-based solder, paint containing zinc dust, or sprayed zinc.
- C. 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:
 - 1. Where supports are placed against ground or atop vapor barrier use precast concrete blocks not less than 3 inches square with two 16 gauge embedded wires.
 - 2. At Architectural Concrete and surfaces exposed to weather; CRSI Class 1 plastic protected.

2.05 REINFORCEMENT FABRICATION

- A. Fabricate reinforcing in accordance with ACI 301, 315 or CRSI "Manual of Standard Practice."
- B. Bending:
 - 1. Do not bend or kink reinforcing except as shown on the Drawings.
 - 2. Minimum bend diameters and hook extensions as shown on the drawings or per ACI.
 - 3. In case of fabrication errors do not rebend or straighten reinforcement in a manner that will injure or weaken the material.
 - 4. Reinforcing bars are to be bent cold, do not preheat, unless approved by Architect.
 - 5. Do not rebend reinforcement that has previously been bent within 6 inches of new bend except as allowed in section 3.3.2.8 of ACI 301.
- C. Spirals: Provide a minimum of 1-1/2 finishing turns top and bottom.
- D. Unacceptable Materials: Reinforcement with any of the following defects shall not be permitted in the Work and will be replaced without cost:
 - 1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
 - 2. Bend or kinks not shown on the Drawings or final shop drawings.
 - 3. Bars with reduced cross-section due to rusting or other cause.

4. Bars with dirt, mud, grease or form release agent.

2.06 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C150, Type II, unless noted otherwise.
 2. Supplement Portland Cement with the following Supplementary Cementitious Materials (SCM):
 - a. Fly Ash: ASTM C618,.
 - b. Slag Cement: ASTM C989, Grade 100 or 120.
 - c. Silica Fume: ASTM C1240. [MasterLife SF 100 (formerly Rheomac SF100) by BASF Corporation or approved equal.]
 - d. Metakaolin: ASTM C618. [MetaMax by BASF Kaolin, Part of BASF Corporation or approved equal.]
 3. Cementitious material used shall have at least 2 years of use with proposed aggregates without detrimental reaction.
 4. Alkali content shall not exceed 0.6% when tested in accordance with ASTM C114.
 5. The temperature of cement delivered to the plant shall not exceed 150 degrees F.

Normal-Weight Aggregates: ASTM C33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Coarse Aggregate:
 - a. Aggregate shall contain no thin or elongated pieces. Any piece having a major dimension more than 2-1/2 times the average thickness shall be considered thin or elongated.
 - b. If shrinkage controlled concrete, Coarse Aggregate shall be crushed limestone, granite, or accepted equal.
 - c. Alkali Silica Reactivity: Aggregate shall be considered non-reactive with documented satisfactory service record for a minimum of ten year period used in concrete with similar cementitious materials. In the absence of service record the aggregate shall be tested and will be considered non-reactive if it passes ASTM C1260 or ASTM C1293 per requirements of the Engineer of Record.
 - d. The maximum size used in a particular location shall be consistent with the form and dimensions of the section being placed, with the location and spacing of the reinforcing steel and with the method of vibration. The aggregate sizes shall be such as will produce dense, uniform concrete, free of rock pockets, honeycombs, or other irregularities.
 - e. Combined aggregate gradation for slabs and other designated concrete shall be 8% to 18% for large top size aggregates (1-1/2-inch) or 8% - 22% for smaller top size aggregates (1-inch or 3/4-inch) retained on each sieve below the top size and above the No. 100.
 2. Combined Aggregate Gradation: Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large size aggregates (1 1/2 in.) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 in.) retained on each sieve below the top size and above the No. 100.
- C. Water: ASTM C1602 clean, free from deleterious matter. Non-potable water is acceptable if meets the chemical content limits of ASTM C1602

Commented [f1]: Are these necessary if crystalline waterproofing admixture or waterproof coating/sealant is applied?

Commented [f2]: Alternate to 10 yrs? Tests? Single source? Ask Bryan

2.07 ADMIXTURES.

- A. General: Only if accepted by the Owner's Representative in accordance with ACI 318/318R 3.6 if they comply with requirements of ASTM C494. Where more than one is used, admixtures shall be compatible. Use of admixtures shall be consistent throughout Work.
1. Where specified herein do not use other admixtures without the written acceptance of the Architect.
 2. Prohibited Admixtures: Admixtures containing intentionally-added chlorides are not permitted. Do not use admixtures that will negatively impact the visual finish of concrete exposed to view.
- B. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other admixtures .
1. Products:
 - a. Grace Construction Materials; Darex AEA or Daravair
 - b. MasterAir AE 90 (formerly MB-AE 90), MasterAir AE 100 (formerly Micro Air) or MasterAir VR 10 (formerly MB VR Standard) by BASF Corporation or approved equal. Euclid Chemical Company (The); Air Mix
- C. Chemical Admixtures: If proposed to be used, provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.
1. Water-Reducing (Plasticizing) Admixture: ASTM C494, Type A. Products:
 - a. Grace Construction Products, W. R. Grace & Co.; "WRDA with Hycol"
 - b. "MasterPozzolith" (formerly "Pozzolith") Series or "MasterPolyHeed" (formerly "PolyHeed") Series by BASF Corporation or approved equal.
 - c. Euclid Chemical Company (The); "WR-75, WR-91 or Eucon MR"
 2. Retarding Admixture: ASTM C494, Type B. Products:
 - a. "MasterSet R" (formerly "Pozzolith") Series or "MasterSet DELVO" (formerly "DELVO") Series by BASF Corporation or approved equal.
 3. Accelerating Admixture or Water-Reducing and Accelerating Admixture: ASTM C494, Type C or Type E. Products:
 - a. MasterPozzolith AC 534 (formerly Pozzolith NC 534) or MasterSet AC 20 (formerly Pozzutec 20+) by BASF Corporation
 - b. Accelguard 80, 90 or NCA by The Euclid Chemical Company
 - c. Polarset by W.R. Grace
 4. Water-Reducing and Retarding Admixture: ASTM C494, Type D. Products:
 - a. Sika Corporation; "Sikament 30,"
 - b. Euclid Chemical Company (The); "Eucon Retarder-75"
 - c. "MasterSet R" (formerly "Pozzolith") Series or "MasterSet DELVO" (formerly "DELVO") Series by BASF Corporation or approved equal.
 5. High-Range, Water-Reducing (Superplasticizers) Admixture: ASTM C494, Type F. Products:
 - a. Grace Construction Products, W. R. Grace & Co.; "WRDA 19 or Daracem 100"
 - b. Sika Corporation; "Sikament 300"
 - c. MasterRheobuild 1000 (formerly Rheobuild 1000) or "MasterGlenium" (formerly "Glenium") Series by BASF Corporation,

- d. Euclid Chemical Company (The); "Eucon 37, 1037 or Plastol 5000"
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G. Products:
 - a. Eucon 537 by The Euclid Chemical Company
 - b. Daracem 100 by W.R. Grace
 - c. Rheobuild 916 by BASF or approved equal.
7. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
8. Workability-Retaining Admixture: ASTM C494, Type S. Products:
 - a. MasterSure Z 60 (formerly RheoTEC Z-60) by BASF Corporation or approved equal.
9. Corrosion-inhibiting admixture: Shall be a nominal 30 percent solution of calcium nitrite or an amine/ester-based organic corrosion-inhibiting admixture. Products:
 - a. MasterLife CI 30 (formerly Rheocrete CNI) or MasterLife CI 222 (formerly Rheocrete 222+) by BASF Corporation or approved equal.
10. Shrinkage-Reducing Admixture: ASTM C494, Type S. Products:
 - a. MasterLife SRA 20 by BASF Corporation or approved equal.
11. Alkali-Silica Reaction-Inhibiting Admixture: ASTM C494, Type S. Shall contain a nominal lithium nitrate content of 30 percent. Products:
 - a. MasterLife ASR 30 (formerly ASRx 30 LN) by BASF Corporation or approved equal.
12. Viscosity-Modifying Admixture: ASTM C494, Type S. Products:
 - a. "MasterMatrix VMA" (formerly "Rheomac VMA") Series by BASF Corporation or approved equal.
 - b. Tamms Industries, Inc.
 - c. Vinylex Corp.

2.08 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Available products:
 1. MasterKure ER 50 (formerly Confilm) by BASF Corporation or approved equal.
- B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film, fiber reinforced asphaltic vapor barrier building paper, or white burlap-polyethylene sheet.
 1. Provide in a thickness of 42 mils; standard weight of 53 lbs./1000 ft²; tensile strength (machine direction) of 36 lbs./in.; and puncture resistance of 70 lbs.
- D. Water: ASTM C1602 clean, free from deleterious matter. Non-potable water is acceptable if meets the chemical content limits of ASTM C1602.

2.09 RELATED MATERIALS

2.10 MORTARS AND GROUTS

- A. Patching Mortar for exposed concrete shall be made of the same material and of approximately the same proportions as used for concrete, except that coarse aggregate shall be omitted and mortar shall consist of not more than 1 part Portland cement to 2-1/2 parts damp loose sand by volume.
1. Combine white and gray Portland cement as necessary to match color specified by Architect. Use no more mixing water than necessary for handling and placing.
 2. Mix patching mortar in advance and allow to stand with frequent mixing with trowel without adding water until it has reached the stiffest consistency that will permit placing.
- B. High Flow Grout:
1. Where high fluidity and/or increased placing time is required, use high flow grout.
 2. ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)".
 3. When placed at a fluid consistency there shall be at least 95% bearing under an 18 inches x 36 inches base plate.
 4. "Hi-Flow Grout" manufactured by The Euclid Chemical Company, "MasterFlow 928" manufactured by BASF Construction Products, or approved equal.
- C. Epoxy grout for anchor reinforcing steel or threaded rods in concrete shall be MasterEmaco ADH 1490 (Formerly Concrevice 1490) as manufactured by BASF Construction Products, or Sikadur 32 Hi-Mod as manufactured by Sika Corporation, or Epoxy 452 or E3G by Euclid Chemical Company, or approved equal.
- D. Cementitious grout for anchor reinforcing steel or threaded rods in concrete shall be MasterFlow 928 grout as manufactured by BASF Corporation, Sika Grout 212 as manufactured by Sika Corporation, Hi-Flow grout by Euclid Chemical Company, or approved equal.
- E. Drypack Mortar for Form Holes at Non-Architectural Grade Surfaces: Composed of 1 part Portland cement and 2 parts of fine aggregate and water. Match color of adjacent surfaces.

2.11 REPAIR MATERIALS

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. The mixes shall be submitted on mix design submittal form at the end of the specification.
1. Procurement of concrete mix design is responsibility of Contractor.
 2. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 3. At the discretion of the Engineer of Record a manufacturer's laboratory may also be approved to perform trial batching. The Manufacturer's lab must be run under the direct supervision of a Professional Engineer and technicians performing the tests must be Both ACI Concrete Field Testing Technician Grade I and Laboratory Testing Technician grade I certified. The facilities must be adequate to properly perform the testing required.
- B. Admixtures: Use admixtures according to 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 accelerating or water-reducing and accelerating admixture in concrete, as required, for cold weather placement or when acceleration of setting time is required.
4. Use high range water-reducing in all fiber concrete pumped concrete, self-consolidating concrete and any concrete with water/cementitious materials ratio below 0.50.

2.13 CONCRETE MIXTURES

A. Definition of Mix Properties:

1. Concrete strength (f'_c) is the minimum compressive strength at 28 days, tested in accordance with ASTM C39.
2. Aggregate size is the largest of the coarse aggregate.
3. Slump shall be measured at the point of delivery in accordance with ASTM C143. Slump tolerance shall meet the requirements of ACI 117. Slump can be increased with use of a high-range water-reducer to improve workability of mix. After addition of high-range water-reducer, slump shall not exceed 9" at point of delivery.
4. Air content is by volume and may be plus or minus 1.5 percent at point of delivery.
5. Water/cementitious materials ratio is specified by weight.
6. Drying shrinkage limit is percentage change in length after 28 days of drying when tested as per ASTM C157 with 4 inches x 4 inches x 11 inches specimen moist cured 7 days prior to drying.

B. Foundations: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (f'_c): 4000 psi
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Maximum Aggregate Size: 1-1/2 inch.
4. Air Content: 6% percent.

C. Fill Below Foundations: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength (f'_c): 500 psi
2. Maximum Water-Cementitious Materials Ratio: 0.50

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. The batching plant shall be equipped with an electric metering device capable of determining moisture content of sand.
 2. Begin the mixing operation within thirty minutes after the cement has been intermingled with the aggregates.

3. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes. Alternatively a retarding admixture may be used where results from testing can be provided for approval by the Engineer of Record.

PART 3 - EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. At least three weeks prior to commencement of concrete work, meet at the Project site to review the proposed mix designs, methods and sequence of concrete construction, standard of workmanship, material selection, testing and quality control requirements, placement procedures, off-site batching requirements, coordination of the work with other trades and other pertinent topics related to the Work. The meeting shall include the following:
 1. Owner's Representative
 2. Architect/Engineer
 3. Construction Manager/General Contractor
 4. Concrete Subcontractor
- B. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design and placing techniques shall produce the concrete quality required by these specifications.

3.02 PREPARATION

- A. Prior to Work specified in this Section, carefully inspect the installed Work of other trades and verify that such Work is complete to the point where this installation may properly commence.
- B. Verify that forms may be constructed in accordance with all applicable codes and regulations, the referenced standards, and the design documents.
 1. Ensure Excavations are sufficient to permit placement, inspection, and removal of forms.
 2. Verify reinforcing steel has been inspected prior to concealing with formwork.
 3. Verify geotechnical engineer has approved all foundation excavations.
- C. The Contractor shall verify all dimensions prior to starting construction.
- D. Coordinate:
 1. Obtain necessary information for coordination of formwork with items to be embedded in concrete.
 2. Coordinate size and location of openings in concrete. Obtain Architects approval for openings not shown on Structural Drawings.
- E. Discrepancies:
 1. Notify the Architect of any discrepancies or inconsistencies.
 2. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.03 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads and such that formwork can withstand excessive deflection when filled with wet concrete.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, camber and position indicated, within tolerance limits of ACI 117. Make proper provision for all openings, offsets, recesses, anchorage, blocking, and other features of the Work as shown or required. Provide openings as required for vibrators and concrete placing.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class B, 1/4 inch for smooth-formed finished surfaces.
 - 2. Class D, 1 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar. Tape all joints at forms for sandblasted finished concrete, including joints between plywood and trim strips.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Do not allow excess form coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed.

3.04 EARTH FORMS

- A. Earth Forms: Unless otherwise indicated or required by the Construction documents, concrete for foundations that will remain in permanent contact with the soil may be placed directly against vertical excavated surfaces provided the material will stand without caving and suitable provisions are taken to prevent raveling of top edges or sloughing of loose material from walls of

excavation. Sides of excavation shall be made with a neat cut and the width made as detailed on Drawings.

1. Where sides are unstable or excavations are not accurately cut tolerances of ACI 301, construct formwork to the extent required, at no additional cost to Owner.
2. Hand trim sides and bottom of earth forms; remove loose dirt prior to placing concrete.
3. Form footings to minimum extent shown on Drawings.

3.05 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded. Ensure that embedded items are placed and held, during placing of concrete, to tolerances consistent with other items that will be attached to them.
 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- B. Provide pipe sleeves when pipes pass through concrete. Fill voids in sleeves, inserts and anchor slots with readily removable material to prevent entry of concrete into voids.
- C. Coring of concrete after placement is not permitted without prior approval by the Engineer of Record.

3.06 REMOVING AND REUSING FORMS

- A. Remove forms carefully to avoid damaging corners and edges of exposed concrete. Prying against the face of concrete shall not be allowed.
- B. All forms below ground surface, along with all shores and braces, shall be removed before backfilling.

3.07 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

3.08 VAPOR RETARDERS

3.09 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 1. Wherever embedded items interfere with placing of reinforcement notify the Architect and obtain approval before placing any concrete. Do not bend or field cut bars around openings or sleeves.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete. Where there is a potential of rust staining adjacent finish surfaces, take necessary steps to prevent staining.
- C. Accurately position, support, and secure reinforcement against displacement, particularly under the weight of workmen and the placement of concrete. Use bar supports in sufficient number, size and location to prevent vertical displacement of the reinforcement and gouging of the

formwork. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Do not exceed the tolerances specified in ACI 117.
 2. Reinforcement shall be held in place by means of supports adequate to prevent displacement and to maintain reinforcement at proper distance from form face. The use of wood supports and spacers inside the forms is not permitted.
 3. Dowels shall be tied securely in place before concrete is deposited. In the event there are no bars in position to which dowel may be tied, No 3 bars (minimum) shall be added to provide proper support and anchorage.
 4. Use templates for placement of column dowels.
 5. Where Drawings do not show the spacing of the reinforcing, the minimum clear spacing shall conform to ACI 318 Section 7.6.
 6. Reinforcing partially embedded in concrete shall not be field bent except as shown on the Drawings or accepted by the Architect.
 7. Wherever conduits, piping, inserts, sleeves, etc., interfere with placing of reinforcing steel, obtain acceptance of method of procedure before any concrete is placed. Bending of bars around openings or sleeves not permitted.
- D. Splicing: Make splices only at those locations shown on the Drawings or as accepted by the Architect. Splice locations not shown on the Drawings shall be approved in shop drawings before fabrication. Stagger splices in adjacent bars wherever possible.
- E. Reinforcing shall be rigidly and securely tied with steel tie wire. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. If allowed, field bending or straightening shall be in accordance with section 3.3.2.8 of ACI 301.
- G. 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 plus 2 inches or 6 inches, whichever is greater. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.10 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Embed keys at least 1-1/2 inches into concrete.
 3. Roughen surface at all construction joints where key is not used and under baseplates. Roughen concrete surface while concrete is still green where possible. Do not leave laitance, loosened particles of aggregate or damaged concrete at surface. Forms and reinforcing shall be cleaned of drippings. Dampen contact surfaces of construction joints, leaving them free of standing water, before placing fresh concrete.

3.11 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Ensure that all foreign material has been removed from surfaces, including reinforcement and embedded items, against which concrete will be placed.
- B. Method: Convey concrete as rapidly and directly as practicable to preserve quality and to prevent segregation.
 - 1. Do not deposit concrete that has initially set. Retempering of concrete, which has partially set, is not permitted.
 - 2. Maximum time for discharge of concrete shall be per ASTM C94.
- C. Placement: Deposit and consolidate concrete in a continuous operation, within limits of construction joints, until placement of a panel or section is complete. Deposit concrete to avoid segregation.
 - 1. When placing is once started, carry it on as a continuous operation until placement of the panel or section is complete. Construction joints to be made only where indicated on the Drawings or on approved shop drawings. Prevent the formation of cold joints at other locations.
 - 2. Deposit concrete in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. Deposit concrete in a manner to avoid inclined construction joints.
 - 3. Particular care shall be used when starting a concrete pour to maintain the continuity of appearance. Use all means necessary to avoid blemishes, imperfections, or changes in the finish.
 - 4. Maintain reinforcement in position on chairs during concrete placement.
- D. Consolidation: Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301. Use and type of vibrator shall conform to ACI 309, Guide for Consolidation of Concrete.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Place vibrating element directly in concrete and not attached to either inside or outside of forms or to reinforcing steel.
 - 3. 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. Do not over-vibrate concrete.
 - 4.
- E. Initial Finishing:
 - 1. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 2. Where floor drains or floor slopes are indicated, slope slabs uniformly to provide even fall for drainage.
 - 3. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When concrete is expected to be placed at air temperatures of less than 40 deg F, contractor shall review with Architect all special procedures that will be used including mix design modifications and methods of protection. This review shall occur prior to the expected extreme temperatures.
 2. Provide sufficient protection material and equipment on the Project site in advance of the time when the mean daily temperatures are expected to drop below 40 degrees F.
 3. 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 301. In addition, take precautions including, but not limited to:
 - a. Use non-chloride, non-corrosive accelerating admixture in accordance with previously accepted submittals.
 - b. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 305.1 and as follows:
1. When concrete is expected to be placed at air temperatures of greater than 80 deg F, contractor shall review with Architect all special procedures that will be used including mix design modifications and methods of protection. This review shall occur prior to the expected extreme temperatures.
 2. Provide sufficient protection material and equipment on the Project site in advance of the time when the mean daily temperatures are expected to rise above 80 degrees F.
 3. When air temperature exceeds 80 deg F, take special precautions to prevent slump loss, rapid setting, and plastic shrinkage; including but not limited to:
 - a. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - b. Use set retarding admixture in accordance with previously accepted submittals.
 - c. Use microsynthetic fibers in the concrete mixture to minimize plastic shrinkage cracking.
 - d. Convey, deposit, finish and commence curing of concrete as rapidly as practicable.
 4. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.12 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.13 CONCRETE PROTECTING AND CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven (7) days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven (7) days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 4. Exterior Flatwork: Apply 1 coat of curing/sealing compound as soon as possible after finishing.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each concrete mixture placed each day.
 - a. When frequency of testing will provide 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; 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, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Water Content and W/cm: In accordance with AASHTO T318.
5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample..
7. Compressive-Strength Tests: ASTM C39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
 - b. Number of specimens in each set shall follow requirements of ACI 318 Section 5.
8. 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, when the specified strength is 5000 psi or less; or by more than 10 percent of specified strength, when the specified strength is above 5000 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28 56 -day tests.
10. Monthly charts and compressive strength, w/cm and air content will be sent to all parties on the pre-concrete conference distribution list.
11. Non-compliant Test Reports: All test reports indicating non-compliance should be e-mailed or faxed immediately to all parties on the test report distribution list. Copies shall be distinguishable from the originals.
12. Nondestructive Testing: Rebound hammer, ultrasonic, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.
 - a. If test results indicate that compressive strength requirements have not been met, the Contractor shall justify that the load carrying capacity of the structure has not been reduced. Carry out tests of cores drilled from the area in question as directed by the Architect in accordance with ASTM C42 and ACI 318 Section 5.6.5.
 - b. If the compressive tests of the core specimens fail to show the compressive strength specified, the concrete shall be deemed defective and shall be replaced or adequately strengthened in a manner acceptable to the Architect. Perform load

tests as outlined in ASTM C39, as directed by the Architect, on the questionable portion of the Work.

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

D. Reinforcing Steel

1. Notify the testing agency and the Architect at least 48 hours before concrete is to be poured or reinforcing is covered up.
2. Before any concrete is poured on any particular portion of the building, the reinforcing steel and form dimensions will be inspected by the Testing Agency. Any errors or discrepancies shall be corrected before concrete is placed.
3. As a minimum, all testing and inspection as per the requirements of the local Building Code.
4. A special inspector from the Testing Agency shall be present during all field bending of reinforcement.
5. Installation of deformed bar anchors to be tested in accordance with Section 7.1 of AWS D1.1.
6. Comply with ICC-ES approvals with respect to special inspection required during installation.

END OF SECTION 03 30 00

CONCRETE MIX DESIGN SUBMITTAL FORM

Project: _____
 City: _____
 General Contractor: _____
 Concrete Contractor: _____
 Concrete Strength (Class): _____
 Use (describe): _____

Design Mix Information

Please check one

Based on Standard Deviation Analysis
 Trial Mix Test Data

Design Characteristics:

Density	<input type="text"/>	pcf
Strength	<input type="text"/>	psi ([28][56] day)
Air	<input type="text"/>	% specified

<u>MATERIALS</u>	<u>Type/ Source</u>	<u>Specific Gravity</u>	<u>Weight/lb.</u>	<u>Absolute Vol. cu.ft.</u>
Cement				
Fly Ash				
Slag Cement				
Silica Fume				
Other SCM				
Coarse Aggregate				
Fine Aggregate				
Microsynthetic Fibers				
Macrosynthetic Fibers				
Steel Fibers				
Water				
Air				
Other				

TOTAL 27.0 cu. ft.

* Water/Cement Ratio (lbs. water/lbs. cement) = _____ %

<u>ADMIXTURES</u>	Manufacturer	Dosage oz/cwt
Water Reducer		
Air Entraining Agent		
High Range Water Reducer		
Non-Corrosive Accelerator		
Other		

Slump before HRWR _____ inches

Slump after HRWR _____ inches

Standard Deviation Analysis (from experience records):

# of Test Cylinders Evaluated:	
Standard Deviation:	

USE THE LARGER VALUE:

$f'_{cr} = f'c + 1.34s$ or $f'_{cr} = f'c + 2.33s - 500$ for 5000 PSI or less

$f'_{cr} = f'c + 1.34s$ or $f'_{cr} = 0.90 f'c + 2.33\pm$ for higher strengths

(Refer to ACI 301 for increased deviation factor when less than 30 tests are available)

LABORATORY TEST DATA

Compressive Strength

Age (days)	Mix # 1	Mix #2	Mix #3
7	psi	psi	psi
7	psi	psi	psi
[28][56]	psi	psi	psi
[28][56]	psi	psi	psi
[28][56] average	psi	psi	psi

$F'_{cr} = f'c + 1200$ psi for 5000 psi or less

Or $1.10 f'c + 700$ psi for strength higher than 5000 psi at [28][56] days

REQUIRED ATTACHMENTS:

Combined Aggregate Gradation Report

Standard Deviation Analysis of Compressive Strength Data or Trial Mixture Test Data

Please Check

ADMIXTURE COMPATIBILITY CERTIFICATION LETTER



Submitted by:
Name:
Address:
Phone #:
Main Plant Location:
Miles from Project:
Secondary Plant Location:
Miles from Project:
Date:

SECTION 03 30 53 – MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures and finishes.
 - 1. General Site Footings / Foundations
 - 2. Concrete Walls with Sand Blast Finish (Wall Type: W3, W4, Furnishings: F8, F9)
 - 3. Pedestrian Duty Architectural Concrete with Sand Blast Finish (Pavement Type: P7)
 - 4. Concrete Curbs with Sand Blast Finish (Wall Type: W1, W2)
 - 5. Concrete Subbase Slabs-on-grade (Pavement Type: P1 – 5)
- B. Related Requirements:
 - 1. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.
 - 2. State of Ohio Department of Transportation Construction and Material Specifications 2019 edition.

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

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, and concrete protection.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Landscape Architect.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Curing compounds.
 - 5. Bonding agents or epoxy adhesive.
 - 6. Joint-filler strips.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
 - 1. Installer experience shall demonstrate completed concrete work sandblast finishing of concrete and of similar work 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.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.
- H. Mockups: Cast formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor and seat wall treatments, and standard of workmanship.
 1. Walls and Curbs: Show typical corners, top/face edges and any special shape conditions. Minimum 6 feet long for each Wall or Curb type.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- I. With Landscape Architect present, Contractor to examine and inspect formwork installation for compliance with installation requirements and tolerances and other conditions affecting performance.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. 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 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 1. When average 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 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is

- calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 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 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301.
 2. ACI 117.
- B. ODOT Standards: Comply with the following ODOT specifications as noted on the drawing unless modified and noted by the requirements in the Contract Documents:
 1. ODOT 204: Subgrade Compaction and Proof Rolling
 2. ODOT 304: Aggregate Base
 3. ODOT 305: Portland Cement Concrete Base
 4. ODOT 452: Non-Reinforced Portland Cement Concrete Base
 5. ODOT 608: Walks, Curb Ramps, And Steps
 6. ODOT 609: Curbing, Concrete Medians, And Traffic Islands
 7. ODOT 703.02: Aggregate for Portland Cement Concrete
 8. ODOT 712.09: Geotextile Fabrics

2.02 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Use flexible or curved forms for all curved walls or curbs with exposed faces or edges.
 - a. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1. Provide in sizes required up to 4 foot widths and 12 foot length to minimize joints with all edges, seams and recesses at fastners sealed.
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed. 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.

- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Standard coil or snap ties with 3/4 inch plastic cones on concrete surfaces. Provide with manufacturer's recessed plugs of grey concrete to seal tie holes; recess minimum 1/4 inch behind face of wall. Form ties permitted at below grade conditions, only
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

2.03 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 1064, as drawn.

2.04 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Micro-Reinforcement: ASTM C 1116, 3/4" long, 100 percent pure virgin nylon-6 fibers by Euclid Chemical Corp.
- C. Reinforcing Supports:
 - 1. Welded Wire Fabric: "Mesh-Ups" by Lotel, Inc., Baton Rouge, LA (504/926-7327) or equal.
 - 2. Bars: Bolsters and chairs suitable for application by Dayton Sure-Grip or equal.

2.05 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150, Type I, Type II, gray.
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Slag Cement: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide fine and coarse aggregates sand and gravel for each type of exposed finish from a single

source (pit or quarry) for entire job. They shall be clean, hard, strong, durable, and inert, free of staining or deleterious material.

1. Maximum Coarse-Aggregate Size:
 - a. Foundations and Subbase Slabs: 1-inch nominal.
 - b. Sandblast Finish Concrete - Pedestrian Duty Concrete, Concrete Curbs and Seat Walls: 3/4-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94 potable.

2.06 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 1. Water-Reducing Admixture: ASTM C 494, Type A.
 2. Retarding Admixture: ASTM C 494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.07 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. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
 - b. BASF Construction Chemicals - Building Systems; Confilm.
 - c. ChemMasters; SprayFilm.
 - d. Conspec by Dayton Superior; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film (J-74).
 - f. Edoco by Dayton Superior; BurkeFilm.
 - g. Euclid Chemical Company (The), an RPM company; Eucobar.
 - h. Kaufman Products, Inc.; Vapor-Aid.
 - i. Lambert Corporation; LAMBCO Skin.
 - j. L&M Construction Chemicals, Inc.; E-CON.
 - k. Meadows, W. R., Inc.; EVAPRE.
 - l. Metalcrete Industries; Waterhold.
 - m. Nox-Crete Products Group; MONOFILM.
 - n. Sika Corporation; SikaFilm.
 - o. SpecChem, LLC; Spec Film.
 - p. Symons by Dayton Superior; Finishing Aid.
 - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
 - r. Unitex; PRO-FILM.
 - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set. Retain curing aids and materials from remaining paragraphs.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 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. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
 - b. BASF Construction Chemicals - Building Systems; Kure 200.
 - c. ChemMasters; Safe-Cure Clear.
 - d. Conspec by Dayton Superior; W.B. Resin Cure.
 - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
 - f. Edoco by Dayton Superior; Res X Cure WB.
 - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
 - h. Kaufman Products, Inc.; Thinfilm 420.
 - i. Lambert Corporation; AQUA KURE - CLEAR.
 - j. L&M Construction Chemicals, Inc.; L&M Cure R.
 - k. Meadows, W. R., Inc.; 1100-CLEAR.
 - l. Nox-Crete Products Group; Resin Cure E.
 - m. Right Pointe; Clear Water Resin.
 - n. SpecChem, LLC; Spec Rez Clear.
 - o. Symons by Dayton Superior; Resi-Chem Clear.
 - p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
 - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.08 ACCESSORIES

- A. Abrasive grit for sandblasting: Ebony Grit 12 by Opta Minerals, Attica NY, (716) 912-1796. Water quenched mineral slag with less than 1.0 percent silica, and a Mohs hardness of 7.5 to 8.0, number 8-16 mesh size. Sand not acceptable.
 - 1. Opti Minerals, www.optaminerals.com.
- B. Expansion Joints: Provide with joint caps.
 - 1. Basis of design: Products by WR Meadows.
 - 2. Sponge Rubber: ASTM-D1751 Type I.
 - a. Typical Thickness: 1/4 inch.
 - b. Joint Cap: Two-piece device with upper portion removable after curing period; width corresponding to joint filler.
 - 3. Cork: ASTM-D1752, Type II.
 - a. Typical Thickness: 1/4 inch.
 - b. Joint Cap: Two-piece device with upper portion removable after curing period; width corresponding to joint filler.
- C. Bonding Agent: ASTM C 1059/C, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

- E. Penetrating Water Repellent Sealer:
1. Penetrating Water Repellent: Clear penetrating sealer consisting of 100% silane and meeting the following criteria:
 - a. Flash Point: 145 Deg F.
 - b. NCHRP No. 244 Reduction in Chloride Content
 - 1) Average 91%
 - 2) Min. Required 75%
 - c. NCHRP No. 244 Reduction in water absorption
 - 1) 1 Day in water 94%
 - 2) 3 Days in water 89%
 - d. VOC's 248 g/l
 - e. Average Depth of Penetration: 0.2"
 - f. Product:
 - 1) Euclid Chemical Company (The): Barcade Silane 100 C
www.euclidchemical.com

2.09 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent 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 according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:
1. Fly Ash: 25 percent.
 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 3. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. 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 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.

2.10 CONCRETE MIXTURES

- A. Foundations / Subbase Slabs: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi or as indicated at 28 days.
 2. Maximum W/C Ratio: 0.50.
 3. Slump Limit: 5 inches, plus or minus 1 inch.

4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
- B. Pedestrian Duty Concrete, Concrete Curbs and Seat Walls: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Slump Limit: 5 inches, plus or minus 1-inch.
 4. Air Content: 5.0 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. 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 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.

3.02 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. Install reglets to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.03 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 has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. 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.

3.04 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4 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. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Butt Joints: Use bonding agent or epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 2. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Contraction Joints in Slabs-on-Grade, Curbs and Walks: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated
 - 1. Locate expansion joints as indicated on Drawings.
 - 2. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 3. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants are indicated.
 - 4. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
 - 5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius, unless noted otherwise. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.06 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 is complete and in compliance with installation requirements and tolerances and other conditions affecting performance. Prior to the inspection, provide Landscape Architect 24-hour notice.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 4. Maintain reinforcement in position on chairs during concrete placement.
 5. Screed slab surfaces with a straightedge and strike off to correct elevations.
 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. Do not further disturb slab surfaces before starting finishing operations.
- D. 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. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.07 FINISHING FORMED SURFACES (FOUNDATIONS / VENEERED CIP WALLS)

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view and where indicated on drawings.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view and where indicated on drawings.
 2. Where designated on drawings, see Special Finishes for Architectural Concrete finishes on vertical walls and curbs.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 SPECIAL FINISHES (PEDESTRIAN WALKS, STEPS, SEAT WALLS AND CURBS)

- A. Steel Troweled & Sandblast Finish, Typical. A two-step process:
1. Steel Troweled Finish: Provide steel troweled finish as soon as conditions permit after normal float finishing.
 - a. Re-work edges to eliminate wide edge mark left by rounding tool.
 - b. After finish, allow concrete to cure to sufficient strength that it will not be damaged by blasting but not less than seven days.

2. Sand Blast Finish: Provide light and medium sandblast finishes over steel troweling to exposed paving surfaces to match approved mock-up.
 - a. Sandblast Finish: Typical for surfaces exposed to view, unless indicated otherwise on drawings.
 - b. Provide light sandblast finish to match the approved Mockup. Sample available for inspection at Landscape Architect's office before bid.
 - c. Provide sandblast finish on exposed portions of Architectural Site Concrete and surfaces designated on drawings.
 - d. Perform sandblasting in as continuous operation as possible, utilizing the same work crew to provide a finish matching the approved Mockup.
 - e. Use specified abrasive grit to expose the aggregate and surrounding matrix surfaces to provide a uniform sandblast finish matching the approved Mockup.
 - f. Use same nozzle person, nozzle, nozzle pressure and blasting technique as used for the approved Mockup.
 - g. Blast corners and edge of patterns carefully, using backup boards in order to maintain a uniform corner or edge line.
 - h. Maintain control of abrasive grit and concrete dust in each area of blasting.
 - i. Remove expended abrasive grit, concrete dust and debris at the end of each day of blasting operations.
 - j. Protect adjacent surfaces from being eroded, damaged, or discolored by the sandblasting.

3.09 FLOAT FINISHING (FLOORS AND SLABS)

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces indicated to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view.
 2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

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

3.11 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.12 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/4 inch.
 - 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 - 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 - 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.

8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Landscape Architect. Remove and replace concrete that cannot be repaired and patched to Landscape Architect's approval.
- B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
- C. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- D. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Landscape Architect.
- E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inchwide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
- F. After concrete has cured at least 14 days, correct high areas by grinding.
- G. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- H. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- I. Perform structural repairs of concrete, subject to Landscape Architect's approval, using epoxy adhesive and patching mortar.
- J. Repair materials and installation not specified above may be used, subject to Landscape Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

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- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least 1 composite sample for each concrete mix placed each day.
 - a. When frequency of testing will provide 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 C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 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.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete 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 shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

END OF SECTION 03 30 53

SECTION 04 05 13 - MASONRY MORTARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes all labor, materials, equipment and testing necessary for a complete masonry mortaring of all concrete and clay masonry units.

1.03 RELATED SECTIONS

- A. Section Includes, but is not limited to:
 - 1. Section 04 05 16 – Masonry Grouting
 - 2. Section 04 05 19 – Masonry Anchorage & Reinforcing
 - 3. Section 04 05 23 – Masonry Accessories
 - 4. Section 04 20 00 – Unit Masonry

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: American Institute for Testing Materials
 - 2. ASCE: American Society of Civil Engineers
 - 3. MSJC: Masonry Standard Joint Committee
 - 4. ACI: American Concrete Institute.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Product data for each type of masonry cement and colored mortar pigments.
- C. Mortar mix designs.
- D. Samples: Samples of colored pigmented mortar.
- E. Test Reports: Submit test reports for mortar indicating conformance with ASTM C 270 property specifications.

- F. Close-Out Document Submittals
 - 1. Maintenance Information

1.07 QUALITY ASSURANCE

- A. Codes and Specifications: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
- B. ACI 530.1/ASCE 6 "Specifications for Masonry Structures".
- C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.
- D. The Owner will employ an independent testing laboratory to perform tests, evaluate samples, and submit test results to the Contractor and Architect.
 - 1. The Contractor shall cooperate with the testing laboratory to perform field quality control testing during the masonry work, unless specifically noted otherwise.
 - 2. For colored and non-colored mortars test for compressive strength by the methods of sampling and testing of ASTM C 109 and ASTM C 780.
 - 3. If the compressive strength test fails to meet the minimum requirements specified, the mortar represented by such tests will be considered deficient in strength.
 - 4. Deficient mortar shall be removed and replaced by the Contractor without additional cost to the Owner.

1.08 DELIVERY, STORAGE & HANDLING

- A. Store cementitious materials off the ground, under cover, and in dry location.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.09 PROJECT CONDITIONS

- A. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:
 - 1. To assure mortar temperatures between 40 degrees F and 120 degrees F until used, heat mixing water or aggregates when air temperature is between 32 degrees F and 40 degrees F. When air temperature is between 25 degrees F and 32 degrees F, heat both water and aggregate.
 - 2. Do not heat water or sand above 160 degrees F.
- B. Hot-Weather Construction: Comply with referenced unit masonry standard for hot-weather construction and the following:
 - 1. Under hot, dry and windy conditions use proper pre-dampening, protection and moist curing procedures required to keep the mortar moist for 72 hours following final tooling

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type III may be used for cold weather, non-staining, without air entrainment and of natural color or white, to produce the required color of mortar.
- B. Masonry Cement: ASTM C 91. For colored aggregate mortars use masonry cement of natural color or white as required to produce mortar color indicated.

-
- C. Ready-Mix Mortar: ASTM C 1142. Cementitious materials, water and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar.
 - D. Hydrated Lime: ASTM C 207, Type S.
 - E. Mortar Aggregate: ASTM C144, standard masonry type.
 - F. Water: Clean and potable.
 - G. Mortar Color: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. The Contractor shall only use pigments with record of satisfactory performance in masonry mortars.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work include, but are not limited to the following:
 - a. Colored Masonry Cement:
 - 1) "Colorbond Custom Color Masonry Cement," Centurion.
 - 2) "Atlas Custom Color Masonry Cement," Lehigh Portland Cement Co.
 - 3) "Flamingo Color Masonry Cement," The Riverton Corp.
 - b. Colored Mortar Pigments:
 - 1) "Centurion Pigments," Centurion.
 - 2) "True Tone Mortar Colors," Davis Colors.
 - 3) "SGS Mortar Colors," Solomon Grind-Chem Services, Inc.
 - H. Cold-Weather Admixtures: Not acceptable.

2.02 MORTAR MIXES

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, anti-freeze compounds, or other admixtures, unless otherwise indicated or approved by the Architect. Do not use calcium chloride in mortar.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification, for job mixed mortar, or ASTM C 1142 for ready mixed mortar for types indicated below:
 - 1. Limit cementitious materials in mortar to portland cement-lime.
 - 2. Type S: Exterior, at or below grade foundation and retaining walls (1800 psi average compressive strength at 28 days).
 - 3. Type S: Exterior, above grade load-bearing walls (1800 psi average compressive strength at 28 days).
 - 4. Type N: Exterior, above grade non-load-bearing walls and brick veneer walls (750 psi average compressive strength in 28 days).
 - 5. Type N: Interior, load-bearing walls and non-load-bearing partitions (750 psi average compressive strength in 28 days).
- C. Use natural (non-colored) mortar for the following:
 - 1. Interior concrete masonry units, unless otherwise noted.
- D. Colored Pigmented Mortar: Select and proportion pigments with other ingredients to produce color indicated or, if not indicated, as selected from manufacturer's standard formulation.
 - 1. Use colored pigmented mortar for the following:
 - a. Face brick

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install mortar in accordance with Section 04 20 00 – Unit Masonry.

END OF SECTION

SECTION 04 05 16 - MASONRY GROUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes all labor, materials, equipment and testing necessary for a complete masonry grouting of all concrete masonry units. Section Includes, but is not limited to:
 - 1. Fine & Course Masonry Core Grout

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
- B. Section 04 05 13 – Masonry Mortaring
 - 1. Section 04 05 19 – Masonry Anchorage & Reinforcing
 - 2. Section 04 05 23 – Masonry Accessories
 - 3. Section 04 20 00 C – Unit Masonry

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: American Institute for Testing Materials
 - 2. ASCE: American Society of Civil Engineers
 - 3. MSJC: Masonry Standards Joint Committee
 - 4. ACI: American Concrete Institute

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Mix Designs: Core grout mix designs for both fine and course grouts including complete identities and proportions of ingredients.
 - 1. Weight of each ingredient including water

2. Measured slump
 3. Water/cement ratio
 4. Sieve analysis for aggregates
- C. Test Results: Submit compression test results from an independent certified testing laboratory from grout samples made from the proposed mix designs.
- D. Product Data: Furnish product data sheets for review.

1.07 QUALITY ASSURANCE

- A. Codes and Specifications: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
1. ACI 530.1/ASCE 6 "Specifications for Masonry Structures".
- B. The Owner will employ an independent testing laboratory to perform tests, evaluate samples, and submit test results to the Contractor and Architect.
1. The Contractor shall cooperate with the testing laboratory to perform field quality control testing during the masonry work, unless specifically noted otherwise.
 2. Grout compressive strength will be tested per ASTM C 1019.
 3. If the compressive strength test fails to meet the minimum requirements specified, the grout represented by such tests will be considered deficient in strength.
 4. Deficient grout shall be removed and replaced by the Contractor without additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type I, unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type C or F may be substituted for up to 20% of the total cementitious materials in the grout mix.
- C. Fine Aggregate: ASTM C 404, clean, sharp natural sand free from loam, clay lumps, or other deleterious substances.
- D. Course Aggregate: ASTM C 404, clean, uncoated, pea gravel containing no clay, mud, loam, or foreign matter.
- E. Water: Clean and potable.

2.02 GROUT MIXES

- A. General: Do not add admixtures including, air-entraining agents, accelerators, retarders, anti-freeze compounds, or other admixtures, unless otherwise indicated or approved by the Architect. Do not use calcium chloride in grout.
- B. Grout mixes shall be plant mix or factory blended (dry mix with water added at site). Field mixed grouts are not acceptable.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
1. Fine Grout: 3000 psi average compressive strength at 28 days for 6 inches and smaller hollow concrete masonry units and between 2 wythes of masonry where space is less than 2 inches in width.
 2. Course Grout: 3000 psi average compressive strength at 28 days for 8 inches and larger hollow concrete masonry units and between 2 wythes of masonry where space is 2 inches in width and wider.
- D. Grout Slump: Properly proportioned grout shall have a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install grout in accordance with Section 04 20 00 – Unit Masonry.

END OF SECTION

SECTION 04 05 19 - MASONRY ANCHORAGE AND REINFORCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes all labor, materials, equipment and testing necessary for complete reinforcing of all concrete masonry units and anchorage of clay masonry units. Section Includes, but is not limited to:
 - 1. Steel reinforcing bars.
 - 2. Joint reinforcement.
 - 3. Anchoring devices and ties

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 04 05 13 – Masonry Mortaring
 - 2. Section 04 05 16 – Masonry Grouting
 - 3. Section 04 05 23 – Masonry Accessories
 - 4. Section 04 20 00 – Unit Masonry

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: American Institute for Testing Materials
 - 2. ASCE: American Society of Civil Engineers
 - 3. MSJC: Masonry Standard Joint Committee
 - 4. ACI: American Concrete Institute

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.

- B. Product Data: Submit manufacturer's specifications and installation instructions for each different masonry anchor, and other manufactured products indicated. Submittals shall indicate specifically where each submittal item is to be used.

1.07 QUALITY ASSURANCE

- A. Codes and Specifications: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
1. ACI 530.1/ASCE 6 "Specifications for Masonry Structures".

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products of the following manufacturers will be considered, provided their products equal or exceed the quality specified; and if they provide products of the type, size, function, and arrangement required:
1. Hohmann & Barnard, Inc
 2. Dur-O-Wal, Inc.
 3. National Wire Products Industries
 4. Masonry Reinforcing Corporation of America
 5. AA Wire Products Co.
 6. Southern Construction Products, Inc.
 7. Heckman Building Products, Inc.
- B. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.

2.02 STEEL REINFORCING

- A. Steel Reinforcing Bars:
1. Size, length and spacing shall be as indicated.
 2. Where No. 3 and larger are indicated, they shall be deformed steel, conforming to ASTM A 615, Grade 60.

2.03 JOINT REINFORCEMENT

- A. Joint Reinforcement:
1. Form from wire complying with ASTM A 82.
 2. Galvanized after fabrication in accordance with ASTM A 153, Class B2 (1.5 oz. of zinc per square foot).
 3. Joint reinforcement at least 10 feet in length.
 4. Joint reinforcement in rolls is not acceptable.
 5. Joint reinforcement that is crimped to form drip is not acceptable.
 6. Maximum spacing of cross wires 16 inches to longitudinal wires.
 7. Width: Approximately 2-inches less than nominal width of walls or partitions, to provide mortar coverage of not less than 5/8-inch on joint faces exposed to exterior and 1/2-inch elsewhere.
 8. Wire Size for Side Rods: 9 gauge.
 9. Wire Size for Cross Rods: 9 gauge.
 10. Wire Size for Eyes/Tabs and Pintles for Two-Part Reinforcing: 3/16-inch dia.
 11. Configuration:

- a. Single-Wythe Masonry: Truss design with continuous diagonal cross rods spaced not more than 16" o.c.
- b. Multi-Wythe Masonry: For cavity of composition walls where bed joints align, provide a tab design with single pair of side rods and rectangular box-type cross ties spaced not more than 16-inches o.c., with side rods spaced for embedment within each face shell of back-up wythe and ties extended to within 1-inch of exterior face of facing wythe.
 - 1) Reinforcing to be an integrated assembly coordinating with the veneer anchoring specified herein.

2.04 ANCHORS & TIES

- A. General: Provide ties and anchors that comply with requirements for metal and size of referenced unit masonry standard and of this article. Zinc coat steel by the hot dip process after fabrication to comply with ASTM A 153 (1.5 oz. of zinc per square foot of surface when tested in accordance with ASTM A 90).
- B. Adjustable Veneer Anchor (for Masonry Backup Walls):
 1. Two piece, adjustable reinforcement with 2X-Hook.
 2. HB-270-2X Ladder Eye-Wire Anchors as manufactured by Hohmann & Barnard, Inc. (or other approved manufacturer)
 - a. Finish: Hot dip galvanized.
 - b. Fasteners: Screw type fasteners as recommended by manufacturer with neoprene gasketed washers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install masonry anchorage and reinforcement in accordance with Section 04 20 00 – Unit Masonry.

END OF SECTION

SECTION 04 05 23 - MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes all labor, materials, equipment and testing necessary for complete installations of accessory component installation of all concrete masonry and clay masonry units. Section Includes, but is not limited to:
 - 1. Expansion joint filler.
 - 2. Control joints.
 - 3. Concealed flashings.
 - 4. Weep vents.
 - 5. Cavity mortar protection.
 - 6. Isolation Liners.
 - 7. Grout Stop.
 - 8. Masonry Cleaners

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 04 05 13 – Masonry Mortaring
 - 2. Section 04 05 16 – Masonry Grouting
 - 3. Section 04 05 19 – Masonry Anchorage and Reinforcing
 - 4. Section 04 20 00 – Unit Masonry

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: The Specifications of the American Institute for Testing Materials
 - 2. ASCE: American Society of Civil Engineers
 - 3. MSJC: Masonry Standard Joint Committee
 - 4. ACI: American Concrete Institute

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.

- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Manufacturer's published, complete product data and installation instructions, with particular items to be provided, clearly marked thereon, for:
1. Proposed masonry in-wall flashing.
 2. Proposed expansion joint filler.
 3. Proposed control joint.
 4. Proposed grout stop.
 5. Proposed isolation liner.
 6. Proposed weep vents & cavity mortar protection.
 7. Proposed masonry cleaners.

1.07 QUALITY ASSURANCE

- A. Codes and Specifications: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
1. ACI 530.1/ASCE 6 "Specifications for Masonry Structures".

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Expansion Joint Filler:
1. Provide expansion joints in exterior brick masonry conforming to ASTM D 1056, Type 2, Class A, Grade 1, compressible up to 35 percent, of width and thickness indicated, formulated from the following material: Neoprene.
 2. Available Products: Subject to compliance with requirements, provide one of the following:
 - a. "Soft Joint", Dur-O-Wall, Inc.
 - b. "NS-Closed Cell Neoprene Sponge", Hohmann & Barnard, Inc.
 - c. "Neoprene Foam", Advanced Building Products, Inc.
- B. Control Joints:
1. Provide Pre-Formed Control-Joint Gaskets made from styrene-butadiene rubber compound, complying with ASTM D 2000, Designation M2AA and designed for standard sash block in concrete masonry unit walls where control joints are indicated on the Drawings and as specified in Section 04 20 00 – Unit Masonry.
 - a. Available Products: Subject to compliance with requirements, provide one of the following:
 - b. "Rapid Poly-Joint", Dur-O-Wall, Inc.
 - c. "VS-Series", Hohmann & Barnard, Inc.
 - d. "BCJ Series, BoMetals, Inc
- C. Concealed Flashing Materials:
1. Provide concealed flashing, shown to be built into masonry and surfaced mounted. Provide the following type of flashing materials:
 - a. Copper-Fabric: Copper sheet of 5 ounce bonded with a rubber base adhesive, between two layers of fiberglass fabric weighing not less than 0.3 oz/sq. ft./layer

with a minimum of 10x20 threads per inch. The fiberglass fabric shall be color coded "red" to identify the ounce weight of the copper in the product.

- 1) Available Products: Subject to compliance with requirements, provide one of the following:
 - a) "York Multi-Flash 500 Copper Fabric Flashing", York Mfg., Inc.
 - b) "Copper Fabric Flashing", Advanced Building Products, Inc.
 - c) "Copper Fabric Flashing". Polytite Manufacturing Corp.
 - d) "H & B C-Fab Flashing", Hohmann & Barnard, Inc.
 - e) Application:
 - f) Built-In: Use where flashing is fully concealed in concrete masonry units.
 - g) Surface Mounted: Use where flashing is surface mounted to Cold-Formed Metal Framing. Provide stainless steel termination bar (T2 H-B), fasteners and cont. sealant.
- b. Flashing Mastic: Surfaces receiving flashing shall be sufficiently spotted with mastic to hold in place until masonry is set. Mastic to be compatible with flashing selected per manufacturers recommended guidelines.

D. Sheet Metal Drip Edge::

1. Fabricated from 0.015 inch thick stainless steel with hemmed edge. Comply with requirements specified in Section 07 62 00 – Flashing and Sheet Metal
2. Application: Where drip edge is required per Section 04 20 00 – Unit Masonry
3. Available Products: Subject to compliance with requirements, provide one of the following:
 - a. Model No. 1008; Heckman Building Products, Chicago.
 - b. IPCO stainless steel drip edge; Illinois Products Corporation
 - c. "DP" Drip Plate; Hohmann & Barnard, Inc.
4. Corners: Provide Pre-Formed Metal 90 degree corners. No field made corners shall be accepted.

E. Weep Vents:

1. Polypropylene cellular vent or polyester mesh vent to fit head joints of course directly above through wall flashing. Space at approximately 24 inches o.c. unless noted otherwise. Color to selected from manufacturer's standard.
2. Available Products: Subject to compliance with requirements, provide one of the following:
 - a. "#QV- Quadro-Vent", Hohmann & Barnard, Inc.
 - b. "D/A 1006 – Cell Vent", Dur-O-Wall, Inc.
 - c. "Mortar Net Weep Vents", Mortar Net USA, Ltd.
 - d. "CavClear Weep Vents", CavClear Archovations, Inc.
3. Locations: Provide weep vents in the following locations, in addition to any other areas indicated on the drawings:
 - a. at the top of the brick veneer below the soffit
 - b. at the door and window heads, above the flashing
 - c. at the window sills, above the flashing
 - d. at the window sills, below the flashing
 - e. at the base of the masonry wall.

F. Grout Stop:

1. Fiberglass, galvanized steel, or polypropylene screen:
2. Available Products:

-
- a. "MGS – Mortar/Grout Screen", Hohmann & Barnard, Inc.
 - b. "Fil-Stop Fiber Glass Mesh", Dur-O-Wal, Inc.
 - c. "Grout Stop", Wire Bond, Inc.
- G. Cavity Mortar Protection:
1. High density polyethylene (HDPE) or nylon stands woven into a 90% open mesh designed to catch and permanently suspend mortar droppings in masonry cavity walls above the flashing and weeps. Provide mesh thickness to fill air space with 1/4" to 3/8" tolerance as shown on the Drawings.
 2. Available Products: Subject to compliance with requirements, provide one of the following:
 - a. "Mortar Trap", Hohmann & Barnard, Inc.
 - b. "Mortar Net", Mortar Net USA, Ltd.
 - c. "CavClear Masonry Mat", CavClear Archovations, Inc.
- H. Isolation Liner:
1. Isolation liner shall used between masonry and structural steel frame and shall be treated asphalt-impregnated cellular paper, 1/4 –inch thick. Material shall be applied in double thickness except where wall dimensions do not permit.
- I. Masonry Cleaners:
1. Proprietary Acidic Cleaners: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned. Provide product for masonry type as specified in Section 04 20 00 – Unit Masonry.
 - a. Manufacturers:
 - 1) Diedrich Technologies, Inc.
 - 2) EaCo Chem, Inc.
 - 3) ProSoCo, Inc.
 2. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated or recommended for pressure, measured at spray tip, and for volume.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install masonry accessories in accordance with Section 04 20 00 – Unit Masonry.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes all labor, materials, equipment and testing necessary for complete installations of all concrete masonry and clay masonry units. Section Includes, but is not limited to:
 - 1. Concrete masonry units (CMU).
 - 2. Clay unit masonry in the form of brick.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 04 05 13 – Masonry Mortaring
 - 2. Section 04 05 16 – Masonry Grouting
 - 3. Section 04 05 19 – Masonry Anchorage & Reinforcing
 - 4. Section 04 05 23 – Masonry Accessories
 - 5. Anchor bolts, steel plates, and steel lintels; refer to Division 5
 - 6. Section 07 21 00 – Thermal Insulation
 - 7. Section 07 27 26 – Fluid Applied Membrane Air & Vapor Barrier
 - 8. Section 07 92 00 – Joint Sealants
 - 9. Steel door frames; refer to Division 8

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: The Specifications of the American Institute for Testing Materials
 - 2. ASCE: American Society of Civil Engineers
 - 3. BIA: Brick Industry Association
 - 4. MSJC: Masonry Standard Joint Committee
 - 5. ACI: American Concrete Institute
 - 6. UL: Underwriter's Laboratory
 - 7. NCMA: National Concrete Masonry Association

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.

- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
B. Product Data: Submit data for each different masonry unit indicated.
C. Samples: Submit samples of each clay masonry unit specified to show full range of color, texture, shapes and sizes.
D. Maintenance Information

1.07 QUALITY ASSURANCE

- A. Codes and Specifications: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified:
1. ACI 530.1/ASCE 6 “Specifications for Masonry Structures”.
 2. NCMA – Technical Bulletins.
 3. BIA – Technical Notes on Brick Construction
 4. UL 618 – “Standard for Concrete Masonry”
- B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- C. Fire Performance Characteristics: Where indicated, provide materials and construction identical to those assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspection organization, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- D. Testing: The Owner will employ an independent testing laboratory to perform tests, evaluate samples, and submit test reports to Contractor and Architect.
- E. Grouting & Reinforcing: All masonry grouting and reinforcing work shall be performed by masonry craft workers holding current International Masonry Institute (IMI) Grouting and Reinforcing Certification.

1.08 DELIVERY, STORAGE & HANDLING

- A. Assume responsibility for acceptance of masonry units delivered to site being in compliance with specified ASTM requirements for chippage and dimensional tolerances.
B. Store masonry units off ground, covered, and protected from wetting by capillary action, rain or snow, and protected from mud, dust, or other materials and contaminants likely to cause staining or defects in the masonry.

1.09 PROJECT CONDITIONS

- A. Cold Weather Requirements: Protect masonry against freezing when the temperature of the surrounding air is 40 degrees F and falling. Heat materials and provide temporary protection of completed portions of masonry work. Comply with the requirements of the governing code and with the “Construction and Protection Recommendations for Cold Weather Masonry Construction” of the Technical Notes of Brick and Tile Construction by the Brick Institute of America (BIA).
- B. Hot Weather Requirements: Masonry construction performed when ambient temperature exceeds 100 degrees F (or 90 degrees F with wind velocities greater the 8 mph) shall conform to the following requirements:

1. Store materials in cool, shaded location.
 2. Cover aggregate stockpiles with plastic sheet to retard the evaporation of moisture.
 3. Cool reinforcing steel, metal accessories, mixers, and mortar boards by flushing with water.
 4. Wet high-suction brick.
 5. Increase lime and/or cement content to maximum allowed under ASTM C 270 for mortar type specified.
 6. Increase water content of mortar and grout as needed.
 7. Spread mortar beds no more than 4 feet ahead of masonry, and set units within one minute of spreading mortar.
 8. Moist cure masonry by water fog spray after tooled joints have set.
 9. Cover walls to retard evaporation.
 10. Schedule work to avoid hottest part of the day.
- C. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 2. When one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and held in place.
- D. Stain Prevention: The Contractor shall prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Any grout, mortar, or soil that comes in contact with such masonry shall be removed immediately.
1. The Contractor shall protect bases of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
 2. The Contractor shall protect sills, ledges, and projections from mortar droppings.
 3. The Contractor shall protect surfaces of windows and door frames, as well as similar products with painted and integral finishes from mortar droppings.

1.10 MOCK UP

- A. The first 100 square feet of each masonry wall type installed shall serve as a mock-up panel for Architect approval of workmanship, including installation of masonry, veneer and backing, anchors, joint reinforcing, flashing, weep vents, and control joints. The sample area, when accepted, shall become the project standard for quality of work, methods of installation and appearance.
- B. Prior to starting general masonry cleaning, prepare mock-up for cleaning using the same cleaning materials and methods proposed for the Work. Obtain Architect's acceptance of visual qualities before proceeding with masonry cleaning.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. The Contractor shall comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.
- B. The Specification for products furnished and installed under this Section are based on those manufacturers listed herein. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.

2.02 CLAY MASONRY UNITS

A. Face Brick Standard:

1. Quality Standard: ASTM C 216, Grade SW for exterior exposure, Type FBS.
2. Sizes:
 - a. Standard: 3-5/8" x 2-1/4" x 8"
3. Provide special molded shapes and solids where indicated and as follows:
 - a. For applications requiring brick of form, color, texture, and size on exposed surfaces that cannot be produced by sawing standard brick sizes or would result in sawn surfaces being exposed to view.
 - b. For applications where stretcher units cannot accommodate special conditions including those at corners, movement joints, bond beams, sashes, and lintels.
4. Provide units without cores or frogs and with all exposed surfaces finished for ends of sills, caps, and similar applications that expose brick surfaces that otherwise would be concealed to view.
5. Compressive Strength: Shall exceed 3000 psi when tested with the loads applied normally to the bedding surface.
6. Water Absorption: Average maximum water absorption by submersion in boiling water for 5 hours shall be less than 20 percent, when tested per ASTM C 67. Average saturation coefficient shall be less than 0.78.
7. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced".
8. The Contractor for this Section of Work shall include in Base Bid the cost for solid brick required, the cost for cutting of brick required, the cost of cutting of brick required to obtain special shapes, the cost of special size brick required, and the cost of special molded shapes required.
9. Products: Subject to compliance with requirement, provide the following:
 - a. Basis of Design is Belden Brick
 - 1) Mod. Black Diamond Velour A
 - b. Approved Equal
 - 1) Taylor Clay Products, Inc.
 - 2) Thomas Brick Company
 - 3) Black Onyx
 - 4) Carolina Ceramics Brick Company
 - 5) Thomas Brick Company
 - 6) Blue Black

2.03 CONCRETE MASONRY UNITS, GENERAL

A. Concrete Masonry Units (CMU):

1. Manufacturer: Shall be member of the National Concrete Masonry Association.
2. Size: Manufacturer's standard units with face dimensions of 15-5/8 by 7-5/8 inches (actual).
3. Special Shapes: Provide, where shown and where required, lintels, corners, jambs, sash, control joints, headers, bond beams, bullnose, and other special conditions. Provide two core type units where required to receive vertical reinforcing.
 - a. Provide one inch radius bullnose at external corners and edges unless otherwise indicated.
4. Linear Shrinkage: Not to exceed 0.065 percent, ASTM C 426.

B. Hollow Load-Bearing Concrete Masonry Units:

1. Provide units complying with ASTM C 90, Grade N.
 2. Compressive Strength: 1900 psi average, 1700 psi minimum.
 3. Weight Classification: Normal Weight
- C. Solid Load-Bearing Concrete Masonry Units:
1. Provide units complying with ASTM C 90, Grade N
 2. Compressive Strength: 1800 psi average, 1500 psi minimum.
 3. Weight Classification: Normal Weight
- D. Exposed Face:
1. Manufacturer's standard color and texture, unless otherwise indicated.
 2. Provide units with special finishes where indicated:
 - a. Provide scored units where indicated.
 - b. Provide integral pigmented color where indicated.
- E. Concrete Brick: ASTM C 55, Grade N.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Masonry installer must examine the areas and conditions under which masonry is to be installed and notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
1. Examine surfaces which are to support masonry work to assure completion to proper lines and grades. Remove all dirt, laitance, loose aggregates, and other deleterious material.
 2. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
 3. Verify that reinforcing dowels are properly placed.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the masonry installer.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.
- C. Remove dirt, ice, loose rust, and scale from metal components prior to installation.
- D. Wetting Clay Brick Units: Verify that the initial rate of absorption of brick is less than 1 gram per square inch per minute. Brick with absorption rates in excess of this amount shall be wetted with clean water 24 hours prior to placement until units are nearly saturated, and shall be surface dry when laid. During freezing weather, sprinkle units that require wetting with warm or hot water just before placement. Do not wet concrete masonry units.

3.03 INSTALLATION, GENERAL

- A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown and as required for the work of other trades.
- C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

- D. Cut masonry units with motor driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting whenever possible. Allow units cut with water cooled saws to dry before placing.
- E. Frozen Materials and Work: Do not use frozen materials mixed or coated with ice or frost. For masonry which is specified to be wetted, comply with the BIA recommendations. Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing.

3.04 CONSTRUCTION TOLERANCES

- A. Comply with tolerances of referenced unit masonry standard (MSJC Code and Specification, ACI 530.1/ASCE 6/TMS 602).

3.05 LAYING MASONRY WALLS

- A. Do not install cracked, broken or chipped units exceeding ASTM allowances.
- B. Clean units of surface dirt and contaminants before placing in contact with mortar.
- C. Lay-out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and whenever possible at other locations.
- D. Lay-up walls plumb and true with courses level, accurately spaced, within specified tolerances, and coordinate with other work. Interior masonry walls shall be carried to the heights as indicated on the Drawings. Do not wedge partitions tight against structural ceiling or beams, but provide a caulk or insulation filled joint between masonry and the structural roof deck, structural steel framing or structural floor deck as non-rated conditions. At rated walls, provide firestopping.
- E. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. One-half running bond with vertical joint in each course centered on units in courses above or below.
- F. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond or interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. Align unit cores that are to be grouted.
- G. Where masonry walls must align with structural steel or concrete framing members, use a string line, plumb bob, or other device to align the base of the wall in correct relationship with the structural members. Walls shall not be constructed out of plumb to accomplish alignment with structural members.
- H. Adjust units to final position while mortar is still soft and plastic. If units are displaced after initial set, remove, clean joints and unit of mortar, and relay with fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set into position.
- I. Provide uniform color blending in walls of exposed brick or concrete masonry units to avoid patchy effect.
- J. Stop horizontal runs at end of work day by racking back ½ unit length in each course.
- K. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- L. Concrete masonry units having 1-inch radius bullnose shall be provided throughout interior spaces at vertical external corners of interior walls and partitions that will be exposed to view or painted, except at door jambs and window jambs.

3.06 MORTAR BEDDING & JOINTING

- A. Mix mortar ingredients according to ASTM C 270. Use water clear and free of deleterious materials which could impair work. Each mortar batch is allowed only one retempering. Do not use mortar which has begun to set after the first retempering or if more than 2-1/2 hours has elapsed since initial mixing. Retempering will be permitted only within 1-1/2 hours of mixing, to replace moisture lost by evaporation. Discard any mortar which is partially set.
- B. Lay brick and other solid masonry units with completely filled bed and head joints. Do not furrow bed joints. Butter ends with sufficient mortar to fill head joints and shove into place. Butter ends of brick in hand and in the wall at closures. Do not slush head joints.
- C. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs in mortar in starting course on footings and foundation walls, in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
- D. As specified, provide integral water-repellent mortar admixture to be used at all exterior concrete masonry wythe locations.
- E. Joints: Maintain joint widths shown, except for minor variations required, to maintain bond alignment. Lay walls with 3/8-inch joints. Tool joints when the mortar is thumb print hard. Tool joints in exposed masonry walls at uniform moisture content to avoid color variations. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials. For exposed masonry, provide the following joints:
 - 1. Exterior Joints Below Grade:
 - a. Trowel pointed
 - 2. Exterior Joints Above Grade:
 - a. Dense concave profile with surface and edges compacted and sealed, unless otherwise noted.
 - 3. Interior Joints:
 - a. Concave tooled, unless otherwise noted.
 - b. Rake vertical joints when CMU units are single scored to imitate score.
- F. Remove mortar protruding into cells or cavities that are to be grouted. Do not permit mortar droppings to fall into cells, cavities of multi-wythe walls or to block weep vents. Maintain clear cavity width between facing and backing material and keep clear of mortar droppings by back beveling the mortar bed to prevent excess from extruding into cavity. Clean any excess that does occur by parging it to back of unit.

3.07 BUILT-IN WORK

- A. As the work progresses, build in items specified under this and other Sections of these specifications. Fill solidly with masonry around built-in items.
- B. Install adjustable hollow metal frame anchors, locating anchors on jambs in horizontal bed courses near top and bottom of each frame and at intermediate points not over 24 inches apart.
- C. Fill jambs and heads of hollow metal door and window frames solid with grout where located on the interior. At exterior frames, insert extruded polystyrene board insulation around perimeter of frames in thickness indicated, or if not indicated, not less than 3/4-inch to act as a thermal break.
- D. Where hollow metal frames do not wrap around masonry jambs and heads, rub exposed corners of block or remove sharp, irregular edges.
- E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of grout stop mesh in the joint below and rod mortar or grout into core.
- F. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Take particular care to embed all conduits and pipes within concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where

electric conduits, outlets, switch boxes, and similar items occur, grind or cut units before building in services.

- H. Install anchors, reglets, and nailers for flashing and related work built into masonry work, where indicated.

3.08 CAVITY WALLS

- A. Wythes of cavity walls shall be laid concurrently except where pintle and eye type joint reinforcing is used.
- B. Keep cavity clean of mortar droppings. Mortar shall be placed so that excess is not pressed into cavity air space as facing wythe is laid up. Bevel mortar back from cavity face of brick to prevent mortar from being pressed into cavity as brick is tapped into position. Install cavity mortar protection in cavity above thru wall flashing.
- C. Inner and outer wythes of cavity walls shall be completely separated by an air space thickness as indicated on the Drawings, except for masonry returns indicated at jambs of openings.
- D. Two wythes shall be securely tied together by continuous wire reinforcement spaced not more than 16-inches o.c. vertically.
- E. Provide concealed flashing around entire perimeter at base of walls in first course above grade. Provide concealed flashing above exterior wall openings and within exterior walls that project above adjacent lower roofs; and at all locations where shown on the Drawings and at any other locations as required or complete the integrity of system. Flashing joints shall be made by lapping a minimum of 4-inches and coating the contacting surfaces with mastic.
- F. Install insulation horizontally within cavity against inner wythe. Install between wall reinforcing, seal edges and fit tight around obstructions across the cavity. Use adhesive to secure insulation flush against inner wythe. Fill all cracks and open gaps in insulation with sealant compatible with insulation.
- G. Provide cell vents in exterior wythe of cavity wall located immediately above through wall base flashing, above through wall flashing at wall openings and above through wall flashing where exterior walls project above adjacent lower roofs. Space at 24-inches o.c., unless otherwise noted.
 - 1. Provide cell vent 32-inches o.c. with CMU exterior wythe, unless otherwise noted.

3.09 HORIZONTAL JOINT REINFORCING

- A. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8-inch on exterior side of wall and 1/2-inch at other locations. Lap reinforcement a minimum of 6-inches at ends of units. Do not bridge control and expansion joints with reinforcing. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, pipe enclosures, and other special conditions.
- B. Space continuous horizontal reinforcing 16-inches o.c. vertically, unless otherwise noted.
- C. Unless otherwise detailed, reinforce masonry openings greater than 1 foot wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8 inches apart, both immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2 feet beyond jambs of the opening except at control joints.

3.10 VERTICAL REINFORCED CONCRETE MASONRY

- A. Where grout filled or steel reinforced concrete block masonry foundations or masonry walls are called for on Drawings, they shall be reinforced and grouted as detailed on approved shop drawings.
 - 1. Place reinforcement and grout to comply with ACI 530.1/ASCE6/TMS 602.
- B. Do not pour grout until masonry wall has properly cured a minimum of 72 hours.

- C. 3000 psi grout shall be installed in the block cavities so as to completely fill each cavity with homogeneous grout, extending from the lowest course to the top of the reinforced portion of the foundation or wall. Concrete or mortar shall be used as grout for CMU.
- D. Within 15 minutes after the grout is placed, it shall be consolidated with a mechanical vibrator. The top of the grout filling shall be stopped 1-1/2 inches below the top of the concrete block to form a key, except for the top course in the wall where the grout shall be struck flush with the top.
- E. Where grouted cores do not extend the full height of a wall, install grout stop mesh at the lower limit of the grout.

3.11 MASONRY ANCHORS & TIES

- A. Provide anchoring devices of the type as specified, unless otherwise indicated on Drawings. Cooperate with other trades to assure proper location of anchors, inserts, penetrations, etc.
- B. Veneer to Concrete Walls:
 - 1. Install dovetail slots in concrete vertically at 2 feet on centers.
 - 2. Locate dovetail anchors at 16 inches maximum vertical intervals.
 - 3. Anchor new masonry to facing of existing concrete with corrugated wall ties spaced at 16 inch maximum vertical intervals, and at 2 feet maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.
- C. Anchorage of Abutting Masonry:
 - 1. Anchor interior masonry bearing walls or interior partitions to masonry walls with rigid wall anchors spaced at 16-inches maximum vertical intervals.
 - 2. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 4-inches into joints of new masonry. Fastened to existing concrete or masonry construction, with power actuated drive pins, nails or other means that provide rigid anchorage. Install anchors at 16-inch maximum vertical intervals.
- D. Column & Beam Anchors & Ties:
 - 1. Provide and open space not less than 1/2-inch width between masonry and structural member. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry to structural steel members with flexible 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. Provide additional anchors within 12-inches of openings, spaced maximum 36 inches around perimeter, and at edges and corners of masonry walls.

3.12 MOVEMENT (CONTROL & EXPANSION) JOINTS

- A. General: Provide specified vertical expansion, control, and isolation joints in masonry where shown. Build in related masonry accessory items as the masonry progresses. Rake out mortar in preparation for application of caulking and sealants. Caulking and Sealing are included under the Work of Section 07920 – Joint Sealants.
- B. Control Joint Locations in CMU: Provide vertical control joints in CMU where indicated on the Drawings, and at all offsets, returns, openings, and intersections with dissimilar materials and as follows to prevent cracking:
 - 1. At change of wall setting on foundation to wall setting on floor slab.
 - 2. At change from exterior to interior wall.
 - 3. At walls setting on floors that cross floor construction joints.
 - 4. At columns within masonry walls.
 - 5. At changes of wall thickness.

6. At end of lintel bearing on one end of openings less than or equal to 6'-4" and at both ends of openings greater than 6'-4".
 7. Straight runs as indicated below, with spacing related to wall height as follows:
 - a. Walls less than 8 feet high: Not more than 3 times wall height.
 - b. Walls 8 feet or higher: Maximum 24 feet.
- C. Expansion Joint Locations in Brick: Provide vertical expansion joints in brick masonry at all offsets, returns, openings, intersections with dissimilar materials, where indicated on Drawings, at not more than 24 feet o.c.. and as follows:
1. Provide horizontal expansion joints by placing a continuous 3/8-inch pad below shelf angles, where indicated.
 2. At one jamb of opening 12 feet or wider.
 3. Form open joint of width indicated, but not less than 3/8-inch for installation of 3/8-in expansion joint filler in preparation for caulking and sealants. Caulking and Sealing are included under the Work of Section 07920 – Joint Sealants. Maintain joint free and clear of mortar.
- D. Column Isolation from Masonry: Continuously wrap steel columns or structural supports within masonry walls with specified isolation liner.

3.13 LINTELS

- A. Install loose steel lintels, plates, anchor bolts embedded in masonry furnished under Division 5.
- B. Provide masonry lintels where shown and wherever openings of more than 8-inches for brick size units and 16-inches for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels.
- C. Provide minimum of 8-inch bearing at each end, unless otherwise noted.
- D. For steel lintels in exterior wythe of face brick, rake back mortar in preparation for sealant.

3.14 GROUTED UNITS

- A. At all locations under finish floor elevation and where subjected to backfill, earth, gravel, etc...
- B. At locations where bearing plates, joists, beams, and lintels directly bear on courses other than bond beam courses. The first three (3) courses of hollow CMU units, shall have cores filled solid with course grout, unless otherwise shown.

3.15 FLASHING FOR MASONRY WORK

- A. General: Install concealed through wall flashing in masonry at shelf angles, lintels, ledges, in the first course above and at other obstructions to the downward flow of water in the wall, and where indicated. Comply with NCMA recommendations for "drainage wall system" masonry construction.
- B. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloped bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.
- C. Install flashings as follows:
 1. At lintel and shelf angles, extend flashing a minimum of 4-inches into masonry at each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4-inches, and through the inner wythe to within 1/2-inch of interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2-inches, unless otherwise indicated.
 2. At heads and sills, extend flashing as specified above, unless otherwise indicated, and turn up ends not less than 2-inches to form a pan.

3. Install flashing in masonry veneer walls as specified above, but carry flashing up sheathing at least 8-inches and behind air infiltration barrier/building paper.
 4. Install stainless steel drip edge as shown in the drawings and in accordance with flashing and drip edge manufacturer's installation instructions.
- D. Provide cell vents in head joints of walls located immediately above through wall base flashing, above through wall flashing at wall openings and above through wall flashing where exterior walls project above adjacent lower roofs. Space at 24-inches o.c., unless otherwise noted.
1. Provide cell vent 32-inches o.c. with CMU exterior wythe, unless otherwise noted.
- E. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.

3.16 REPAIRING, POINTING & CLEANING

- A. Repairing: Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.
- C. 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 non-metallic scrape hoes or chisels.
 2. Test cleaning method on sample wall panel; leave ½ panel un-cleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 4. Wet all surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clean water.
 5. Clean exposed brick masonry surfaces by means of bucket and brush hand-cleaning method with proprietary acidic cleaner specified in Section 04090 as recommended by BIA "Technical Notes 20 Revised".
 - a. Apply in compliance with directions of acidic cleaner manufacturer.
 - b. Remove efflorescence in accordance with brick manufacturer's recommendations. Cleaning agents may be used only with approval of masonry unit manufacturer.
 6. Clean exposed CMU masonry by dry brushing after final pointing and at the end of each day's work to remove mortar spots and droppings in accordance with cleaning methods recommended in NCMA TEK 45 applicable to type of stain present.
 - a. If additional cleaning is necessary for special or pre-faced CMU, consult with masonry unit manufacturer for approved method.
 - b. Water application method shall never exceed 400 psi.
 7. Clean exposed Cast Stone complying with Section 04 72 00.

END OF SECTION

**SECTION 05 12 00 - STRUCTURAL STEEL FRAMING
(Café Building Only)**

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. Structural steel.
 2. Field-installed shear connectors.
 3. Grout for baseplates and bearing plates.
- B. Related Sections:
1. Division 03 Section "Cast-in-Place Concrete" for setting anchor rods and embedded plates in concrete.
 2. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
 3. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
 4. Division 05 Section "Metal Stairs."
 5. Division 09 painting Sections for surface-preparation, priming requirements and touch up painting.
- C. **["DOMESTIC STEEL USE REQUIREMENTS AS SPECIFIED IN SECTION 15 3.011 OF REVISED CODE APPLY TO THIS PROJECT. COPIES OF SECTION 15 3.011 OF THE REVISED CODE CAN BE OBTAINED FROM THE OFFICE OF THE OHIO FACILITIES CONSTRUCTION COMMISSION."]**

1.03 DEFINITIONS

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

1.04 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions and directions for installation.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.06 PERFORMANCE REQUIREMENTS

- A. The drawings indicate typical connection details, specific connection details and/or connection details indicating design intent for the various connection locations required by the drawings. Simple connections may not be detailed on the drawings. The steel fabricator shall provide details of all connections including the connections not specifically detailed, following the intent of the drawings. The connection design shall be performed under the supervision of a qualified professional engineer registered in the state where the project is located. The connections shall be designed for loads shown on the drawings. Where the reactions of beams and girders are not shown, the connections shall be designed to support the maximum allowable uniform loads as indicated in the load tables of the AISC Steel Construction Manual for the given beam size and span. Double angle and single plate connections detailed in accordance with the AISC Steel Construction Manual are acceptable; single angle connections are not permitted.
1. Select and complete connections using schematic details indicated and AISC 360.

1.07 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
1. Provide shop drawings including erection drawings and detail sheets of all structural steel components.
 - a. Erection drawings shall include at a minimum:
 - 1) Anchor rod plans and embedment plans showing templates and directions for installation of anchor rods and other anchorages and embedded items to be installed by others.
 - 2) Floor and roof plans.
 - 3) Mezzanines, entrances, canopies and trellis.
 - 4) Plans shall include member marks and all dimensions and elevations required to erect the structural steel.
 - 5) Details and/or sections of all erections that include field welding, assembly, processes, field alignment, etc.
 - b. For fabrication and detail drawings:
 - 1) Include sizes, dimensions, steel grade, surface preparation, primer paint, details of cuts, copes, connections, splices, camber, holes, and other pertinent data.
 - 2) Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 3) Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 - 4) Identify members and connections of the seismic-load-resisting system.
 - 5) Indicate locations and dimensions of protected zones.
 - 6) Identify demand critical welds.
 2. The electronic files of the project's structural drawings will be provided upon request for use in the preparation of fabrication or erection drawings.
 - a. Prior to receiving the drawing files, the contractor is required to sign an "Agreement for Transfer and Use of Electronic Files."
 - b. The electronic files are not contract documents. Significant differences may exist between the electronic files and the corresponding hard copy documents due to addenda, change orders, revisions, layer visibility or other reasons. In the event of a conflict, printed hard copy drawings and specifications shall take precedence over electronic files. The Contractor is responsible to verify the accuracy of all data contained in the electronic files.

- c. If the electronic files are imported into other software or applications packages for the purpose of preparing fabrication, erection, manufacturing drawings or any other type of document, the contractor shall verify all dimensions, lines, reference points, etc. with annotated dimensions found elsewhere in the contract documents. The Contractor is responsible to adjust the file accordingly prior to their use of the files.
- C. Delegated-Design Submittal: Calculations stamped and signed by an engineer registered in the state where project is located for:
 - 1. Moment connections (flexible, partially restrained and fully restrained).
 - 2. Bracing connection (x-brace, v-brace, etc.)
 - 3. As noted on drawings.

1.08 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and shop-painting applicators.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties, to comply with ASTM A6 or ASTM A568.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control and special inspection reports.

1.09 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- B. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

1.10 DELIVERY, STORAGE, AND HANDLING

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

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating F1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M or as noted on drawings.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Finish: Black except where indicated to be galvanized.
- F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A 325 or F 1852, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
- B. Bolts, nuts and washers indicated to be galvanized on drawings shall be hot dipped galvanized per ASTM A153.
- C. Unheaded Anchor Rods: provide ASTM F 1554, Grade 36 unless noted otherwise on drawings.
 1. Configuration: Straight.
 2. Nuts: ASTM A 563 heavy-hex carbon steel.
 3. Plate Washers: ASTM A 36 carbon steel.
 4. Washers: ASTM F 436 Type 1, hardened carbon steel.
 5. Finish: Plain, except if noted on drawings to be galvanized, provide anchor rods, plates, nuts and washers hot dipped galvanized per ASTM A153, class C.
- D. Threaded Rods: ASTM A 36.
 1. Nuts: ASTM A 563 heavy-hex carbon steel.
 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
 3. Finish: Plain, except if noted on drawings to be galvanized, provide threaded rods, nuts and washers hot dipped galvanized per ASTM A153, class C.

2.03 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat. Color as indicated
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.04 GROUT

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

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- G. Equipment Supports and Mechanical Opening Framing: Framing shown on structural drawings is for general arrangement only and may require modification to suit the actual purchased equipment. Coordinate with mechanical trades for necessary certified drawings before starting fabrication. Steel Fabricator shall provide a complete job ready for installation of equipment, and Contract price shall cover this requirement regardless of subsequent modifications to framing shown on drawings, at no extra cost to the Owner.

2.06 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, pre-tensioned or slip critical as indicated on the drawings. Twist-off type tension-control bolts are permitted only at joints indicated as pre-tensioned or slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M (Structural welding code) and AWS D1.8/D1.8M (Structural welding code, Seismic Supplement) for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.07 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. All interior steel exposed to view SSPC – SP6 commercial blast cleaned.
 2. All exterior steel exposed to weather SSPC – SP10/NACE No. 2 near white blast cleaned.
 3. All other steel SSPC – SP3 power tool cleaned.
 4. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for architecturally exposed steel, unless otherwise indicated in Division 05 Section "Architecturally Exposed Structural Steel Framing."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated on drawings according to ASTM A 123/A 123M.
 1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

2.09 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a special inspector to perform shop tests and inspections and prepare test reports.
 1. Provide special inspector and testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections shall be inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- D. Welded Connections: all shop welded connections shall be visually inspected according to AWS D1.1/D1.1M.
- E. In addition to visual inspection, complete penetration shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M by ultrasonic inspection procedures per ASTM E164.
- F. Required special inspection and verification as outlined in the applicable building code, including but not limited to:

1. Material verification of high strength bolts, nuts and washers.
2. Inspection of high strength bolting.
3. Material verification of steel.
4. Review of welders' certification.
5. Material verification of weld filler material.
6. Inspection of welding.
7. Inspection of joint details.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base, Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.

- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Snug tight joints (bearing bolts) shall be tightened such that all plies are brought into firm contact only. This is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench. Do not over-tighten bearing bolts. Do not use twist-off type tension-control bolts for bearing bolts.
 - 2. Pretensioned and Slip-critical bolts shall be tightened in accordance with AISC by the turn of the nut method, by using direct tension indicators, by properly calibrated wrenches or by using twist-off type tension-control bolts.
- B. Weld Connections: Comply with AWS D1.1/D1.1M (Structural welding code) and AWS D1.8/D1.8M (Structural welding code, Seismic Supplement) for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a special inspector to perform tests and inspections and prepare the necessary reports.
- B. Required special inspection and verification as outlined in the applicable building code, including but not limited to:
 - 1. Material verification of high strength bolts, nuts and washers.
 - 2. Inspection of high strength bolting.
 - 3. Material verification of steel.
 - 4. Review of welders' certification.
 - 5. Material verification of weld filler material.
 - 6. Inspection of welding.
 - 7. Inspection of joint details.
- C. Bolted Connections: Bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts." Non-slip-critical connections require only visual inspection. Pre-tensioned and slip-critical connections require inspection to conform with AISC specifications for the method of tightening selected. Contractor shall discuss with the Engineer prior to erection.
- D. Welded Connections: All field welds shall be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, full penetration field welds shall be tested and inspected according to AWS D1.1/D1.1M by ultrasonic inspection procedures, per ASTM E164.
- E. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION

**SECTION 05 12 00 - STRUCTURAL STEEL FRAMING
(Stage/Pavilion/Rotunda Only)**

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. Structural steel.
 - 2. Grout.
- B. Related Requirements:
 - 1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
 - 2. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.

1.03 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.04 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Landscape Architect's office.

1.06 ACTION SUBMITTALS

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

- C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by a Professional Engineer licensed in the State of Ohio.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer] [fabricator] [shop-painting applicators] [professional engineer] [testing agency].
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Survey of existing conditions.

1.08 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of all connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Load and Resistance Factor Design; data are given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.

2.02 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992 Grade 50.
- B. Channels, Angles: ASTM A572 Grade 50
- C. Plate and Bar: ASTM A36 Grade 50
- D. Cold-Formed Hollow Structural Sections: ASTM A500 Grade B, structural tubing.
- E. Welding Electrodes: Comply with AWS requirements.
- F. Stainless Steel Plates: ASTM A240 S31603 Grade 316L

2.03 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
- B. Anchor Rods: ASTM F1554, Grade 36
- C. Bracing Rods: TriPyramid A70-024 Carbon Steel Rod, Grade 460, Ultimate Strength 90 ksi, or similar approved
- D. Jaw Assemblies: TriPyramid B275-860-024 Jaw Assembly for Grade 460 Rod or similar approved

2.04 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A6/A6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Slip critical
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work. Stainless steel welds shall meet AWS 316L specifications A5.9, A5.4 and A5.22, with a maximum sulfur content of 0.005.
1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.07 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 2-3 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 SOURCE QUALITY CONTROL

- A. Testing Agency: The City of Canton will engage a qualified testing agency to perform shop tests and inspections.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E165.
 - 2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E164.
 - 4. Radiographic Inspection: ASTM E94.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in

permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
F. Do not use thermal cutting during erection.
G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Slip critical
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: The City of Canton will engage a qualified special inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: The City of Canton will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94.

3.06 REPAIRS AND PROTECTION

- A. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00

**SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING
(Stage/Pavilion/Rotunda Only)**

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. Architecturally exposed structural steel (AESS).
 - 2. Section 05 12 00 "Structural Steel Framing" requirements that also apply to AESS.

1.03 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.

1.04 COORDINATION

- A. Coordinate surface preparation requirements for shop-primed items.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Landscape Architect's office.

1.06 ACTION SUBMITTALS

- A. Product Data:
 - 1. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 2. Filler.
 - 3. Primer.
- B. Shop Drawings: Show fabrication of AESS components.
 - 1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
 - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 3. Include embedment Drawings.
 - 4. Indicate orientation of mill marks and HSS seams.
 - 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.
 - 6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.

7. Indicate exposed surfaces and edges and surface preparation being used.
 8. Indicate special tolerances and erection requirements.
 9. Indicate weep holes and grout holes for HSS
 10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- C. Samples: Submit Samples to set quality standards for AESS.
1. Two steel plates, 3/8 by 8 by 4 inches, with long edges joined by a groove weld and with weld ground smooth.
 2. Steel plate, 3/8 by 8 by 8 inches, with one end of a short length of round steel tube, minimum 6 inches in diameter, welded to plate with a continuous fillet weld and with weld ground smooth and blended.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.08 FIELD CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.02 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.
- B. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.
- C. Category AESS 2:
1. Comply with overall profile dimensions of AWS D1.1 for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
 3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.

4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
6. Limit butt and plug weld projections to 1/16 inch
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

2.03 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Slip critical
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.

1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
 2. Grind tack welds smooth.
 3. Remove backing and runoff tabs, and grind welds smooth.
 4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
 5. Remove erection bolts in AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
 6. Fill weld access holes in AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
 7. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
1. Erection of AESS:
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than 1/16 inch.
 - e. Continuous welds shall be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.

3.04 FIELD CONNECTIONS

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

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: The City of Canton will engage a qualified testing agency to inspect AESS as specified in Section 05 12 00 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect/Structural Engineer will observe AESS in place to determine acceptability relating to aesthetic effect.

END OF SECTION 05 12 13

SECTION 05 31 00 - STEEL DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
 - 2. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 3. Division 09 painting Sections for repair painting of primed deck.

1.03 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, attachments to other construction.
 - 1. Shop drawings shall indicate the date of the structural drawings that were used to prepare the shop drawings.
 - 2. Shop drawing submittals shall consist of three (3) prints of each drawing.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of steel deck, signed by product manufacturer.
- B. Welding certificates.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- D. Research/Evaluation Reports: Evaluation reports from ICC-ES for each of the following:
 - 1. Steel deck.
 - 2. Power-actuated mechanical fasteners.

- E. Field quality-control test and inspection reports.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.
- D. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.; The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. Epic Metals Corporation.
 - e. New Millennium Building Systems, LLC.
 - f. Nucor Corp.; Vulcraft Division.
 - g. United Steel Deck, Inc.
 - h. Valley Joist; Division of EBSCO Industries, Inc.
 - i. Vercor Manufacturing Co.
 - j. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.02 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with the latest edition of SDI-RD "Standard for Steel Roof Deck", and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Gray.
 - 2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 zinc coating.
 - 3. Deck Profile: Type WR, wide rib as indicated on the drawings.
 - 4. Profile Depth: As indicated on the drawings.
 - 5. Design Uncoated-Steel Thickness: As indicated on the drawings.
 - 6. Span Condition: Triple span or more.

7. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.03 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile as required to comply with SDI-C and SDI-NC for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- J. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI-RD, SDI-C, or SDI-NC, manufacturer's written instructions, and requirements in this Section.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use deck units for storage or working platforms until permanently secured.

- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Fastening Deck:
 - 1. Fasten deck units to steel supporting members by welding as noted on drawings.
 - 2. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work. Use welding washers where indicated on drawings.
 - 3. Mechanically fasten side laps of adjacent deck units as noted on drawings.
- G. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- H. Provide additional reinforcement and closure pieces at openings as required for strength and continuity of deck.
- I. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- J. Mechanical fasteners may be used in lieu of welding to fasten deck, subject to prior approval by engineer. Mechanical fastener design values shall equal or exceed the specified weld values.
 - 1. Design Requirements: ICC-ES AC43 or SDI method for diaphragm shear strength and stiffness.
 - 2. Installers shall be trained and certified by manufacturer.

3.03 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: As indicated on the drawings.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated on the drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on the drawings:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
 - 1. Mechanically fasten cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

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- G. No light gage framing, mechanical, electrical, or other equipment shall be suspended from or attached to any metal roof deck.

3.04 FLOOR-DECK INSTALLATION

- A. Floor-Deck Closures: Weld steel sheet column closures and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- B. Ceilings, ductwork and lights may be hung from the composite floor deck after concrete has reached 75% of its design strength. Contractor shall list allowable hanger tab capacity on shop drawings. Hung loads shall not exceed tab capacity.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Required special inspection and verification as outlined in the applicable building code, including but not limited to:
 - 1. Material verification of weld filler material.
 - 2. Inspection of welding.
 - 3. Inspection of mechanical fastening.
- C. Field welds will be subject to inspection, conforming to AWS D1.3.
- D. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.06 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
1. **[Exterior non-load-bearing wall framing.]**
 2. Interior non-load-bearing wall framing exceeding span limitations of standard, non-structural metal framing.
 3. **[Ceiling joist framing.]**
 4. **[Soffit Framing.]**
- B. Related Sections include the following:
1. **[Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.]**
 2. Division 09 Section "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with span limitations, and ceiling-suspension assemblies.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer as defined in section 01 40 00 "Quality Requirements", to design cold-formed steel framing.
- B. Structural Performance: The delegated designer shall design a complete system incorporating the minimum member sizes and the details indicated on the drawings. The complete system shall conform to the design intent indicated on the drawings. This system shall include all framing members shown on the structural drawings. The Architect and Engineer shall review any deviation from this design and additional review costs shall be the responsibility of the Contractor. The supplier and delegated designer are responsible to provide and design all connections, bracing, bridging, stiffeners, etc. as well as miscellaneous structural elements not already sized on the contract documents required for a complete system and continuous load path as indicated on the structural drawings. The design shall not impose loading on the structure, which differs from the design intent indicated on the drawings. Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on the drawings.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Wall Framing: Horizontal deflection shall not exceed the following for the respective supported finishes:

EIFS	1/240
Brick Veneer	1/600
Brick Veneer Wainscot Less Than 1/3 Story Height of Stud	1/360
Tile	1/720
Thin Brick*	[1/360]
Cultured Stone	1/600
Terra Cotta*	[1/360]
Metal Panel*	[1/240]
Interior Finished Drywall	1/360

Stucco

1/360

High loads on parapets shall not reduce back span deflection.

*Verify deflection criteria with finish system manufacturer's recommendations. Design with consideration for differential deflection between adjacent members as recommended by manufacturer.

- b. Interior Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of five lbf/sq. ft.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1inch, unless indicated otherwise on drawings.
 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Framing shall comply with AISI S100, AISI S200, and the following:
1. Wall Studs: AISI S211
 2. Headers: AISI S212.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing, product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed metal framing indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, registered in the state where the project is located.

1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of code-compliance certification for studs and tracks.
- C. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.

6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

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

1.06 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, the Steel Stud Manufacturers Association, or a similar organization that provides verifiable code compliance program.
- F. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3/D1.3M, "Structural Welding Code--Sheet Steel."
- G. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required in AISI's "Code of Standard Practice".
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
1. AllSteel Products, Inc.
 2. California Expanded Metal Products Company.
 3. Clark Dietrich Building Systems.
 4. Consolidated Fabricators Corp.; Building Products Division.

5. Craco Metals Manufacturing, LLC.
6. Custom Stud, Inc.
7. Formetal Co. Inc. (The).
8. MarinoWare; a division of Ware Industries.
9. Quail Run Building Materials, Inc.
10. SCAFCO Corporation.
11. Steel Construction Systems.
12. Steeler, Inc.
13. United Metal Products, Inc.
14. Telling Industries, LLC.

2.02 MATERIALS

- A. Framing Members, General: Comply with ASTM C955.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST33H, ST50H.
 2. Coating:
 - a. G90 or GF90 for wall back up at brick veneer.
 - b. G60, A60, AZ50, or GF30 for all other framing.
- C. Steel Sheet for Connection Clips and Connection Materials: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: 50, Class 1 or 2.
 2. Coating: G90.

2.03 NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: As indicated on the drawings (0.0428 inch for wall stud back up at brick veneer).
 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Minimum Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Clark Dietrich Building Systems.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure.

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- E. Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure.

2.04 CEILING JOIST FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As indicated on the drawings.
 - 2. Minimum Flange Width: 1-5/8 inches, minimum.

2.05 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by design. Coordinate with finish system manufacturer's recommendations.
 - 2. Minimum Flange Width: 1-5/8 inches, minimum.

2.06 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A1003, Structural Grade, Type H, G90.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers, knee braces, and girts.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.07 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES Acceptance Criteria as appropriate for the substrate.
- D. Power-Actuated Fasteners: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.08 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.09 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C1007 and AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding or screw fastening as indicated on the drawings. Wire tying of framing members is not permitted. Welding of studs at brick veneer back up is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
 2. Connect vertical deflection clips to studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically 48 inches maximum or as indicated on Shop Drawings. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **[12 inches [18 inches]** of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at 96-inch centers or as indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.05 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting conforming to AWS D1.3 requirements.
- C. Required special inspections and verifications as outlined in the applicable building code, including but not limited to:
1. Fabrication and welding of fabricated cold formed metal elements.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

3.06 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. Framing with dimensional lumber
 - 2. Wood grounds, nailers, blocking, sleepers, and furring.
 - 3. Temporary closures and protection

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 1 – Construction Waste Management

1.04 REFERENCES

- A. Reference Standards:
 - 1. American National Standards Institute:
 - a. ANSI A208.1 - Mat-Formed Wood Particleboard.
 - 2. American Wood-Preservers' Association:
 - a. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
 - b. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
 - 3. National Institute of Standards and Technology:
 - a. NIST PS 20 - American Softwood Lumber Standard.
 - 4. Southern Pine Inspection Bureau:
 - a. SPIB - Standard Grading Rules for Southern Pine Lumber.
 - 5. West Coast Lumber Inspection Bureau:
 - a. WCLIB - Standard Grading Rules for West Coast Lumber.
 - 6. Western Wood Products Association:
 - a. WWPA G-5 - Western Lumber Grading Rules.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the

Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.

- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.07 QUALITY ASSURANCE

- A. Mill and Producers Mark: Each piece of lumber and plywood shall be gradestamped indicating type, grade, mill, and grading agency certified by the Board of Review of the American Lumber Standards Committee. Mark shall appear on unfinished surface, or ends of pieces with finished surfaces.
1. Pressure Preservative Treated Material: Accredited agency quality mark on each piece of wood indicating treatment.
 2. Fire-Retardant Treated Material: Accredited testing agency mark on each piece of wood indicating compliance with the fire hazard classification.

1.08 DELIVERY, STORAGE & HANDLING

- A. Keep materials dry during delivery. Store materials 6 inches minimum above ground surface. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation between stacks.
B. Cover stored materials until ready for use for protection from moisture. Place and anchor covering in a manner which will assure good ventilation under the covering.

1.09 COORDINATION

- A. Coordinate location of supporting members to allow proper attachment of other Work.

PART 2 - PRODUCTS

2.01 LUMBER

- A. General: Furnish seasoned dimension lumber dressed to nominal sizes indicated with 19 percent maximum moisture content at time of dressing, marked "S-DRY". Comply with dry size requirements of PS 20.
1. Dress: Surfaced 4 sides (S4S) unless otherwise indicated.
- B. Framing Lumber: Species: Douglas Fir or Hem-Fir (WWPA or WCLIB), Southern Pine (SPIB), Redwood (RIS), or Spruce-Pine-Fir (NLGA) unless otherwise indicated.
1. Light Framing; 2 inches through 4 inches thick, less than 6 inches wide:
 - a. Stud grade lumber for stud framing and Standard grade lumber for other light framing.
 2. Structural Framing; 2 inches through 4 inches thick, 6 inches and wider:
 - a. Select Structural grade.
 - b. No. 1 grade.
 - c. No. 2 grade.

- d. No. 3 grade.
- 3. Exposed Framing; 2 inches through 4 inches thick: Furnish the following species and grade where framing will not be concealed by other Work:
 - a. Douglas Fir, Select Structural grade (WWPA or WCLIB).
 - b. Southern Pine, Select Structural grade (SPIB).
 - c. Douglas Fir, Appearance grade (WWPA or WCLIB).
 - d. Southern Pine, Appearance grade, kiln dried (SPIB).
 - e. Redwood, Clear All Heart (RIS).
 - f. Spruce-Pine-Fir, Appearance grade (NLGA).
- C. Board Lumber; less than 2 inches thick:
 - 1. Exposed Board Lumber, for Paint Finish: Southern Pine No. 1 (SPIB), Douglas Fir 2 Common (WWPA) or Select Merchantable (WCLIB), Redwood Construction Common (RIS), or Spruce-Pine-Fir No. 1 / No. 2 (NLGA).
 - 2. Exposed Board Lumber, for Transparent Finish: Redwood Clear (RIS).
 - 3. Concealed Board Lumber: Southern Pine No. 3 (SPIB), any species No. 4 (WWPA) or any species Standard (WCLIB), Redwood Merchantable (RIS), or Spruce-Pine-Fir No. 1 / No. 2 (NLGA).
- D. Miscellaneous Lumber: Standard grade, No. 3 grade, or better grade of the following species unless otherwise indicated.
 - 1. Nailers and Blocking: Douglas Fir, Hem-Fir, Idaho White Pine, Southern Pine, or Spruce-Pine-Fir.
 - 2. Furring: Douglas Fir, Southern Pine, or Spruce-Pine-Fir.
 - 3. Plaster Grounds:
 - a. Interior Use: Douglas Fir, Southern Pine, or Spruce-Pine-Fir.
 - b. Exterior Use: Western Red Cedar or Redwood.
 - 4. Floor Sleepers: Western Red Cedar or Redwood Construction Heart.
 - 5. Door Bucks: Western Red Cedar or Redwood.

2.02 PLYWOOD

- A. Sheathing and Subflooring: APA RATED SHEATHING, EXPOSURE 1. Furnish APA PS 1 veneered panels, with span ratings for the required thicknesses as listed below unless otherwise indicated.
 - 1. Thickness: 3/8 inch; Span Rating: 24/0.
 - 2. Thickness: 1/2 inch; Span Rating: 32/16.
 - 3. Thickness 5/8 inch; Span Rating: 40/20.
 - 4. Thickness 3/4 inch; Span Rating: 48/24.
- B. Underlayment: APA UNDERLAYMENT, EXPOSURE 1.
 - 1. For use under resilient tile flooring and resilient sheet flooring: Sanded face.
 - 2. For use under carpet and "liquid" flooring: Touch-sanded.

2.03 PRESERVATIVE TREATMENT

- A. Treat lumber and plywood where indicated and as specified. Comply with applicable AWPA and AWPB Standards and quality control and inspection requirements.
 - 1. Fasteners and anchoring devices to be used with wood treated with waterbourne preservatives shall be hot-dipped galvanized or stainless steel if the wood will be exposed to moisture.

- B. Complete fabrication of items to be treated to the greatest extent possible prior to treatment. Where items must be cut after treatment, coat cut surfaces with heavy brush coat of the same chemical used for treatment or other solution recommended by AWWPA Standards for the treatment.
- C. Inspect wood after treating and drying. Discard warped or twisted items.
- D. Pressure Treatment (Above Ground Use): Treat the following wood items with waterbourne preservatives for above ground use, complying with AWPB LP-2. Redry wood to a maximum moisture content of 19 percent after treatment.
 - 1. Nailers, blocking, cants, shim stock, and similar members used in conjunction with roofing (including related flashings, trim and vapor barrier), coping, and waterproofing.
 - 2. Nailers, blocking, furring, stripping, and similar concealed members in contact with exterior masonry and concrete (including interior wythe of exterior walls), and all sills for framing.
 - 3. Wood items indicated or scheduled on the Drawings to be preservative treated.
- E. Pressure Treatment (Ground Contact Use): Treat the following wood items with waterbourne preservatives for below ground use, complying with AWPB LP-22:
 - 1. Wood members placed in the ground.
 - 2. Wood members immersed in fresh water.

2.04 FIRE-RETARDANT TREATMENT

- A. Furnish "FR-S" lumber where indicated, complying with AWWPA Standards for pressure impregnation with fire-retardant chemicals to achieve a flamespread rating of 25 or less, when tested in accordance with UL Test 723, ASTM E 84 or NFPA Test 255.
 - 1. Where treated items are indicated to receive a transparent or paint finish, use a fire-retardant treatment which will not bleed through or adversely affect bond of finish.
 - 2. Provide UL label or identifying mark on each piece of fire-retardant lumber.
 - 3. Redry treated items to a maximum moisture content of 19 percent after treatment.
- B. Fire-Retardant wood / blocking shall be used in the following areas:
 - 1. Non-loadbearing exterior walls where no fire rating is required.
 - 2. Roof construction where wood or blocking is indicated

2.05 FRAMING HARDWARE

- A. Fasteners and Anchoring Devices: Select and furnish items of type, size, style, grade, and class as required for secure installation of the Work. Items shall be galvanized for exterior use. Unless shown or specified otherwise, comply with the following:
 - 1. Nails and Staples: FS FF-N-105.
 - 2. Wood Screws: FS FF-S-111.
 - 3. Bolts and Studs: FS FF-B-575.
 - 4. Nuts: FS FF-N-836.
 - 5. Washers: FS FF-W-92.
 - 6. Lag Bolts or Lag Screws: FS FF-B-561.
 - 7. Masonry Anchoring Devices: Expansion shields, masonry nails and drive screws: FS FF-S-325.
 - 8. Toggle Bolts: FS FF-B-588.
 - 9. Bar or Strap Anchors: ASTM A575 carbon steel bars.
 - 10. Wall Plugs: Corrugated type, galvanized steel, 24 USS gage min, not less than 2 inches wide x 2-1/2 inches deep.
 - 11. Cross Bridging: Nailable type, galvanized steel, 16 USS gage min, by 3/4 inch wide.

12. Metal Hangers and Framing Anchors: Size and type for intended use, galvanized finish, manufacturer's recommended fasteners.
13. Buck Anchors: Corrugated type, galvanized steel not lighter than 12 USS gage min, 4 inches wide (except where partitions are less than 4 inches thick) by 8 inches long, punched for two 5/16 inch carriage bolts at buck end.
14. Sleeper Anchors: Approved type, galvanized steel not lighter than 20 USS gage min, not less than 1-1/4 inches wide, designed to anchor into concrete not less than 1-1/2 inches and permit height adjustment of sleeper.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine substrate and supporting structure on which rough carpentry is to be installed for defects that will adversely affect the execution and quality of the Work. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION – GENERAL

- A. Do not use units of material with defects which impair the quality of the Work and units which are too small to fabricate the Work with minimum joints or with optimum joint arrangement.
- B. Install Work accurately to required lines and levels with members plumb and true, accurately cut and fitted and securely fastened. Closely fit rough carpentry to other associated construction.
- C. Securely attach carpentry Work to substrates by anchoring and fastening as indicated or, if not indicated, as required by the referenced standards. Select fasteners of size that will not penetrate through members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required. Set nail heads in exposed Work which is to be painted or stained and fill resulting holes.
- D. Treated Wood: Apply heavy brush coat of treatment material to field cut surfaces.

3.03 WOOD FRAMING

- A. Install framing members of nominal sizes indicated or of units built-up to dimensions indicated, on spacings shown. Unless otherwise indicated, comply with the recommendations of the AFPA "Manual for Wood Frame Construction". Construct required openings for installation of related work. Do not splice structural members between supports.
- B. Anchor and nail members as indicated. If not indicated, comply with the "Recommended Nailing Schedule - Table 1" of the "Manual for Wood Frame Construction" and other applicable recommendations of the AFPA.
- C. Install miscellaneous blocking and framing indicated and as required for attachment and support of facing materials, fixtures, specialty items, and trim.
- D. Firestop concealed spaces with wood blocking not less than 2 inches thick, if not blocked by other framing members. Install blocking at each building story level and at ends of each joist.
- E. Stud Framing: Install stud framing indicated. Unless otherwise shown, use 2 x 4 inch wood studs spaced 16 inches oc with 4 inch face perpendicular to direction of wall or partition. Install single bottom plate and double top plates 2 inches thick by width of studs; except single top plate may be used for non-load-bearing partitions. Nail or anchor plates to supporting construction.
 1. Construct corners and intersections with not less than 3 studs. Frame openings with multiple studs and headers. Install nailed header members of thickness equal to width of studs.

2. Install diagonal bracing in exterior wall stud framing unless otherwise indicated. Brace both walls at each external corner, full story height, at 45 degree angle. Use either a let-in 1 x 4 inch board or 2 x 4 inch blocking.
- F. Joist Framing: Install framing of sizes and on spacings shown. Install with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach to wood bearing members by toe nailing or metal connectors; frame to wood supporting members with wood ledgers or with metal connectors. Fire-cut members built into masonry (if any). Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 4 feet. Do not notch in middle third of joists; limit notches to 1/6-depth of joist, 1/4 at ends. Do not bore holes larger than 1/3-depth of joist or locate closer than 2 inches from top or bottom. Install solid blocking (2 inches thick by depth of joist) at ends of joists unless nailed to header or band member.
1. Lap members framing from opposite sides of beams, girders or partitions not less than 4 inches or securely tie opposing members together. Install solid blocking (2 inches thick by depth of joist) over supports.
 2. Anchor masonry bearing members with 1/4 x 1-1/4 inch metal strap or "T" anchors with wall ends bent 4 inches at every second joist. Extend anchors not less than 1'-4" along bottom of joist end and nail.
 3. Anchor members paralleling masonry with 1/4 x 1-1/4 inch metal strap anchors spaced not more than 8 feet oc. Extend anchors at least 4 inches into masonry, turn up 4 inches and extend over and fasten to 3 joists.
 4. Install solid blocking between joists under jamb studs at openings.
 5. Under non-load-bearing partitions, install double joists separated by solid blocking equal to depth of studs above.
 - a. Install triple-joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures, unless otherwise shown.
- G. Install bridging between joists where nominal depth-to-thickness ratio exceeds 4, at intervals of 8 feet.

3.04 WOOD NAILERS, BLOCKING, AND GROUNDS

- A. Install required items where indicated and where required for support, attachment or screeding of other Work. Form to shapes indicated or required. Coordinate locations and cut and shim as required to provide items at true and level planes to receive Work to be attached. Install closure strips for nailers at all edges.
1. Attach to substrates as indicated; if not indicated, size and space fasteners as required to support applied loading. Maximum spacing of fasteners shall not exceed 16 inches. Unless otherwise shown on the Drawings, install and secure material to non-wood construction as follows:
 - a. To Concrete: Attach material less than 1-1/2 inches thick with screws and non-ferrous metal expansion shields. Attach material 1-1/2 inches and thicker with machine bolts and non-ferrous metal compound type anchors.
 - b. To Concrete Unit Masonry: Attach material to new masonry with annular ring nails driven into wall plugs where fastening occurs at joints of masonry or with special hardened steel masonry nails where fastening occurs in the masonry units. Attach material to existing masonry with machine screws and non-ferrous metal expansion shields where fastening occurs in solid portions of masonry. If fastening occurs at cells of masonry, secure material in place with toggle bolts.
 - c. To Brick Masonry: Attach material to new masonry with annular ring nails driven into wall plugs. Attach material to existing masonry with machine screws and non-ferrous metal expansion shields.

- d. To Steel: Attach material with galvanized bolts and nuts or stainless steel machine screws tapped into the metal, as required by conditions.
 - e. To Non-Ferrous Metal: Attach material with stainless steel or other approved non-ferrous metal bolts and nuts or self-tapping screws, as required by conditions.
2. Counter-sink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry Work. Where possible, anchor to formwork before concrete placement. Bevel both edges of members to be anchored in concrete. Shims shall be cedar shingles or redwood wedges.
 3. Install permanent grounds of dressed, preservative treated, key- beveled lumber not less than 1-1/2 inches wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.05 WOOD FURRING

- A. Install members plumb and level with closure strips at all edges. Shim with wood as required to achieve tolerance specified.
 1. Fastening: Attach to substrates as indicated; if not indicated, attach material as specified for nailers and blocking.
 2. Tolerance: Shim and level wood furring to a tolerance of 1/8 inch in 10 feet.
 3. Firestop furred spaces on walls at each floor level, with wood blocking or other approved non-combustible materials. Fit members accurately to close furred spaces.
 4. Furring to Receive Plywood Paneling: Unless otherwise indicated, 1 x 3 inch furring at 2 feet oc, horizontally and vertically.
 5. Furring to Receive Gypsum Drywall: Unless otherwise indicated, 1 x 2 inch furring at 16 inches oc, vertically.
 6. Furring to Receive Plaster Lath: Unless otherwise indicated, 1 x 2 inch furring at 16 inches oc, vertically.
 7. Suspended Furring: Size and spacing indicated, including hangers and attachment devices.

3.06 WASTE MANAGEMENT

- A. Separate wood waste in accordance with the Waste Management Plan.
- B. Set aside damaged wood for acceptable alternative uses; for example, use as bracing, blocking, cripples, or ties.
- C. Separate the following categories for disposal and place in designated areas for hazardous materials.
 1. Treated, stained, painted, or contaminated wood.
- D. Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

END OF SECTION

SECTION 06 61 16 - SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.
- D. Related Sections:
 - 1. Section 01 74 19 – Construction Waste Management
 - 2. Section 06 41 00 – Architectural Wood Casework for supports for countertops and sinks.
 - 3. Section 12 32 16 – Manufactured Plastic Laminate Clad Casework for cabinet and fixture work
 - 4. Section 22 – Plumbing piping and trim.

1.02 SUMMARY

- A. System Description:
 - 1. Solid Surface Sheet: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.
- B. Section Includes, but is not limited to:
 - 1. Countertops.
 - 2. Lavatory tops with integral bowls.
 - 3. Window sills
 - 4. Other items indicated as solid surfacing on the Drawings.
 - 5. Drilling holes as required.
 - 6. Installation of above listed items.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
- B. Section 06 10 00 – Rough Carpentry
 - 1. Section 09 22 00 – Non-Load Bearing Steel Framing
 - 2. Section 09 30 00 – Tiling
 - 3. Section 10 28 13 – Toilet Accessories
 - 4. Division 26 – Plumbing

1.04 REFERENCES

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI)
 - 2. NSF International
 - 3. American Society for Testing and Materials (ASTM):
 - a. C501 Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abrader.

- b. D256: Impact Resistance of Plastics and Electrical Insulating Materials.
 - c. D570: Water Absorption of Plastics.
 - d. D638: Tensile Properties of Plastics.
 - e. D696: Coefficient of Linear Thermal Expansion of Plastics.
 - f. D2583: Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser.
 - g. E84: Surface Burning Characteristics of Building Materials.
4. National Electrical Manufacturers Association (NEMA) LD.3 High Pressure Decorative Laminates.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Section 01 33 00 – Submittal Procedures.
- B. Product data:
 1. Detailed specification of construction and fabrication.
 2. Manufacturer's installation instructions.
 3. Manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.
- C. Shop drawings:
 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
 - a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
 - b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
 - c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.
- D. Samples for Selection: Full range of colors and patterns.
- E. Samples for Verification: Submit a 6" square sample of each selected color.
- F. Fabricator/installer qualifications: Provide copy of certification number.
- G. Manufacturer certificates: Signed by manufacturers certifying that they comply with requirements.
- H. Sample Warranty: Sample copy of manufacturer's warranty.
- I. Close-Out Document Submittals
 1. Warranty: Signed warranty.
 2. Operations & Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
 - a. Maintenance kit for finishes shall be submitted.

1.07 QUALITY ASSURANCE

- A. NSF/ANSI standards:

1. Refer to www.nsf.org for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.
- B. Source Limitations: Obtain materials and products from single source.
- C. Qualifications:
 1. Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.
 - a. Acceptable to or licensed by manufacturer.
 2. Fabricator Qualifications: Manufacturer certified solid surface fabricator/installer.

1.08 DELIVERY, STORAGE & HANDLING

- A. Deliver no components to project site until areas are ready for installation.
- B. Store components indoors prior to installation.
- C. Handle materials to prevent damage to finished surfaces.
 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.09 PROJECT CONDITIONS

- A. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 F° for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.10 PERFORMACE REQUIREMENTS

- A. Fire test response characteristics:
 1. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame Spread Index: 25 or less.
 - b. Smoke Developed Index: 450 or less.

1.11 WARRANTY

- A. See Section 01 77 00 – Closeout Procedures, for additional close out submittal information.
- B. See Section 01 78 36 – Warranties, for additional warranty requirements.
- C. Provide manufacturer’s warranty against defects in materials.
 1. Warranty shall provide material and labor to repair or replace defective materials.
 2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
 3. Manufacturer’s warranty period:
 - a. Ten years from date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: (* indicates the basis-of-design product) see Finish drawings for Finish Schedule for manufacturer and color selection and location.
 1. *Corian® surfaces from the DuPont Company
 2. Avonite Surfaces® from Aristech Acrylic LLC

3. Gibraltar Solid Surface, Type 051 as manufactured by Wilsonart International
4. Formica Solid Surface; Formica Corporation
5. Meridian, Tower Industries Massillon, Ohio
6. American Marble Industries Canton, Ohio

2.02 MATERIALS

- A. Products shall be "GREENGUARD Indoor Air Quality Certified" by the GREENGUARD Environmental Institute under the GREENGUARD Standard for Low Emitting Products.
- B. Solid polymer components
 1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
 2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
 3. The color and pattern shall extend throughout the material.

2.03 FEATURES

- A. Thickness:
 1. 1/4", 1/2", or 3/4"
 - a. When not specified elsewhere, thicknesses shall be as follows:
 - 1) Countertops:
 - 2) Lavatory tops with integral bowls: 3/4" w/ applied 4" apron
 - 3) Window sills:
- B. Edge treatment:
 1. As indicated on the drawings
 - a. When not specified elsewhere, edge treatments shall be as follows:
 - 1) Countertops:
 - 2) Lavatory tops with integral bowls: 1/2" top bullnose
 - 3) Window sills:
 2. Unless stated differently elsewhere, all exposed corners shall have 1/2" bullnose
- C. Sinks
 1. Integral sink:
 - a. Model number 7722 "Chic" Vanity Sink (basis of design: Corian®)
 - b. Mounting: Seamed undermount.

2.04 ACCESSORIES

- A. VOC emissions from adhesives and sealants must not exceed the VOC and chemical components limits of the LEED-NC, Version 3.0, Indoor Environmental Quality, Credit 4.1, Low-Emitting Materials: Adhesives & Sealants. This requirement shall supersede and take precedence over materials defined in this Section.
- B. Joint adhesive:
 1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints with a chemical bond.
- C. Sealant:

1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.
- D. Conductive tape:
1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- E. Insulating felt tape:
1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.05 FACTORY FABRICATION

- A. Fabrication to be performed by a manufacturer certified solid surface fabricator/installer.
- B. Shop assembly
1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
 2. Joints between components:
 - a. Form using manufacturer's standard joint adhesive without conspicuous joints.
 - b. Located where shown on approved shop drawings
 - c. Reinforce with strip of solid polymer material, 4" wide.
 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings and/or shop drawings.
 4. Rout and finish component edges with clean, sharp returns.
 - a. Rout cutouts, radii and contours to template.
 - b. Smooth edges.
 - c. Repair or reject defective and inaccurate work.
- C. Thermoforming:
1. Comply with manufacturer's data.
 2. Construct matching molds to form components shape.
 3. Heat entire component.
 - a. Material shall be uniform, between 275 and 325 degrees Fahrenheit during forming.
 4. Form pieces to shape prior to seaming and joining.
 5. Cut pieces to finished dimensions.
 6. Sand edges and remove nicks and scratches.
 7. Prevent blistering, whitening or cracking of material during forming.

2.06 COLORS

- A. Selected from manufacturer's full range of available selections
- B. Refer to Room Finish Plans for color selections.
- C. Lavatory tops with integral bowls:
1. Lavatory Top Color: refer to Finish Schedule and plans.
 2. Bowl Color: White Frost
- D. Verify color with Architect prior to fabrication.

2.07 FINISHES

- A. Finish:
 - 1. Provide surfaces with a uniform finish.
 - a. Matte; gloss range of 5–20.
 - b. Satin
 - c. Polished

2.08 PERFORMANCE CHARACTERISTICS

Property	Typical Result	Test
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10 ⁶ psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10 ⁶ psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale, ASTM D 785
Thermal Expansion	56 3.02 x 10 ⁻⁵ in./in./°C (1.80 x 10 ⁻⁵ in./in./°F)	Barcol Impressor, ASTM D 2583 ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000, Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000, Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000, Method 3.6
Izod Impact	0.3 ft.-lbs./in. of notch	ASTM D 256
Ball Impact	No fracture—1/2 lb. ball:	NEMA LD 3-2000
Resistance: Sheets	1/4" slab—36" drop 1/2" slab—144" drop	Method 3.8
Weatherability	Passes	ASTM D 2565
Specific Gravity	1.7 grams / cubic centimeter	ASTM D792
Water Absorption	Long-term 0.4% (3/4") 0.6% (1/2") 0.8% (1/4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburgh Protocol Test ("LC50" Test)
Flammability	All colors	ASTM E 84, (Class I and Class A)
Flame Spread Index	<25	NFPA 255 & UL 723
Smoke Developed Index	<25	

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Precondition solid surfacing in accordance with manufacturer's printed installation instructions.

3.03 INSTALLATION

- A. General Installation:
 - 1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
 - 2. Provide product in the largest pieces available.
 - 3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
 - a. Exposed joints/seams shall not be allowed.
 - b. Field joints shall be hard seamed unless otherwise specified.
 - 4. Reinforce field joints with solid surface strips extending a minimum of 2 inches on either side of the seam with the strip being the same thickness as the top.
 - 5. Cut and finish component edges with clean, sharp returns.
 - 6. Rout radii and contours to template.
 - 7. Anchor securely to base cabinets or other supports.
 - 8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
 - 9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 10. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
 - 11. Coordinate plumbing installation with Division 22.
 - 12. Install plumb, level, true and straight. Shim as necessary using concealed shims.
 - 13. Use silicone sealant for attaching back splashes and reveal edges. Seal all joints with sealant.
- B. Installation of integral sinks/vanities:
 - 1. Provide solid surface materials bowls and/or lavatories sinks with overflows in locations shown on the drawings.
 - 2. Attach top securely to base unit or support brackets in accordance with manufacturer's printed instructions.
- C. Installation of window stools
 - 1. Install window stools full length of window, set securely into place using only concealed fasteners and manufacturer's approved adhesive.
 - 2. Provide minimum 1/8" expansion gaps on both sides of window stools, sealed with Manufacturer's approved sealant.
 - 3. Ease edges and sand smooth.

3.04 REPAIR

- A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.05 CLEANING AND PROTECTION

- A. Keep components clean during installation.
 - 1. At completion of work, remove all excess material, dirt, dust, trash and other materials resulting from the installation. Clean surfaces, remove all labels and leave the area clean.

- B. Remove excessive adhesive and sealants. Components shall be clean on Date of Substantial Completion.

3.06 PROTECTION

- A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged components that cannot be repaired to architect's satisfaction.
- B. Fabricator/Installer to provide the care and maintenance kit, review maintenance procedures and the warranty with the head of maintenance upon completion of project.

END OF SECTION

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section Includes, but is not limited to:
 - 1. The work included in this Section consists of furnishing all labor, materials, tools, and equipment necessary to furnish and install the following types of thermal insulation:
 - a. Unfaced mineral and glass fiber sound attenuation batt insulation
 - b. Miscellaneous insulation (mineral wool)
 - c. Auxiliary insulating materials
 - 2. Items specified in this Section, but installation under other Sections include:
 - a. Perimeter Continuous Rigid Insulation.
 - b. Cavity Wall Insulation; Section 04 20 00 – Unit Masonry for installation.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 1 – Construction Waste Management
 - 2. Section 07 26 30 – Spray Foam Insulation Air Barrier
 - 3. Section 07 54 23 – Mechanically Attached TPO Roofing System
 - 4. Division 22 and 23, Mechanical – Insulation for ducts, heating, air conditioning, ventilating, and plumbing work shall be furnished and installed by the respective Mechanical Contractor.
 - 5. Division 26, Electrical – Insulation for electrical work shall be furnished and installed by Electrical Contractor.

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: The American Society for Testing and Materials.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Manufacturer's Literature and Data for each material proposed:
 - 1. Manufacturer's specifications.
 - 2. Installation instructions.

1.07 QUALITY ASSURANCE

- A. The "R" values indicated are for the insulation tested at 75 degrees F mean temperature. It shall be for the total thickness of the insulation and shall exclude surface resistance. Manufacturers shall certify that their insulation complies with these requirements.
- B. Where the thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- C. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- D. Fire-Test Responses Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL or another testing and inspection agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspection agency.
 - 1. Surface Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.08 DELIVERY, STORAGE & HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storage, and protecting during installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Rigid Board Insulation (Perimeter Insulation)
 - a. Owens-Corning
 - b. Dow Chemical
 - c. DiversiFoam Products
 - 2. Rigid Board Insulation (Cavity Insulation)
 - a. Owens-Corning
 - b. Dow Chemical
 - c. DiversiFoam Products
 - 3. Mineral and Glass Fiber Insulation
 - a. CertainTeed Corporation
 - b. Johns Manville Corporation
 - c. Owens-Corning
 - d. Knauf Fiber Glass
 - e. Guardian
 - 4. Wool Fiber Insulation

- a. Owens-Corning
 - b. Casco Mineral Wool
 - c. Thermafiber, Inc.
 - d. Fibrex Insulations, Inc.
 - e. Roxul Inc.
- B. Products of other manufacturers will be considered for acceptance provided they are equal or exceed the material requirements and functional qualities of the specified product.

2.02 MATERIALS

- A. General: Thermal resistance of the insulation shall be not less than the R-values shown. R-values shall be determined at 75 degrees F in accordance with ASTM C 518. Insulation shall conform to EPA requirements for recycled content. Insulation shall be factory marked manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages.
- B. Rigid Board Insulation (Perimeter Insulation)
1. Foundation Insulation at Brick Veneer support locations: ASTM C578, Type IV, density 1.6 lb/c.f. minimum, compressive strength 40 psi. Rigid insulation board shall be closed cell extruded polystyrene thermal board. Insulation shall be 2 inches thick, unless otherwise noted, and have an aged R-value of 10. Subject to compliance with requirements, provide one of the following:
 - a. "Styrofoam Square Edge"; Dow Chemical
 - b. "Foamular 250"; Owens Corning
 - c. Or Architect Approved equal
 2. Foundation Insulation at Curtain Wall locations: ASTM C578, Type IV, density 1.6 lb/c.f. minimum, compressive strength 40 psi. Rigid insulation board shall be closed cell extruded polystyrene thermal board. Insulation shall be 1 inch thick, unless otherwise noted, and have an aged R-value of 5. Subject to compliance with requirements, provide one of the following:
 - a. "Styrofoam Square Edge"; Dow Chemical
 - b. "Foamular 250"; Owens Corning
 - c. Or Architect Approved equal
 3. Bonding Adhesive: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates. Subject to compliance with requirements, provide one of the following:
 - a. "PL Premium"; OSI Sealants, Inc.
 - b. "DAP Big Stick"; DAP, Inc.
 - c. "Henry #238"; W.W. Henry Co.
 - d. Or Architect Approved equal
- C. Rigid Board Insulation (Cavity Insulation)
1. Rigid closed cell extruded polystyrene thermal board of thickness as indicated on the Drawings. Insulation shall be 2.5 inches thick, unless otherwise noted, and have an aged R-value of 12.5. Subject to compliance with requirements, provide one of the following:
 - a. Comply with ASTM C 578-95, Type IV, density 1.6 lb/cu. Ft. min., compressive strength 25 psi (ASTM D 1621-94).
 - b. Thermal resistance: 5-year aged R-values of 5.4 and 5.0 min. degrees F-sq. ft.-h/Btu squared/inch at 40 degrees F and 75 degrees F respectively (ASTM C-518-91).
 - c. Water Absorption: Max. 0.1% by volume (ASTM C 272-91 (96)).

- 1) Surface Burning Characteristics:
 - 2) Flame Spread: 5.
 - 3) Smoke Development: 165.
- d. Available Products: Subject to compliance with requirements, provide one of the following:
- 1) "STYROFOAM CAVITYMATE Plus", The Dow Chemical Co.
 - 2) "FOAMULAR CW25", Owens Corning.
 - 3) "CERTIFOAM 25", DiversiFoam Products
2. Bonding Adhesive: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates. Subject to compliance with requirements, provide one of the following:
- a. "PL Premium"; OSI Sealants, Inc.
 - b. "DAP Big Stick"; DAP, Inc.
 - c. "Henry #238"; W.W. Henry Co.
 - d. Or Architect Approved equal
- D. Mineral and Glass Fiber Insulation (Batt Insulation):
1. Unfaced Mineral Fiber Sound Attenuation Batt Insulation: Sound attenuation batts, unfaced glass fiber acoustical insulation complying with ASTM C 665, Type I; and as follows:
 - a. Surface Burning Characteristics: Maximum flame spread and smoke developed of 10 and 10, respectively, when tested in accordance with ASTM E 84.
 - b. Combustion Characteristics: Noncombustible, tested in accordance with ASTM E 136.
 - 1) Sound Attenuation Batts: Shall be equal to "Sound Attenuation Batts" as manufactured by Owens Corning.
- E. Mineral Wool Fiber Insulation:
1. Shall be inorganic (non-asbestos) mineral wool insulation without facing, for the purpose of filling and stuffing openings in walls around pipes, structural components, windows, conduits, expansion joints to eliminate noise transfer and to insulate. Use to seal top of interior walls, except fire rated walls, between masonry and roof deck, where indicated. Use at expansion joints as detailed. Insulation shall have a flame spread rating of 15 or less, and a smoke development rating of 0; per ASTM E 84.

2.03 AUXILIARY INSULATING MATERIALS

- A. Provide auxiliary materials as required and as recommended by manufacturer for complete and secure installation.
- B. Provide FSK rated tape for any insulation seams within the plenum.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare surfaces and areas to receive insulation material as required by the manufacturer. Do not install materials in unsatisfactory areas or to improperly prepared surfaces.
- B. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.02 GENERAL INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Coordinate application of insulation with the appropriate building trades involved.
- C. The installer doing the insulation work shall furnish adhesives or attaching means, if required, so that insulation material will be properly held in alignment and permanently attached to the surfaces which they are to be applied without damaging surface.
- D. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
- E. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation.
- F. Set vapor-retarder-faced units with vapor retarder to warm side of construction.
- G. Place loose fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C1015. Level horizontal applications to uniform thickness as indicated, tightly settle to uniform density, but do not compact.
- H. Water-Piping Coordination: If water piping is located on inside of insulated exterior wall, coordinate location of piping to ensure that it is placed on the warm side of insulation and insulation encapsulates piping.

3.03 SPECIFIC INSULATION TYPE INSTALLATION:

- A. Rigid Board Insulation (Perimeter Insulation)
- B. See Section 04 20 00 – Unit Masonry for cavity wall insulation installation.
- C. Mineral and Glass Fiber Insulation (Batt Insulation):
 - 1. Provide batt insulation where indicated and where the insulation is not part of another Specification Section.
 - 2. Install mineral fiber blanket/batts in cavities formed by framing members according to the following requirements:
 - a. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - b. Place blankets/batts in cavities formed by members to produce a friction fit between edges of insulation and adjoining framing members.
 - c. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
 - 3. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
 - 4. Where acoustical insulation is installed above suspended ceilings, install blankets at right angles to the main runners or framing.
- D. Mineral Wool Fiber Insulation:
 - 1. Where interior walls extend to roof deck or roof, openings in walls between rooms above the ceiling shall be sealed with mineral wool placed or stuffed in openings to eliminate noise transfer and air movement. Mineral wool shall be provided at other building locations indicated or requiring minor fill to eliminate air movement, such as around the perimeter of openings: i.e., windows.

3.04 CLEANING AND PROTECTION

- A. Clean up all wrappings, scrap, and cut material waste at the end of each days' work.

- B. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 26 30 - SPRAY FOAM INSULATION AIR BARRIER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work

1.02 SUMMARY

- A. The work included in this Section consists of furnishing all labor, materials, tools, and equipment necessary to furnish and install the following types of thermal insulation:
 - 1. Spray-in-place ridged polyurethane foam insulation in various assemblies, to provide an air barrier and improve thermal resistance.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 5 Section – Metal Decking
 - 2. Division 7 Section – Fluid Applied Membrane Air Barriers
 - 3. Division 8 Section – Curtain Wall

1.04 REFERENCES

- A. The American Society for Testing and Materials (ASTM) referred to below with their serial designation are included herein and made an integral part of the specifications.
 - 1. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 4. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - 5. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
 - 6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 7. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - 8. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 9. ASTM E 413 - Classification for Rating Sound Insulation.
- B. Canadian General Standards Board (CGSB) 51.23 - Spray Applied Rigid Polyurethane Cellular Plastic Thermal Insulation.
- C. International Code Council – International Residential Code:

1. Section 103.7 - Alternate Materials and Methods.
2. 2006 IRC Section R314 - Foam Plastic Insulation.
3. 2009 IRC Section R316 - Foam Plastic Insulation.
4. Section 806.4 – Unvented Attic Assemblies.

D. International Code Council – International Building Code:

1. Section 10 4. 11 Alternative materials, design and methods of construction and equipment.
2. Section 2603 Foam Plastic Insulation.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Manufacturer's Literature and Data for each material proposed:
1. Manufacturer's specifications.
 2. Installation instructions.
- C. Before commencing work, submit in accordance with local code.
1. Submit technical data sheets and samples as required by local code officials.
 2. Submit the technical data sheet from the manufacturer showing the test results from the ASTM E84 (Surface Burning Characteristics).
- D. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Air Barrier Subcontractor Qualifications: Subcontractor shall be currently accredited by the Air Barrier Association of America (ABAA) whose installers are certified in accordance with the ABAA Quality Assurance Program.
 - a. Installers shall also be certified by ABAA/BPQI (Building Performance Quality Institute) in accordance with the training requirements outlined in the ULC S705.2-05 Installation Standard. Installers shall have their photo-identification certification cards in their possession and available on the project site, for inspection upon request.
- B. Manufacturer:
1. Obtain primary materials from a single manufacturer regularly engaged in the manufacturing of air barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.
- C. Accredited Laboratory Testing for Materials:
1. Laboratory accredited by the International Accreditation Service, Inc. (IAS), American Association for Laboratory Accreditation (AALA), or the Standards Council of Canada (SCC).
- D. VOC Regulations:
1. Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

-
- E. Pre-Construction Installation Meeting:
1. Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.
- F. Field Quality Assurance:
1. Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air barriers until it has been inspected, tested and accepted.

1.07 PERFORMANCE REQUIREMENTS

- A. Material Performance:
1. Provide materials which have an air permeance not to exceed 0.004 cubic feet per mit per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/sm at 75 Pa) when tested according to ASTM E 2178.
- B. Spray Foam:
1. Material shall meet requirements of ULC S704.1, Standard for Thermal Insulation – Spray Applied Ridgid Polyurethane Foam, Medium Density – Material – Specification. CCMC Evaluation Report or reports from accredited testing laboratory shall be made available upon request. Materials shall meet or exceed the following performance requirements as indicated in the test reports.
 - a. Design R value Min. of R 6 per inch.
 - b. Density of 1.9 pounds per cubic foot.
 - c. Smoke development not greater than 450 and flame spread not greater than 25 when tested according with ASTM E84.
- C. Assembly Performance:
1. Provide a continuous air barrier assembly that has an air leakage rate not to exceed 0.040 cubic feet per square foot per minute under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/sm at 75 Pa) when tested according to ASTM E 2357. Assembly shall perform as a liquid drainage plain flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions.
 - a. Assembly shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure.
 - b. Assembly shall not displace adjacent materials under full load.
 - c. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement.
- A. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:
2. Walls, windows, curtain walls, storefronts, louvers and doors.
 3. Wall and roof connections.

4. Walls, floor and roof across construction, control and expansion joints.
 - a. All other leakage pathways into the building envelope.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered in manufacturer's original containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.
- B. Material shall be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer.
- C. Empty containers shall be removed from site on a daily basis.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B.
- C. Ventilate area to receive insulation to maintain safe working conditions.
- D. Protect workers as recommended by standards and manufacturer's recommendations.
- E. Protect adjacent surfaces, windows, equipment and site areas from damage of overspray.

1.10 WARRANTY

- A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum of three (3) years from date of Substantial Completion.
- B. Installation Warranty: Provide air barrier subcontractor's two (2) year warranty from date of Substantial Completion, including all components of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: DEMILEC (USA) LLC®; 2925 Galleria Dr, Arlington, TX 76011. ASD. Toll Free Tel: (877) DEMILEC. Tel: (817) 640-4900. Fax: (817) 633-2000. Email: specs@demilecusa.com. Web: <http://www.demilecusa.com> (Basis-of-Design)
- B. Other Manufacturers: WALLTITE US; BASF; InsulBloc; NCFI.
- C. Architect approved equal.

2.02 SPRAY FOAM INSULATION

- A. Spray Applied Rigid Polyurethane Foam Insulation System: (Closed Cell Foam)
 1. Product: HEATLOK SOY® 200 Manufactured by DEMILEC (USA) LLC®, Arlington, TX
 2. Product Approval:
 - a. International Code Council Evaluation Services Report #3210
 - b. Approved for non-structural walls in building types I, II, III, IV, and V construction under IBC and dwellings for IRC.
 - c. Approved for exterior walls in building types I, II, III, and IV construction.

- d. Passed AC 377 Appendix X compliant NFPA 286.
- 3. Physical Properties:
 - a. Density (ASTM D 1622): 2.1 lb/cf (0.034 gm/cu. cm).
 - b. Thermal Resistance (ASTM C 518):
 - 1) Aged R value at 1 inch (180 days at 76 degrees F (23 degrees C)) – R-7.4 (sf.h degree F/BTU), refer to ESR 3210 for R-value table
 - c. Water Vapor Permeance @ 1.5"(ASTME 96-05): 0.79 perms (is a vapor barrier per IBC Section 202 definitions at 1.2")
 - d. Air Permeance @ 75 Pa @ 1" (ASTME 2178-03): 0.004 L/sm²
 - e. Air Leakage of Air Barrier Assembly (static loading to 600 Pa and gust loading to 1,200 PA) Complies with ABAA requirements (ASTME 2357-05): <0.0022L/sm²
 - f. Compressive Strength (ASTM D 1621): 20.6 psi (142 kPa).
 - g. Tensile Strength (ASTM D 1623): 45.4 psi (313 kPa)
 - h. Off Gassing Test (VOC Emissions) (CGSB 51.23-92): Pass (no toxic vapor).
 - i. Surface Burning Characteristics (ASTM E 84) 4 inches: Class I. Flame Spread Index 20, Smoke Developed Index 400.
 - j. Closed Cell Content (ASTM D2856) : >92%.
 - k. Bio-based Solid Content (ASTM D 6866): 3%
 - l. Oxygen Index (ASTM D 2863): 23%
 - m. Water Absorption % by Volume (ASTM D 2842): 0.3%
 - n. Bio-based Content (ASTMD 6866-08): 3%
- 4. Equipment used to apply the foam insulation shall have fixed ratio positive displacement pumps and approved by foam manufacturer.

2.03 AUXILIARY MATERIALS

- A. Listed as follows:
 - 1. Provide spray-on liquid applied air and vapor barrier to misc steel lintels, etc. per Drawing details prior to installation of this Air Barrier system. See specification 07 27 26 Fluid Applied Membrane Air Barriers.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Apply as recommended by manufacturer to thickness as indicated on drawings.

- B. Transition Strip Installation: Install transition strip materials to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and the following:
1. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
 2. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.
 3. Overlap horizontally adjacent pieces of transition strips a minimum of 2 inches, unless greater overlap is recommended by manufacturer. Roll seams with roller.
 4. Seal around all penetrations with a transition strip or other procedure in accordance with manufacturer's recommendations.
 5. Connect air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, to curtain walls, to storefronts, to louvers, to exterior doors, to penetrations, and to other intersection conditions using transition membranes and in accordance with the manufacturer's recommendations.
 6. At change in substrate plane, provide transition material recommended by manufacturer to make a smooth transition from one plane to another.
 7. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plan and to make a smooth transition from one plan to another. Membrane shall be continuously supported by substrate.
 8. At through wall flashings, provide an additional strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane. Seal exposed top edge of strip with bead of mastic as recommended by manufacturer.
 9. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
 10. At expansion and seismic joints, provide transition to the joint assemblies.
 11. Apply a bead or trowel coat of mastic along membrane seams as reverse lapped seams, rough cuts, and as recommended by the manufacturer when membrane will be exposed to the elements.
 12. At the end of the working day, seal top edge of self-adhered membrane to substrate with termination mastic if exposed.
 13. Do not allow materials to come in contact with chemically incompatible materials.
 14. Do not expose transition membrane to sunlight longer than as recommended by the manufacturer.
 15. Inspect installation prior to enclosing assembly and repair damaged areas with spray polyurethane foam as recommended by manufacturer.
- C. Spray Application: Install materials in accordance with manufacturer's recommendations, ULC S705.2 and the following:
1. Equipment used to spray foam shall comply with ULC S705.2 and the manufacturer's recommendations for the specific type of application. Record equipment settings on each Daily Work Record / Ticket as required by the ULC S705.2 installation standard. Each proportioner unit shall supply one spray gun.
 2. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and the ULC S705.2 Installation standard.
 3. Apply in consecutive passes as recommended by the manufacturer to thickness indicated on the Drawings. Passes shall not be less than 1/2 inch and not greater than 2 inches. An additional pas of 2 inches shall only be done after the first pass has had time to cool down. At no time shall more than 4 inches be installed in a single day.
 4. Install within the manufacturer's tolerances, but not more than minus 1/4 inch or plus 1/2 inch.

5. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.
6. Finished surface of foam insulation to be free of voids and embedded foreign objects.
7. Remove masking materials and overspray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
8. Trim, as required, any excess thickness that would interfere with the application of cladding, brick veneer, metal wall panels, etc. by other trades.
9. Clean and restore surfaces soiled or damaged by work of the Section. Consult with section of Work soiled before cleaning to ensure methods used will not damage the Work.
10. Complete connections to other components and repair any gaps, holes or other damage material which conforms to ULC S701.1 or ULC S711.1 and installed in accordance with ULC S701.2 or ULC S711.2 as applicable.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Mask and cover adjacent areas to protect from overspray.
- C. Seal off ANY ventilation equipment.
- D. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.
- E. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 27 26 - FLUID APPLIED MEMBRANE AIR & VAPOR BARRIERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. System Description:
 - 1. The work included in this Section consists of materials and installation methods for fluid-applied membrane to provide an air barrier component and secondary water-resistive barrier/drainage plane for unit masonry and sheathing wall assemblies to completely enclose the building.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
- B. Section 04 05 09 – Masonry Anchorage & Reinforcing
 - 1. Section 04 05 23 – Masonry Accessories
 - 2. Section 04 20 00 – Unit Masonry
 - 3. Section 07 65 26 – Self-Adhering Flexible Flashing

1.04 REFERENCES

- A. Reference Standards:
 - 1. C 297 Test Method for Tensile Strength of Flat Sandwich Constructions in Flatwise Plane
 - 2. D 522 Test Methods for Mandrel Bend Test of Attached Organic Coatings
 - 3. D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting
 - 4. D 2247 Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity
 - 5. D 3273 Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
 - 6. E 84 Test Method for Surface Burning Characteristics of Building Materials
 - 7. E 96 Test Methods for Water Vapor Transmission of Materials
 - 8. E 283 Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 9. E 330 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - 10. E 331 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
 - 11. E 1233 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential
 - 12. E 2178 Test Method for Air Permeance of Building Materials

1.05 DESIGN REQUIREMENTS

- A. Deflection Criteria: maximum allowable deflection normal to the plane of the wall: L/240
- B. Wind Load: conform with code requirements.
- C. Moisture Control:
 - 1. Minimize condensation within the assembly.
 - 2. Drain water directly to the exterior where it is unlikely to penetrate components in the wall assembly (windows and doors, for example).
 - 3. Provide flashing to direct water to the exterior in accordance with code requirements, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, intersections of lower walls with higher walls, and at the base of the wall.
- D. Air Barrier Continuity: provide continuous air barrier system of compatible air barrier components.
- E. Mechanical Ventilation: maintain pressurization and indoor humidity levels in accordance with recommendations of ASHRAE (see 2001 ASHRAE Handbook—Fundamentals).

1.06 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.07 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, samples and a complete set of standard details for the air/vapor barrier membrane systems showing a continuous plane of air tightness throughout the building envelope.
- C.

1.08 QUALITY ASSURANCE

- A. Perform Work in accordance with the manufacturer's written instructions of the air/vapor barrier membrane and this specification.
- B. Maintain one copy of manufacturer's written instructions on site.
- C. At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the air barrier membrane manufacturers' representative.
- D. Components used in this section shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, and adhesives.
- E. Ensure all preparation work is complete prior to installing air/vapor barrier membrane.
- F. Ensure continuity of the air/vapor barrier membrane system throughout the scope of this section.
- G. Qualifications:
 - 1. Installer Qualifications: Submit in writing a document stating that the applicator of the primary air barrier membranes specified in this section is recognized by the manufacturer as suitable for the execution of the Work.

1.09 DELIVERY, STORAGE & HANDLING

- A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90 degrees F (32 degrees C). Store away from direct sunlight.

1.10 PROJECT CONDITIONS

- A. Maintain ambient and surface temperatures above 40 degrees F (4 degrees C) and below 100 degree F (38 degrees C) during application and drying period, minimum 24 hours after application of air and water-resistive barrier.
- B. Provide supplementary heat for installation in temperatures less than 40 degrees F (4 degrees C) or if surface temperature is likely to fall below 40 degrees F (4 degrees C). (*Note: surface temperature is lower than air temperature at night*).

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Acceptable Manufacturers:
 - 1. Prosoco R-Guard VB (Basis-of-Design)
 - 2. W.R. Meadows; Air Shield LM (All Season)
 - 3. Carlisle ; Barriseal-S Spray Applied
 - 4. Grace Construction Products (Perm-a-Barrier Liquid)
 - 5. Polyguard Products, Inc. (Poly Wall Airllok Flex)
 - 6. BASF Wall Systems, (Enershield-I)
- B. Fluid Applied Membrane (IMPERMEABLE)
 - 1. Procoso R-Guard VB: Is a fluid-applied air and water-resistive barrier that stops air and water leakage in cavity wall, masonry veneer construction, as well as in stucco, EIFS and most other building wall assemblies. The easily applied liquid quickly dries into a rubberized, highly-durable, water-resistant membrane. R-GUARD VB performs the function of both a vapor barrier and an air/water resistive barrier and is ideal for special construction types that require protection from the passage of air, liquid water and water vapor. R-GUARD VB reduces heating and cooling costs and lowers the risk of mold and mildew.
 - 2. Use: Procoso R-Guard VB as a high-performing water resistive barrier, vapor barrier or as part of a continuous building-wide air barrier system. The durable membrane conforms and adheres to common building surfaces and is compatible with most paints, sealants and self-adhered waterproofing or air barrier components. R-GUARD VB is appropriate for vertical, above-grade applications to structural sheathing, CMU, cast concrete and most other common building materials.
 - 3. Technical Data:
 - a. Thickness: Apply in accordance with manufacturer's instruction.
 - b. Air Infiltration: Less than 0.004 cfm per square foot (0.02 L/s/sq m) when tested in accordance with ASTM E 2178 or ASTM E 283.
 - c. Water vapor permeability: Less than 0.1 perms when tested in accordance with ASTM E 96.
 - d. Surface Burning: Pass when tested in accordance with ASTM E 84.
 - e. Water Penetration (static pressure): No uncontrolled water penetration when tested in accordance with ICC-ES AC 212 AATCC 127 (Water Column).
 - f. Tensile Strength: Greater than 15 psi or exceeds strength of substrate when tested in accordance with ASTM C 297 modified.

- g. Nail Sealability: Pass when tested in accordance with ASTM D 1970.
 - h. Flexibility: Pass when tested in accordance with ASTM D 522.
 - i. Volatile organic compounds (VOC): Less than 50 g/L.
 - j. Color: Mint Green.
4. Other Related Items:
- a. R-GUARD Transition Membrane - A 6 inch (152 mm) wide self-adhering water-resistive air barrier material that functions as alternative protection for sheathing joints and rough openings; a secondary seal for sealant joints; or as an air barrier connection material bridging dissimilar materials. Pliable black self-adhering membrane for bridging dissimilar materials. Covering with a coat of R-GUARD Spray Wrap or MVP will extend UV exposure window from thirty days to six months.
 - b. R-Guard AirDam Air and Waterproof Sealant for Windows and Doors.
 - 1) Acceptable product: PROSOCO, Inc. AirDam
 - 2) Description: AirDam is a medium modulus sealant that combines the best silicone and polyurethane properties. This single component, 98% solids Silyl-Terminated-Poly-Ether (STPE) is easy to gun and tool in all weather conditions. AirDam cures quickly to produce a durable, high performance, high movement elastomeric interior air sealant
 - 3) Characteristics:
 - a) Hardness: Shore A, 20-25 when tested in accordance with ASTM C661.
 - b) Tensile strength: 110 psi when tested in accordance with ASTM D412.
 - c) Elongation at break: 1300% when tested in accordance with ASTM D412.
 - d) Peel strength: 30 pli when tested in accordance with ASTM D1781.
 - e) Type: Type S, Grade NS, Class 50 when tested in accordance with ASTM C920.
 - f) Volatile organic content (VOC): 30 g/L.
 - g) Shrinkage: None.
 - h) Form: heavy white paste, mild odor
 - 4) Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth.
 - c. R-Guard Gypprime Water Based Primer for Raw Gypsum Board Edges.
 - 1) Acceptable product: PROSOCO, Inc. R-GUARD GypPrime.
 - 2) Description: GypPrime consolidates and seals the cut edges of gypsum wall boards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of R GUARD Joint and Seam Filler fiber-reinforced fill coat and seam treatment for through-wall components. GypPrime brushes or sprays on easily and is usually dry in 30 minutes.
 - 3) Characteristics:
 - a) Freeze point: 32 degrees Fahrenheit.
 - b) Flash point: greater than 200 degrees Fahrenheit.
 - c) Active content: 18 percent.
 - d) Volatile organic content (VOC): less than 100 g/L.
 - e) Form: Milky blue liquid, mild odor.
 - d. R-Guard Joint and Seam Filler fiber reinforced fill coat and seam filler.
 - 1) Acceptable product: PROSOCO, Inc. R-GUARD Joint & Seam Filler

- 2) Description: Joint & Seam Filler is a high modulus, gun-grade, crack and joint filler, adhesive and detailing compound that combines the best silicone and polyurethane properties. This single-component, 99% solids, fiber-reinforced, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool.
 - 3) Characteristics:
 - a) Thickness: Apply according to manufacturer's instructions.
 - b) Hardness: Shore A, 45-50 when tested in accordance with ASTM C661.
 - c) Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E-96.
 - d) Tensile strength: 225 psi when tested in accordance with ASTM D412.
 - e) Lap shear strength: 275 psi when tested in accordance with ASTM D1002.
 - f) Elongation at break: 275% when tested in accordance with ASTM D412.
 - g) Peel strength: 30 pli when tested in accordance with ASTM D1781.
 - h) Volatile organic content (VOC): 30 g/L.
 - i) Shrinkage: None.
 - j) Form: Pale Red, Gun Grade.
- e. R-Guard Fastflash Liquid-Applied Flashing Membrane.
- 1) Acceptable product: PROSOCO, Inc. R-GUARD FastFlash.
 - 2) Description: FastFlash is a gun-grade waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. This single component, 99% solids, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool to produce a highly durable, seamless, elastomeric flashing membrane in rough openings of structural walls.
 - 3) Characteristics:
 - a) Thickness: Apply according to manufacturer's instructions.
 - b) Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E96.
 - c) Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM E547.
 - d) Hardness: Shore A, 40-45 when tested in accordance with ASTM C661.
 - e) Tensile strength: 180 psi when tested in accordance with ASTM D412.
 - f) Elongation at break: 400% when tested in accordance with ASTM D412.
 - g) Peel strength: 25 pli when tested in accordance with ASTM D1781.
 - h) Volatile organic content (VOC): 30 g/L.
 - i) Form: Brick Red, Gun Grade Sealant.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify design professionals in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates.

- B. All surfaces must be sound, dry, clean, and free of grease, dirt, excess mortar or other contaminants. Fill voids, gaps, and spalled areas with R GUARD Joint & Seam Filler in substrate to create an even plane. Masonry head joints should be fully filled and tooled.
- C. Where curing materials are used they must be clear resin based without oil, wax or pigments
- D. Condition materials to room temperature prior to application to facilitate extrusion and handling.

3.02 PREPARATION

- A. Air, water-resistive and waterproofing membrane and accessories may be applied to green concrete 16 hours after removal of forms.
- B. Refer to manufacturer's product data for requirements for condition of and preparation of substrates.
 - 1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
 - 2. Remove contaminants such as grease, oil and wax from exposed surfaces.
 - 3. Remove dust, dirt, loose stone and debris.
 - 4. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.
 - 5. The PROSOCO R-GUARD product line includes several options for preparing structural walls to receive the primary air and water resistive barrier. Refer to manufacturer's product data and R-Guard Installation Guidelines for additional information.
- C. Exterior sheathing:
 - 1. Ensure that sheathing is properly installed with ends, corners and edges properly fastened.
 - 2. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, fastened and spotted with R-GUARD Joint & Seam Filler and fastened into solid backing.
 - 3. Fill sheathing end and prime edge joints with R-GUARD GypPrime as herein specified.
- D. Masonry and concrete substrates:
 - 1. Masonry shall have smooth trowel-cut mortar joints.
 - 2. Mechanically remove loose mortar fins, snots and debris.

3.03 INSTALLATION

- A. Before applying, read "Preparation" and "Safety Information" sections in the Manufacturer's Product Data Sheet for PROSOCO R-GUARD® VB. Refer to the Product Data Sheet for additional information about application.
- B. Do not dilute or alter R-GUARD VB, except for use in sprayers. The product may be thinned with up to 5 percent fresh water, based on surface, drying conditions and equipment. Mix well before use with a low-speed drill and clean mixing paddle. Avoid mixing air into the membrane.
- C. Structural Sheathing : Exterior gypsum sheathing board or exterior plywood.
 - 1. Spray or roller apply sufficient VB to cover and hide the entire face of the structural wall. Apply to uniform thickness of 15 wet mils per coat.
 - 2. Apply second coat to uniform thickness of 15 wet mils. Coating must be opaque after drying.
 - 3. Back roll as needed to ensure there are no pinholes, voids or gaps in the membrane.
 - 4. Inspect membrane before covering. Repair any punctures or damaged areas by applying additional R-GUARD VB. Overlap repairs, penetration treatments, transitions, rigid flashing and other air barrier components to ensure positive drainage and continuity of the air and water-resistive barrier.
- D. CMU Wall Construction:

1. Spray or roller apply sufficient R-GUARD VB to cover and fill the entire surface. Back roll spray applications if necessary. Let dry.
2. Spray or roller-apply a second coat of R-GUARD VB to achieve hide. Back roll spray to achieve a void- and pinhole-free surface. Take special care to achieve full coverage around wall ties or surface irregularities.
3. Inspect membrane before covering. Repair any punctures or damaged areas by applying additional R-GUARD VB. Overlap repairs, penetration treatments, transitions, rigid flashing and other air barrier components to ensure positive drainage and continuity of the air and water-resistive barrier.

3.04 CURING AND DRYING

- A. Complete drying times vary with temperature, humidity and surface conditions. Protect from rain or freezing until completely dry. At 70 degrees Fahrenheit (21 degrees Celsius) and 50 percent relative humidity, R-GUARD VB dries to touch and can be over coated in 2 to 4 hours.

END OF SECTION

**SECTION 07 54 23 - THERMOPLASTIC-POLYOLEFIN ROOFING SYSTEM
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Induction adhered membrane roofing system.
 - 2. Cover protection board
 - 3. Roof insulation
- B. System Description: The project consists of installing induction adhered TPO membrane roofing system.
 - 1. Apply the TPO Roofing System in conjunction with polyisocyanurate insulation and protection board, where indicated, over the new steel roof deck.
 - 2. Provide all watertight transitions and flashings for curbs
- C. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of the white reinforced TPO (Thermoplastic Polyolefin) membrane Induction Adhered Mechanically Attached Roofing System including flashings, insulation and underlayment board as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.
- D. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
- E. The roofing contractor shall confirm all given information and advise the Architect, prior to bid, of any conflicts that will affect their cost proposal.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 0 – Alternates for deduct alternate affecting the type of roof insulation to be used.
 - 2. Section 05 31 00 – Steel Decking
 - 3. Section 07 62 00 – Sheet Metal Flashing & Trim
 - 4. Section 07 92 00 – Joint Sealants
 - 5. Section 07 96 00 – Extensive Green Roof Assembly

1.04 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.

-
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.05 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 "Terminology Relating to Roofing and Waterproofing"; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute "Glossary of Roofing Terms" for definition of terms related to roofing work in this Section.
- B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.06 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and Flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Standards:
1. Membrane: ASTM D 4637, ASTM D 5019, CGSB 37 – GP – 52M
 2. Insulation: ASTM C 1289, Type 1
- D. Jobsite Safety: Execute all operations and provide a safe work environment in accordance to OSHA standards and regulations. This requirement applies to all contractor personnel, associated subcontractors, workers in other trades, and jobsite visitors.
1. Follow all industry fire prevention guidelines for storage of materials, staging areas, roof access, and application means and methods.
 2. Any applicable local fire codes supersede industry guidelines
- E. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.
1. Fire/Windstorm Classification: Class 1A-90

1.07 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Shop Drawings: Shop drawings showing layout, details of construction and identification of materials.
1. Provide fastening schedule indicating the anchorage of insulation and protection boards as well as induction fasteners. Fastening schedule shall be engineered to comply with all OBC 2017 roof loading and uplift requirements. This schedule shall be stamped by Ohio licensed engineer.
 - a. Include with this submittal, the anchorage of glass-mat roof protection boards.
- C. Contractor Certification: Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.
1. Installer to submit data proving 5 years' experience installing specified roof system.
- D. Warranty Reserve Certification: Certification of the manufacturer's warranty reserve.

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- E. Sample Warranty: A sample of the manufacturer's Membrane System Warranty.
 - F. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.
 - 2. Operations & Maintenance Data: Maintenance instructions.
 - 3. Inspection Tickets: Submit copies of the manufacturer's final inspection to the specifier prior to the issuance of the manufacturer's warranty.
 - 4. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of meeting performance requirements

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- C. Test Reports:
 - 1. Roof drain and leader test or submit plumber's verification.
 - 2. Roof deck fastener pullout test.
- D. Source Limitations: Obtain all components from single source roofing manufacturer.
- E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A, ASTM E 108, for application and roof slopes indicated
- F. The membrane roofing system must achieve a UL Class A rating.
- G. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for pre-installation conferences in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Require that all complimentary trades be present at conference. Including, but not limited to; electrical, plumbing, HVAC, and framing contractors.
 - 7. Review Flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 8. Review governing regulations and requirements for insurance and certificates if applicable.

9. Review temporary protection requirements for roofing system during and after installation.
 10. Review roof observation and repair procedures after roofing installation.
- H. If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the Architect by phone and solicit the manufacturer's approval prior to commencing with the work. Necessary steps shall be taken to make the building watertight until the discrepancies are resolved.
 - I. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
 - J. The roofing system must be installed by a contractor authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer.
 - K. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.
 - L. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the Architect. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the Architect's consideration.
 - M. Upon completion of the installation, the Contractor shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the building owner seventy-two (72) hours prior to the manufacturer's final inspection.

1.09 DELIVERY, STORAGE & HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
- B. Comply with the manufacturer's written instructions for proper material storage.
 1. Store membrane in the original undisturbed plastic wrap in a cool, shaded area and cover with light-colored, breathable, waterproof tarpaulins. Membrane that has been exposed to the elements for approximately 7 days must be prepared with manufacturer's weathered membrane cleaner prior to hot air welding.
 2. Store curable materials (adhesives and sealants) between 60°F and 80°F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60°F minimum temperature before using.
 3. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.
- C. Insulation must be on pallets, off the ground and tightly covered with waterproof materials.
- D. Any materials which are found to be damaged shall be removed and replaced at the Contractor's expense.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 SEQUENCE & SCHEDULING

- A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.
- B. Do not disrupt activities in occupied spaces.

1.12 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
- B. See Division 1 – Warranties, for additional warranty requirements.
- C. Provide manufacturer's 20 year Total System Warranty covering both labor and material with no dollar limitation. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
 - 1. The maximum wind speed coverage shall be peak gusts of 70 mph minimum.
- D. Provide manufacturer's Puncture Warranty.
- E. Installer's Guarantee: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, flashing, roof insulation, fasteners, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion
- F. Pro-rated System Warranties shall not be accepted.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All components of the specified roofing system shall be products of Versico Incorporated or accepted by Versico as compatible.
 - 1. Subject to compliance with requirements, provide roofing system by one of the following:
 - a. Versico Incorporated
 - b. Firestone Building Products
 - c. Carlisle
- B. All products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.

2.02 MEMBRANE

- A. Basis-of-Design: Furnish VersiWeld .060"thick white reinforced TPO (Thermoplastic Polyolefin) membrane as needed to complete the roofing system.

2.03 INSTALLATION OF EQUAL GREEN ROOF MANUFACTURES

- A. Refer to Section 07 96 00 Extensive Green Roof Assembly
- B. **BASE BID GREEN ROOF ASSEMBLY** involves the installation of roof membrane at green roof areas that are specified, installed and warranted by the green roof manufacturer. Base bid involves no TPO membrane at those areas.
- C. **ROOF ASSEMBLY IF EQUAL GREEN ROOF ASSEMBLY IS USED** will involve the installation of TPO roof membrane over the entire project roof. Bidding Contractor shall include a complete roof membrane installation if using an equal green roof manufacture.

2.04 INSULATION

- A. When applicable, insulation shall be installed in multiple layers. The first and second layer of insulation shall be mechanically attached to the substrate in accordance with the manufacturer's published specifications.
- B. **BASE BID INSULATION** to be installed at low sloped roof over Electric Room 105 and Equipment Room 106. All components of the specified roofing system shall be products of Versico Incorporated or accepted by Versico as compatible.
1. Material Basis of Design Characteristics
 - a. Polycyanurate insulation
 - b. Minimum roof slope of ¼-inch per 12-inches
 - c. Average R-value required is 30 minimum
 2. Subject to compliance with requirements, equal material roofing insulation by one of the following:
 - a. Firestone Building Products
 - b. Carlisle
- C. **BASE BID INSULATION** to be used where Extensive Green Roof System is installed: All components of the specified roofing system shall be products of Styrofoam Brand as manufactured by The Dow Chemical Company.
1. Material Basis of Design Characteristics
 - a. Extruded polystyrene rigid board insulation
 - b. 6" minimum thickness of material
 2. Subject to compliance with requirements and compatibility with Green Roof assembly used, equal material roofing insulation by one of the following:
 - a. Owens Corning
- D. **INSULATION IF EQUAL GREEN ROOF MANUFACTURER IS USED** All components of the specified roofing system shall be products of Versico Incorporated or accepted by Versico as compatible.
1. Material Basis of Design Characteristics
 - a. Polycyanurate insulation
 - b. 6" minimum thickness of material
 2. Subject to compliance with requirements, equal material roofing insulation by one of the following:
 - a. Firestone Building Products
 - b. Carlisle

2.05 COVER PROTECTION BOARD

- A. Subject to compliance with requirements, provide products by one of the following: (* indicates basis of design)
1. G-P Gypsum, Camden, NJ*
 2. USG Corp., Aliquippa, PA
 3. CertainTeed, Valley Forge, PA
- B. The need for a separator sheet between roof boards and the roofing membrane must be determined by the roof membrane manufacturer or roofing systems designer.
- C. When applying solvent-based adhesives or primers, allow sufficient time for the solvent to flash off to avoid damage to roofing components.
- D. **Mechanically Attached Systems:** Install per FM guidelines for wind uplift resistance.

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- E. Basis-of-Design for installation under Base Bid:
1. Product: "DensDeck Prime® Roof Boards" as manufactured by G-P Gypsum Corporation.
 2. Thickness: 5/8" DensDeck Type X products.
 3. Edges: Square
 4. Fire Resistance: Type X - Noncombustible when tested according to ASTM E 136.
- F. Basis-of-Design for installation at green roof areas under Deduct Alternate: Glass-Mat Gypsum Sheathing Board; ASTM C 1177.
1. Product: "DensDeck Prime® Roof Boards" as manufactured by G-P Gypsum Corporation.
 2. Thickness: 5/8" DensDeck Type X products.
 3. Edges: Square
 4. Fire Resistance: Type X - Noncombustible when tested according to ASTM E 136.

2.06 ADHESIVES AND CLEANERS

- A. Bonding Adhesive: VersiWeld
- B. Edge Sealant: Cut Edge Sealant
- C. Sealer: Water Cut-Off Mastic and PT 304 Sealant
- D. Pocket Sealant: TPO Molded Pocket Sealant
- E. Cleaner: Versico Weathered Membrane Cleaner

2.07 FASTENERS AND PLATES

- A. All fasteners and plates required for complete system shall be approved by manufacturer.
- B. Induction Welding Plate: A round specially coated Galvalume® plate with a recessed center and raised flat bonding surface specifically designed for induction welding application. Product: JM TPO RhinoPlate.

2.08 METAL EDGING AND MEMBRANE TERMINATIONS

- A. All flashings and terminations shall be according to manufacturer's specifications.

2.09 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer.
 1. Furnish proper amount of pads for walking across lower roof over electric room to mechanical access at higher roof

PART 3 - EXECUTION

3.01 GENERAL

- A. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- B. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

3.02 JOB CONDITIONS, CAUTIONS AND WARNINGS

- A. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.
- B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.
- C. When loading materials onto the roof, the Roofing Contractor must comply with the requirements of the Architect to prevent overloading and possible disturbance to the building structure.
- D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- F. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
- G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- H. New roofing shall be complete and weathertight at the end of the work day.
- I. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

3.03 JOB SITE PROTECTION

- A. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion. The contractor shall repair or be responsible for costs to repair all property damaged during the roofing application.
- B. Do not overload any portion of the building, either by use of or placement of equipment, storage of debris, or storage of materials.
- C. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
- D. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.
- E. Store moisture susceptible materials above ground and protect with waterproof coverings.
- F. Remove all traces of piled bulk materials and return the job site to its original condition upon completion of the work.

3.04 SAFETY

- A. The roofing contractor shall be responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. Safety shall be the responsibility of the roofing contractor. All related personnel shall be instructed daily to be mindful of the full time requirement to maintain a safe environment for the facility's occupants including staff, visitors, customers and the occurrence of the general public on or near the site.

3.05 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Proceed with installation only after unsatisfactory conditions have been corrected

3.07 WORKMANSHIP

- A. Contractors installing new roof, flashing and related work shall be factory trained and approved by the manufacturer they are representing.
- B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the building owner's satisfaction.
- C. There shall be a supervisor on the job site at all times while work is in progress.

3.08 INSULATION PLACEMENT AND ATTACHMENT

- A. Install insulation or membrane underlayment over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch. Stagger joints both horizontally and vertically if multiple layers are provided.
- B. Secure insulation to the substrate with the required fasteners and plates in accordance with manufacturers specifications.

3.09 UNDERLAYMENT BOARD PLACEMENT

- A. A. Place glass-mat underlayment boards for protection of sloped insulation at exterior balcony on first floor only.

3.10 MEMBRANE PLACEMENT AND ATTACHMENT

- A. Unroll and position membrane without stretching. Provide and secure both perimeter and field membrane sheets in accordance with the manufacturer's most current specifications and details.
- B. Secure the membrane with the required Fasteners and Plates spaced a maximum of 12 inches on center depending on project conditions (centered over the pre-printed marks approximately 1-1/2 inches from the edge of the membrane sheet).
- C. Install adjoining membrane sheets in the same manner in accordance with the manufacturer's specifications.

3.11 MEMBRANE SPLICING/HOT AIR WELDING PROCEDURES

- A. Hot air weld the membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's specifications. At all splice intersections, roll the seam with a silicone roller prior to membrane seam cooling. (Note: When using .060" thick membrane, all splice intersections shall be overlaid with non-reinforced flashing)
- B. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).
- C. Repair all seam deficiencies the same day they are discovered.
- D. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete.

3.12 INDUCTION ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer.
 - 1. Stagger end laps.
 - 2. Align membrane sheets perpendicular to the flutes of the deck.
- D. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- E. Induction Welding Installation:
 - 1. Perform calibration and set-up as detailed by the Induction Welder Owner's Manual
 - 2. Adjust the handle height, if desired, by releasing handle clamps and pulling or pushing handle to desired position.
 - 3. Center the Induction Welder over the first plate in pattern and activate the weld.
 - a. Induction Welder must be centered over the plate to create a 100% bond.
 - b. If an error occurs during activation, refer to the induction welder owner's manual for corrective action.
 - 4. Place cooling clamp over the welded plate.
 - a. Keep clamp in place at least 45 seconds while the assembly cools.
 - 5. Repeat process for each plate.
- F. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - a. Remove and repair any unsatisfactory sections before proceeding with Work.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.
- H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- I. Proceed with installation only after unsatisfactory conditions have been corrected

3.13 FLASHING

- A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced membrane. Non-reinforced membrane can be used for flashing pipe penetrations, Sealant Pockets, scuppers, as well as inside and outside corners when the use of pre-fabricated accessories is not feasible.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.14 WALKWAYS

- A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the drawings.
- B. Hot air weld walkway pads to the membrane in accordance with the manufacturer's specifications.

3.15 DAILY SEAL

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.16 ROCK BALLAST APPLICATION

- A. Install an additional 60 mil TPO membrane on top of roofing membrane as a "sacrifice" sheet.
- B. Install ballast in accordance with the manufacturer's installation instructions.
- C. Install ballast evenly without bare spots to provide complete coverage over the membrane.
- D. Comply with published ANSI (American National Standards Institute) ANSI/SPRI RP-4 guidelines (dated November 19, 2002) concerning applicable coverage rates.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.18 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.19 CLEAN UP

- A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the Contractor must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

END OF SECTION

**SECTION 07 62 00 - SHEET METAL FLASHING & TRIM
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Sheet metal flashing and trim
 - 2. Flexible flashings
 - 3. Gutter and downspouts
 - 4. Fasteners and attachment devices
 - 5. Coatings to isolate sheet metal from dissimilar materials
 - 6. Sealants between components of this Section and between the roof and other materials

1.03 RELATED SECTION

- A. Section includes, but is not limited to:
 - 1. Division 4: For flashing in masonry walls
 - 2. Section 07 54 23 – Mechanically Attached TPO Roofing System
 - 3. Section 07 62 01 – Pre-Finished Gutters and Downspouts
 - 4. Section 07 92 00 – Joint Sealants
 - 5. Section 07 96 00 – Live Roof
 - 6. Division 23: For curbs for mounted heating and ventilating equipment

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: The American Society for Testing and Materials
 - 2. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Manufacturer's technical information and installation instructions, in sufficient detail to demonstrate products comply with Contract documents.
- C. Samples:
 - 1. 8-inch square samples of specified sheet materials to be exposed as finished surface.
 - 2. Color samples for confirmation of color selection.

1.07 QUALITY ASSURANCE

- A. Quality Standard: Fabricate and install sheet metal work in accordance with Architectural Sheet Metal Manual and SMACNA, unless specifically indicated otherwise.
- B. Installer Qualifications: Engage an experienced Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Coordinate work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

1.08 PERFORMANCE REQUIREMENTS

- A. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

PART 2 - PRODUCTS

2.01 MATERIALS (AT CONCEALED LOCATIONS, NOT EXPOSED)

- A. The type and locations of various kinds, gauges, and finish of sheet metal to be used is specified herein under the individual items. Where sheet metal is indicated on the Drawings and kind or type of metal is not definitely specified, coil coated galvanized steel shall be provided.
- B. Galvanized Steel Sheet: ASTM A 526, G 90, commercial quality, or ASTM A 527, G 90, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inch thick, unless otherwise indicated.
- C. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 0.0336 inch thick, unless otherwise indicated.
- D. EPDM Flashing: Uncured EPDM sheet; minimum 60 mil thickness; minimum properties as follows:
 - 1. Tensile Strength (ASTM D412): 1305 pounds per square inch.
 - 2. Elongation (ASTM D412): 300 percent.
 - 3. Tear Resistance (ASTM D412): 150 pounds per inch.
 - 4. Ozone Resistance (ASTM D1149): No cracks after 160-hour exposure to one part per million ozone at 104 degrees F and 20 percent strain.
 - 5. Maximum Brittleness Temperature (ASTM D746): Minus 49 degrees F.
 - 6. Resistance to Heat Aging (ASMT D573): Minimum properties (ASTM D412) after aging at 240 degrees F for 672 hours.
 - a. Tensile Strength: 1205 pounds per square inch.
 - b. Elongation: 200 percent.
 - c. Tear Resistance: 125 pounds per inch.

2.02 REGLETS

- A. General: Fabricate reglet flashing system from 24 gauge galvanized steel sheet, formed to provide secure interlocking of separate reglet and counterflashing pieces compatible with flashing indicated.
- B. Surface Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- C. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

2.03 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Solder: ASTM B 32, Grade Sn50, used with rosin flux.
- B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- C. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.
- D. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- E. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for elastomeric joint sealants as specified in ASTM C 920.
- F. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- G. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.
- H. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.
- I. Installation Accessories, EPDM Flashing: Provide joint tape, adhesives, sealers, and fasteners as recommended by flexible flashing manufacturer for indicated application.

2.04 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- E. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant concealed within joints.
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- H. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

- I. For a one-half inch hem on underside or exposed edges.

2.05 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Exposed Trim, Gravel Stops, Scuppers and Fasciae: Fabricate from the following material:
1. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.
- C. Copings: Fabricate from the following material:
1. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.
- D. Base Flashing: Fabricate from the following material:
1. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.
- E. Counterflashing: Fabricate from the following material:
1. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.
- F. Flashing Receivers: Fabricate from the following material:
1. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.
- G. Drip Edges: Fabricate from the following material:
1. Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.

2.06 COIL-COATED GALVANIZED STEEL SHEET FINISH

- A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.
1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color and Gloss: Provide colors or color matches as indicated or, if not indicated, as selected by A/E from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- B. Insulate dissimilar metals by means of a heavy bituminous coating or approved paint coating.

3.03 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's

"Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except where pre-tinned surface would show in finished Work.
 - 1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- E. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- F. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.
- G. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items with roofing installation.
- H. Splash Pans: Install where downspouts discharge on lower roof. Where placed on roofing, set in roof cement compatible with roofing membrane.

3.04 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Remove protective film from prefinished sheet metal immediately after installation.
- C. Repair or replace work which is damaged or defective, as directed by Construction Manager. Refinish marred and abraded areas of prefinished sheet metal using finish manufacturer's recommended methods and materials. Replace units which cannot satisfactorily be refinished in place.
- D. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

3.05 WASTE MANAGEMENT

- A. Collect metal scrap and place in designated area for recycling.

END OF SECTION

SECTION 07 62 01 - PRE-FINISHED GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Pre-finished galvanized steel gutters and downspouts.
 - a. Provide downspout boots at connections to piped storm system where required. Refer to Civil Drawings.
 - b. Provide angled discharge and precast concrete splash pads at emergency downspout.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 1 – Construction Waste Management

1.04 REFERENCES

- A. American Architectural Manufacturers Association:
 - 1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM International:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 3. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 4. ASTM B32 - Standard Specification for Solder Metal.
 - 5. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
- C. Federal Specification Unit:
 - 1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

- D. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - Architectural Sheet Metal Manual

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.
- C. Gutter
 - 1. Downspout
 - 2. Hanger Brackets, Braces, and Stiffeners
 - 3. Fasteners
- D. Product Data: Submit data on manufactured components, materials, and finishes.

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA Manual.

1.08 DELIVERY, STORAGE & HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.

1.09 PERFORMANCE REQUIREMENTS

- A. Conform to SMACNA Manual CDA Handbook for sizing components for rainfall intensity determined by storm occurrence of 1 in 5 years.

1.10 COORDINATION

- A. Coordinate Work with downspout discharge pipe inlet.

PART 2 - PRODUCTS

2.01 GUTTERS AND DOWNSPOUTS

- A. Prefinished Steel: Galvalume steel sheet, ASTM A 792, fabricated from “tension leveled” coil stock.
 - 1. Finish: Full strength 70 percent Kynar 500 Fluorocarbon Coating (polyvinylidene fluoride, PVF) applied by the coil coating process. Minimum dry film thickness 1.0 mil. **Final color to be Kynar Dark Bronze**

2. Components:
 - a. Hung Gutter: 22 gage galvalume steel.
 - b. Downspouts: 26 gage galvalume steel.
 - c. Outlet Tube, Offsets, and Elbows: 26 gage galvalume steel.
 - d. Gutter Hanger Brackets: 1/8 inch by one inch galvalume steel bar with Kynar finish.
 - e. Gutter Braces: 1/4 inch by one and one half inch galvalume steel bar with Kynar finish.
 - f. Gutter Stiffener: 1/8 inch x 3/4 inch galvanized steel bar.
 - g. Downspout Support Hanger: 26 gage galvalume steel.
 - h. Wire Strainers: Copper wire type.
3. Fasteners:
 - a. Screws, Bolts, and Other Fastening Accessories: galvanized steel.
 - b. Rivets: Stainless steel, minimum diameter 3/16 inch.
- B. Sealant:
 1. Silicone, one part, low modulus.
 2. Butyl rubber, one part.
- C. Polyester Fabric, non-woven, ASTM D 5034.
- D. Splash Pad: Precast concrete, 3500 psi. Form splash pads with a sloped depressed center area. Approximate size, one foot wide x two feet long.

2.02 FABRICATION

- A. Fabricate gutters, downspouts, and fittings to the shape and profile indicated on the Drawings. When fabrication details are not indicated follow the applicable requirements of the Architectural Sheet Metal Manual of the Sheet Metal And Air Conditioning Contractors National Association, Inc.
 1. Form gutters and downspouts in 10 foot long sections.

2.03 ACCESSORIES

- A. Connectors: Furnish required connector pieces for PVC (Polyvinyl Chloride) components.
- B. Anchors and Supports: Profiled to suit gutters and downspouts.
 1. Anchoring Devices: In accordance with SMACNA requirements. Type recommended by fabricator.
 2. Gutter Supports: Brackets.
 3. Downspout Supports: Brackets.
- C. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers.
- D. Primer: Galvanized iron type.
- E. Protective Backing Paint: Zinc molybdate alkyd
- F. Primer and Solvent for Polyvinyl Chloride (PVC): As recommended by manufacturer.
- G. Hem exposed edges of metal.
- H. Modified silicone polyester coating: Baked enamel system conforming to AAMA 2603.
- I. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Do not install the Work of this Section unless all necessary nailers, blocking and other supporting components have been provided.

3.02 JOINING

- A. Solder all copper connections with one inch wide lapped, riveted, and soldered seams. Use 3/16 inch diameter rivets spaced 2 inches oc.
- B. Tinning and Soldering:
 - 1. Use hand held soldering coppers only. The use of opened flame torch is not permitted.
 - 2. Tin Surfaces of uncoated metal in contact with solder.
 - 3. Wire brush surfaces of coated metals in contact with solder. Produce a clean and bright surface.
 - 4. Apply flux as required.
 - 5. Sweat solder thoroughly into seams, completely filling the full width of the seam.
 - 6. Upon completion of soldering, remove traces of flux residue. If required, apply a neutralizing wash followed by a clean water wash.
- C. Join steel sections with one inch wide lapped, riveted, and sealed seams. Seal seams with butyl tape sealant within the lap and polyester cloth embedded in silicone sealant over the entire joint. Use 3/16 inch diameter rivets spaced on inch oc.

3.03 INSTALLATION

- A. Connection to Existing Construction: Tie the items of Work in with the existing work to obtain watertight installation. Match the existing installation as much as practicable, unless otherwise specified. Repair and dress adjacent existing components as required to make secure and neat connections with new items.
- B. Installation of Hung Gutters:
 - 1. Install gutter hanger brackets 3 feet oc. Install the brackets so there will be a slight pitch in the gutter towards the downspouts.
 - 2. Join the gutter sections, end pieces, mitered corners, and outlet tubes.
 - 3. Install expansion joints where indicated on the drawings. If not indicated, place the expansion joints at mid points between the downspouts at maximum intervals of 48 feet.
 - a. Form the expansion joints with end baffles conforming to the shape of the gutter. Join the baffles to the gutter section.
 - b. Install a cover plate over the baffle.
 - 4. Install a continuous stiffener bar along the top front edge of the gutter. Fold the gutter around the stiffener bar so it is securely locked in place.
 - 5. Install gutter braces 3 feet oc, staggered from the gutter hanger brackets. Secure the braces to the stiffener bar and to the back vertical portion of the gutter with brass or copper bolts.
 - 6. Secure the top back edge of the gutter to the gravel stop, eave flashing, or continuous cleat as indicated on the drawings.
- C. Installation of Downspouts:
 - 1. Join the downspout sections with end joints that telescope at least 1-1/2 inches.
 - 2. Install necessary offsets and elbows.
 - 3. Secure downspout with hangers 5'x 0" o.c. and with a minimum of 2 hangers at each downspout section. Form hangers to keep downspouts 1 inch away from wall.
 - 4. Fasten downspouts to hangers with sheet metal screws.

5. Secure hangers to masonry and concrete walls with machine bolts in lead shields and to wood walls with screws.
 6. Discharge Elbows: Fasten leader shoes to downspouts with a minimum of 3 sheet metal screws.
 7. Connection to Underground Drains: Fit the downspout neatly into the drain pipe or boot. Caulk the joint with lead wool and seal with sealant.
- D. Installation of Splash Pads: Install splash pads under discharge elbows unless otherwise indicated.

END OF SECTION

SECTION 07 65 26 - FLEXIBLE FLASHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Self-adhering flexible flashing, Primers, Fasteners

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 1 – Construction Waste Management

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM International
 - 2. ASTM C920; Standard Specification for Elastomeric Joint Sealants
 - 3. ASTM C1193; Standard Guide for Use of Joint Sealants
 - 4. ASTM E96; Test Method for Water Vapor Transmission of Materials
 - 5. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Submit manufacturer current technical literature for each type of product.
- C. Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
- D. Manufacturer Instructions: Provide manufacturer's written installation instructions.

1.07 QUALITY ASSURANCE

- A. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
- B. Qualifications:
 - 1. Installer Qualifications: Installer shall have documented successful experience with installation of flexible flashing systems under similar conditions.

1.08 DELIVERY, STORAGE & HANDLING

- A. Deliver flexible flashing materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store flexible flashing materials as recommended by manufacturer. Keep away from open flame or sources of ignition.

1.09 PROJECT CONDITIONS

- A. Do not apply flexible flashing on wet or damp surfaces.
- B. Apply to surfaces free of dirt, oils, lubricants and other debris.
- C. Install flexible flashing materials at temperatures above 40°F. At temperatures below 40°F, apply primer in accordance with flashing manufacturer recommendations, prior to installation of flashing.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. DuPont Building Innovations; 4417 Lancaster Pike, Chestnut Run Plaza 721, Wilmington, DE 19805;
1-800-44-TYVEK (8-9835); <http://construction.tyvek.com>
- B. Or approved equal.

2.02 MATERIALS

- A. Self-Adhering – Flexible Flashing
 - 1. Basis of Design: Self-adhering flexible flashing membrane is based on DuPont™ FlexWrap™.
 - 2. Description:
 - a. Face Material Composition: Conformable textured polyethylene laminate barrier.
 - b. Face color: White.
 - c. Adhesive composition: Butyl adhesive
 - d. Thickness: 70 mil
 - e. Release liner: 2-part siliconized paper.
 - f. Elastic Elongation: >230% at 70°F.
 - g. Dimension: 9 inches wide by 75 feet
- B. Performance Characteristics:
 - 1. Water intrusion: No leakage at 75 Pa, when tested in accordance with ASTM E331.
 - 2. Water Vapor Permeability: < 1 perm, when tested in accordance with ASTM E96.

2.03 ACCESSORIES

- A. Seam Tape: DuPont™ Tyvek® Tape as manufactured by DuPont Building Innovations.

1. Description: Pressure sensitive, polypropylene substrate with acrylic based adhesive.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with flexible flashing manufacturer recommended tolerances prior to installation.
- B. Review requirements for sequencing of installation of flexible flashing assembly with installation of windows, doors, louvers and wall penetrations to provide a weather-tight flashing assembly.

3.02 OPENING PREPARATION (for use with flanged windows installed after weather barrier)

- A. Cut weather barrier membrane in a modified "I-cut" pattern.
 1. Cut weather barrier horizontally along the bottom of the header.
 2. Cut weather barrier vertically 2/3 of the way down from top center of window opening.
 3. Cut weather barrier diagonally from bottom of center vertical cut to the left and right corners of the opening.
 4. Fold side and bottom weather barrier flaps into window opening and fasten.
- B. Cut a head flap at 45-degree angle in the weather barrier membrane at window head to expose 8 inches of sheathing. Temporarily secure weather barrier membrane flap away from sheathing with tape.

3.03 FLASHING (for use with flanged windows installed after weather barrier)

- A. Cut 9-inch wide DuPont™ FlexWrap™ a minimum of 12 inches longer than width of sill rough opening.
- B. Cover horizontal sill by aligning DuPont™ FlexWrap™ edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.
- C. Fan DuPont™ FlexWrap™ at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.
- D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.
- E. Install window according to manufacturer's instructions.
- F. Apply 4-inch wide strips of DuPont™ StraightFlash™ at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.
- G. Apply 4-inch wide strip of DuPont™ StraightFlash™ as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.
- H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide DuPont™ StraightFlash™ over the 45-degree seams.
- I. Tape head flap in accordance with manufacturer recommendations
- J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C 1193.

3.04 FIELD QUALITY CONTROL

- A. Notify manufacturer's designated representative to obtain periodic observations of flexible flashing assembly installation.

3.05 PROTECTION

- A. Protect installed flexible flashing from damage during construction.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. System Description:
 - 1. Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

1.03 RELATED SECTIONS:

- A. Section includes, but is not limited to:
 - 1. Division 1 – Construction Waste Management
 - 2. Division 4 – Masonry Units
 - 3. Division 5 – Miscellaneous Steel
 - 4. Division 8 – Curtain Wall

1.04 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Provide data and installation recommendations, including joint preparation instructions for each material provided.
- C. Sample Warranty: Sample copy of manufacturer's warranty.
- D. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.
 - 2. Operations & Maintenance Data: Maintenance instructions.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- B. Preparation of joint surfaces, backing, and the conditions under which the sealant and caulking is to be installed shall conform to manufacturer's recommendations.
 - 1. Use of bond break tape is prohibited without the expressed permission of the A/E. Each situation will be evaluated with regard to inability to properly use backer rod to prevent adhesion.
- C. Qualifications:
 - 1. Installer Qualifications: Shall be a sealant and caulking subcontractor with a minimum of five (5) years experience in the application of types of materials required, and who agrees to employ only skilled tradesmen for the Work.

1.07 DELIVERY, STORAGE & HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.08 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.09 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.10 COORDINATION

- A. Pre-installation Meeting: Conduct conference at the Project site to review conditions, materials, colors, and other requirements.

1.11 WARRANTY

- A. See Section 01 77 00 – Closeout Procedures, for additional close out submittal information.
- B. See Section 01 78 36 – Warranties, for additional warranty requirements.
- C. Special Installer's Warranty: Written warranty signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion.
- D. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified including adhesive and cohesive failure and infiltration of water and air, within the specified warranty period.
 1. Warranty Period: Ten (10) years from date of Substantial Completion.
- E. Special warranties specified in the Article exclude deterioration or failure of elastomeric joint sealants from the following:
 1. Movement of structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Manufacturer's standard color that is the closest to the lightest adjacent substrate.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 117.2600.

2.02 JOINT SEALANTS

- A. Caulking Compounds (Acrylic Latex Sealant)
 1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, nonsag, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated to be a paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
 2. Acceptable Standard
 - a. Acrylic Latex Caulk with Silicone; DAP
 - b. Acrylic Latex Caulk 834; Tremco, Inc.
 - c. Pro Series SA-167; OSI Sealants Inc.
 - d. Sonolac; Sonneborn Building Products, Inc.
 - e. AC-20; Pecora Corp.
 - f. Tremflex 834; Tremco
 - g. LC 160 All Purpose Acrylic Caulk; Ohio Sealants, Inc.
 3. Typical Applications:
 - a. See sealant schedule in this specification.
- B. One-Part Elastomeric Sealant (Silicone):
 1. One component elastomeric sealant, complying with ASTM C 920, Class 25, Type NS (non-sag), unless Type S (self-leveling) recommended by manufacturer for the application shown. Provide additional movement capability where indicated.

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- a. Acceptable Standard
 - 1) Spectrem 1; Tremco Inc.
 - 2) Dow Corning 790; Dow Corning Corp.
 - 3) Pecora 864 Architectural Silicone Sealant; Pecora Corp.
 - 4) Omniseal; Sonneborn Building Products, Inc.
 - 5) Pro Series HM-270 Silicone; OSI Sealants, Inc.
 2. One component mildew resistant silicone sealant: (Around countertops and backsplashes and other wet interior locations.)
 - a. Acceptable Standard
 - 1) Dow Corning 786; Dow Corning Corp.
 - 2) Tremsil 600 White; Tremco Inc.
 - 3) 898 Silicone Sanitary Sealant; Pecora Corp.
 - 4) Rhodorsil 6B White; Rhone-Poulenc Inc.
 3. Typical Applications:
 - a. See sealant schedule in this specification.
- C. Elastomeric Sealant (Polyurethane)
1. One component polyurethane sealant, complying with ASTM C 920, Type S, Grade NS, Class 25 (nonsag).
 - a. Acceptable Standard
 - 1) Dymonic; Tremco Inc.
 - 2) Sonolastic NP 1; Sonneborn Building Products, Inc.
 - 3) Pro Series PR-295 Polyurethane Sealant; OSI Sealants Inc.
 - 4) Dynatrol I; Pecora Corp.
 - 5) PR-255; Ohio Sealants, Inc.
 - 6) Vulkem 921; Mameco International
 2. Two component polyurethane sealant, complying with ASTM C 920, Type M, Grade NS, Class 25 (nonsag).
 - a. Acceptable Standard
 - 1) Dymeric 511; Tremco Inc.
 - 2) Vulkem 922; Mameco International
 - 3) Sonolastic NP 2; Sonneborn Building Products, Inc.
 - 4) Sikaflex – 2c NS; Sika Corporation
 - 5) Dynatrol II; Pecora Corp.
 3. Typical Applications:
 - a. See sealant schedule in this specification.
 - D. One-part self-leveling polyurethane sealant (for traffic areas)
 1. One component polyurethane self-leveling sealant, complying with ASTM C 920, Type S, Grade P, Class 25
 - a. Acceptable Standard
 - 1) Sonolastic SL 1; Sonneborn Building Products, Inc.
 - 2) NR-201 Urexpan; Pecora Corp.
 - 3) Vulkem 45; Mameco International
 - 4) Vulkem Nova 300 SSL; Mameco International
 - 5) PL Polyurethane Self Leveling Concrete Crack Sealant
 2. Two component polyurethane self-leveling sealant, complying with ASTM C 920, Type M, Grade P, Class 25.
 - a. Acceptable Standard

- 1) Sonolastic SL 2; Sonneborn Building Products, Inc.
- 2) NR-200 Urexpan; Pecora Corp.
- 3) Vulkem 245; Mameco International
- 4) Sikaflex – 2c SL; Sika Corporation
- 5) THC900/THC901; Tremco Inc.

3. Typical Applications:
 - a. See sealant schedule in this specification.

- E. **Additional Movement Capability:** Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
- F. **Stain-Test-Response Characteristics:** Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- G. **Continuous-Immersion-Test-Response Characteristics:** Where elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion period and additional immersion periods specified below, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.
 1. Three additional four-week immersion periods.

2.03 JOINT-SEALANT BACKING

- A. **General:** Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. **Cylindrical Sealant Backings:** ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. **Type C:** Closed-cell material with a surface skin.
- C. **Bond-Breaker Tape:** Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

- A. **Primer:** Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. **Cleaners for Nonporous Surfaces:** Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. **Masking Tape:** Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints. Leave no residue.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. 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.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- F. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.06 JOINT-SEALANT SCHEDULE

- A. Caulking Compounds (Acrylic Latex Sealant):
 1. Caulking compounds shall be used for interior nonmoving joints and at locations indicated, including, but not limited to the following locations:
 - a. Generally non-traffic interior locations involving joint movement of not more than plus or minus 5 percent.
 - b. Interior perimeter joints of exterior openings, unless otherwise noted.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - d. Interior control joints, unless otherwise noted.
 - e. Control and construction joints.
 - f. Miscellaneous openings and penetrations.
 - g. Joints between dissimilar materials
 - h. Other joints as indicated.
- B. One-Part Elastomeric Sealant (Silicone):

1. One component elastomeric silicone sealants shall be used at exterior and interior joints where thermal or dynamic movement is anticipated including, but not limited to, the following locations:
 - a. Metal to metal joints.
 - b. Sheet metal flashing, coping, preformed metal caps, fascias, extenders, trim, and panels.
 - c. Glass to glass joints.
 - d. Glass to metal joints.
 2. One component mildew resistant silicone sealant at locations indicated, including but not limited to the following locations:
 - a. Joints between plumbing fixture and adjoining walls, floors, and counters.
 - b. Joints between countertops and backsplashes and walls where a sink is located in the countertop.
 - c. Piping which penetrates wall and is exposed to view.
 - d. Any other wet interior locations
- C. Elastomeric Sealant (Polyurethane)
1. One or two component elastomeric polyurethane sealants shall be used at exterior and interior joints where weatherproofing or waterproofing is required and at exterior and interior joints between dissimilar materials including, but not limited to the following locations:
 - a. Generally all non-traffic exterior locations.
 - b. Exterior and interior sides of building expansion joints.
 - c. Exterior side of frames of doors, windows, and louvers to adjacent dissimilar materials.
 - d. Lintels and shelf angles to masonry construction.
 - e. Exterior building control joints and clay masonry expansion joints in the building.
 - f. Bed joint between cast stone and brick masonry.
 - g. Joints between the concrete slabs and dissimilar materials.
 - h. Sealant in pipe sleeves where materials must penetrate the floor slab. (Nonrated)
 - i. Perimeter of floor slabs which abut vertical surfaces.
 - j. Tile control and expansion interior joints in vertical and horizontal nontraffic surfaces.
 - k. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by the various methods of construction to make watertight.
 - l. Exterior locations which are noted "caulked" or "sealant" and not specifically listed herein or included in the Work of other Sections of the Specifications.
 - m. Interior joints between dissimilar materials where the joining of the 2 surfaces leave a gap between the meeting materials and components, where gap may move more than 25% of the joint. Use acrylic latex sealant unless movement occurs.
 - n. Flashings.
 - o. Mechanical openings.
 - p. Miscellaneous openings and penetrations.
 - q. Other joints, as indicated.
- D. Self-leveling polyurethane sealant (for traffic areas)
- E. One or two part self-leveling polyurethane sealants shall be used for exterior and interior horizontal joints subject primarily to pedestrian traffic and light and moderate vehicular traffic.
1. Interior and exterior applications subject to traffic.
 2. Isolation and contraction joints in cast-in place concrete slabs.

END OF SECTION

SECTION 07 96 00 - EXTENSIVE GREEN ROOF ASSEMBLY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Furnish and install all labor, materials, tools, handling equipment, delivery, etc... for a complete installation of the extensive green roof assembly. This includes, but not limited to, the following:
- B. Roof substrate protection board
- C. Surface conditioners
- D. Roofing membrane and associated flashings at green roof areas only
- E. Roofing terminations and flashing associated with above
- F. Root barrier protection
- G. Roof drainage boards
- H. Roof edge protection measures
- I. Stone ballast
- J. Edge restraint
- K. System filter fabrics
- L. Lightweight engineered growing media
- M. Plantings growing medium and vegetation
- N. This Contractor shall review the Section 07 21 00 – Thermal Insulation for the type of roof insulation indicated. During Bidding, Bidding Contractor must notify Architect if roof deck insulation specified does not comply with green roof assembly specifications.

1.03 RELATED SECTIONS

- A. Related sections
- B. Division 5 – Metal Decking
- C. Section 06 10 00 – Rough Carpentry
- D. Section 07 21 00 – Thermal Insulation
- E. Section 07 54 23 – Mechanically Attached TPO Roofing System
- F. Section 07 62 00 – Sheet Metal Flashing & Trim
- G. Section 07 92 00 – Joint Sealants

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Canadian General Standards Board, CGSB-37.50-M89, Standard for Asphalt, Rubberized, Hot Applied, for Roofing and Waterproofing.
- C. Underwriters Laboratories (UL) Class A.
- D. ANSI/SPRI VR-1 2011 “Procedure for Investigating Resistance to Root Penetration on Vegetative Roofs”.
- E. International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) Scale.

1.05 DEFINITIONS

- A. Green Roof – An area of planting/landscaping, built up on a waterproofed substrate at any level that is separated from the natural ground by a man-made structure.
- B. Extensive Green Roof – Low maintenance landscaping consisting of shallow growing media depths (< 6 inches (152mm)) with plant varieties restricted to primarily mosses, herbs and succulents capable of withstanding harsh growing conditions.
- C. Intensive Green Roof – Landscaping requiring regular maintenance, consisting of deeper growing media depths (> 6 inches (152mm)) with a wider variety of plant species possible including shrubs and small trees.
- D. Lawn Green Roof – Lawn oriented landscaping requiring at-grade lawn oriented maintenance. Can include sodded or seeded turfgrasses or naturalized grasses with growing media depths > 8 inches (203mm).
- E. Garden Roof® – Patented system of drainage, water retention and root barrier components utilized in the construction of green roofs over Hydrotech's MM 6125® roofing membrane.
- F. Steep Slope Green Roof – Defined as a slope exceeding 3:12 pitch.
- G. "C" Factor – The runoff coefficient used in the Rational Method, "C" represents the portion of the storm rainfall that becomes runoff.
- H. Curve Number (CN) – A number that is used with Natural Resource Conservation Service (SCS) methods to convert rainfall depth into runoff volume. The Curve Number takes into account a site's soil type, plant cover, impervious cover, interception and surface storage.

1.06 SUBMITTALS

- A. Certification from an approved independent testing laboratory experienced in testing rubberized asphalt material, that the material meets the CGSB-37.50-M89 standard for rubberized asphalt membranes, including applicable ASTM procedures.
- B. Certification that the roofing membrane has current validation by Underwriters Laboratories, or other approved independent validation service provider, of a minimum 40% recycled content.
- C. Certification that the roof membrane assembly is currently Class A listed with Underwriters Laboratories.
- D. Certification showing full time quality control of production facilities responsible for the manufacture of the rubberized asphalt and that each batch of material is tested to insure conformance with the manufacturers published physical properties.
- E. Certification that the plant manufacturing the rubberized asphalt material has ISO 9001-2015 approval as evidenced by a copy of the official certificate.
- F. Certification showing that all components of the green roof assembly are being supplied and warranted by a single-source manufacturer.
- G. Certification that the extruded polystyrene insulation if used is free from CFC's.
- H. Ballasting requirements for the specified loose laid extruded polystyrene insulation, and as referenced in part 1.09.L., shall be provided to include the following:
 - 1. A written ballast review on membrane manufacturer's letterhead outlining specific roof level ballasting requirements required to satisfy limited wind resistance warranty conditions.
 - 2. Each roof level shall be individually evaluated and prepared during the design and prebid process
 - 3. A final ballast review shall be submitted that reflects the designed conditions at the time of the project bid.
- I. Product data on all components of the green roof assembly shall be provided.
- J. Evidence indicating that water is available at the roof level to ensure that the vegetation can receive sufficient moisture through proper maintenance of the green roof.
- K. Evidence that a contract is in place to maintain the vegetation to requirements once installed and throughout the warranty period.

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- L. Certification from an approved independent testing laboratory that the roofing manufacturer's extensive 4-inch vegetated roof assembly has been tested in accordance with CSA123.25-15 to a minimum wind speed of not less than 110mph without failure of the assembly.

1.07 QUALITY ASSURANCE

- A. The Roofing/Waterproofing Contractor shall demonstrate qualifications to perform the work of this Section by submitting the following documentation:
 - 1. Certification or license by the membrane manufacturer as a locally based, authorized applicator of the product the installer intends to use, for a minimum of five (5) years.
 - 2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.
- B. The Green Roof Installing Contractor shall demonstrate qualifications to perform the work of this Section by submitting the following documentation:
 - 1. Certification or license by the green roof assembly supplier as a locally based, authorized applicator of the products the installer intends to use, for a minimum of five (5) years.
 - 2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.
- C. The Green Roof Maintenance Contractor shall demonstrate qualifications to perform the work of this Section by submitting the following documentation:
 - 1. List of at least three (3) green roof projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.
- D. Include single-source for all components from the manufacturer.
- E. The rubberized asphalt membrane product shall contain an inert filler and crumb rubber to enable the product to be resistant to acids (fertilizers, building washes and acid rain) and maintain membrane thickness during application respectively.
- F. Membrane Manufacturer shall have available an in-house technical staff to assist the contractor, when necessary, in application of the products and final inspection of the assembly.
- G. Membrane Manufacturer Qualifications: Manufacturer shall demonstrate qualifications to supply materials of this section by certifying the following:
 - 1. Membrane Manufacturer shall show evidence that the specified rubberized asphalt has been manufactured by the same source for thirty five (35) years and successfully installed on a yearly basis for a minimum of thirty five (35) years on projects of similar scope and complexity.
 - 2. Membrane Manufacturer shall not issue warranties for terms longer than they have been manufacturing their hot fluid rubberized asphalt membrane.
- H. Green Roof Supplier shall show evidence that the specified green roof assembly has been developed, marketed, supported and installed for a minimum of fifteen (15) years on projects of similar complexity.
- I. Green roof supplier shall provide data and calculations, specific to the products being submitted, that verify that the green roof assembly specified meets the project criteria for storm water runoff volume and rate control.
 - 1. Calculations shall be based on actual testing of suppliers green roof components to be used for the project including but not limited to the regionally specific growing media formulation and water retention/drainage materials.

2. Calculations shall account for vegetated and un-vegetated portions of the roof as well as local climatic conditions including rainfall depth, intensity, duration, and timing.
- J. Green roof supplier shall provide data demonstrating that the composite C-factor and Curve Number parameters for the specified green roof assembly are less than or equal to those factors used in the engineering design and analysis for the projects drainage and storm water systems analysis.
- K. Pre-Construction Conferences. The manufacturer will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the roofing assembly.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, all identifying numbers, and U.L. labels.
- B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.
- C. Store materials in a clean, dry area protected from water and direct sunlight.
- D. Store all adhesives at temperatures between 60°F (15.5°C) and 80°F (26.6°C). If exposed to lower temperatures, restore materials to 60°F (15.5°C) minimum temperature before using.
- E. Keep roof substrate board dry before, during, and after installation. Outside storage shall be off ground and protected by a breathable waterproof covering. Roof substrate board shall be roofed the same day as installed.
- F. Vegetation shall be handled and stored in accordance with the Hydrotech Extensive Garden Roof Plant Installation and Maintenance Guideline.

1.09 PROJECT CONDITIONS

- A. Application of the membrane shall not commence nor proceed during inclement weather. All surfaces to receive the membrane shall be free of water, dew, frost, snow and ice.
- B. Application of membrane shall not commence nor proceed when the ambient temperature is below 0°F (-17.7°C).
- C. Preparation and application of membrane shall be conducted in well ventilated areas.
- D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180°F (82°C) (i.e., hot pipes and vents or direct steam venting, etc.).
- E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.
- F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roof membrane. Any exposure to foreign materials or chemical discharges shall be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.
- G. Ballasting requirements vary depending on height of roof deck, parapet height, and design wind speed based upon location of building. Vegetated green roofs also require proper ballasting and the possible use of wind erosion mats. Ballast design shall be in accordance with green roof system requirements and other applicable codes or wind design guides.
- H. Contractor shall assure that adequate protection is to the membrane and plantings to prevent damage from subsequent trade traffic.

1.10 WARRANTY

- A. Upon completion of the work, the contractor shall supply the owner with a single-source warranty of U.S. origin direct from the manufacturer.
- B. Warranties available from the manufacturer:

1. Material Warranty; excludes labor.
 - a. Duration: 20-year
2. Watertightness Warranty; includes labor and material to maintain watertight condition and replacement of green roof supplied roof substrate board.
 - a. Duration: 20-year
3. Total System Warranties; covers components of the green roof assembly, including membrane, flashing, green roof components, vegetation, pavers and ballast units. Includes removal and replacement of the insulation, green roof components, vegetation, pavers, ballast units and growing media when supplied, installed, and maintained per green roof system requirements, and replacement of green roof supplied roof substrate board.
 - a. Duration of Membrane/Flashing and replacement of green roof supplied roof substrate board from date of installation (watertight condition):
 - 1) 20-year
 - b. Material Integrity of green roof components from date of purchase:
 - 1) 20-year
 - c. Extensive Vegetation: 2-year thrive and coverage from date of installation:
 - 1) Sedum Plugs: minimum 50% coverage end of year 1; 80% coverage end of year 2
 - 2) Sedum carpet and sedum tile: minimum 75% coverage at delivery and end of year 1; 90% coverage end of year 2
 - 3) Perennial Plugs: 2-year thrive from date of installation
 - d. Duration of Pavers and ballast units from date of purchase: (will not crack, split or delaminate due to freeze-thaw)
 - 1) 10-year

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design – All components shall be obtained as a single-source from the membrane / green roof manufacturer to ensure total system compatibility and integrity.
 1. American Hydrotech, Inc.
303 East Ohio Street
Chicago, Illinois 60611-3318
800-877-6125 or 312-337-4998
FAX: 312-661-0731
Web Site: www.hydrotechusa.com
- B. Equal Manufacturer's – Based on compliance with this Specification, the following alternate green roof assemblies are accepted:
 1. Columbia Green Technologies
79 SE Taylor St.
Suite 201
Portland, OR 97214

3" Depth Extensive Layered Green Roof System, 4'x6' pre-grown sedum mats
 2. Green Roof Solutions
4336 Regency Dr.

Glenview, IL 60025

- C. Extensive media category less than 6", 4' x 6.25' or 1m x 2m Sedum mix vegetative mats
- D. **SPECIAL NOTE TO BIDDING CONTRACTORS FOR EQUAL GREEN ROOF ASSEMBLIES** – Basis of Design manufacture assembly includes roof protection board and roof membrane installation. The above equal manufacturers do not have these components as part of their assemblies. If equal green roof manufacturers are to be used by a Bidding Contractor, this contract must include the furnishing and installation of a complete water-tight and warranted TPO roof membrane assembly at all areas indicated to have a green roof system. This includes but not limited to the following (refer to Section 07 54 23):
 - 1. Roof substrate protection board
 - 2. Surface conditioners
 - 3. Mechanically Adhered TPO Roof Assembly
 - 4. Sacrifice TPO membrane install over finished roof assembly
 - 5. Associated flashings at green roof areas only
 - 6. Roofing terminations and flashing associated with above
 - 7. Root barrier protection
 - 8. Roof drainage boards
 - 9. Roof edge protection measures
 - 10. Stone ballast
 - 11. Edge restraint
 - 12. System filter fabrics
 - 13. Lightweight engineered growing media
 - 14. Plantings growing medium and vegetation

2.02 MATERIALS

- A. Membrane
 - 1. Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the CGSB-37.50-M89 standard and other pertinent physical properties:

(40% recycled content)

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
Flash point	CGSB-37.50-M89 ASTM D-92	< 500°F* (260°C)
Penetration	CGSB-37.50-M89 ASTM D-5329	@ 77°F (25°C) max. 110 @ 122°F (50°C) max. 200
Flow	CGSB-37.50-M89 ASTM D-5329	@ 140°F (60°C) max. 3.0mm
Toughness	CGSB-37.50-M89	≥ 5.5 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	≥ 0.040
Water Vapor Permeability	CGSB-37.50-M89	≤ 1.7 ng/Pa.s.m ² (0.027 perm)

	ASTM E-96, Procedure E	
Water Absorption	CGSB-37.50-M89	Gain in weight 0.35 g max. Loss in weight 0.18 g max.
Low Temperature Flexibility (-25°C)	CGSB-37.50-M89	No delamination, adhesion loss, or cracking
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetra- tion, flow or low temperature flexibility
Viscosity	CGSB-37.50-M89	2 - 15 seconds
Water Resistance (5 days/50°C)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Softening Point	ASTM D-36	180°F (82°C)
Elongation	ASTM D-5329	1000% minimum
Resiliency	ASTM D-5329	40% minimum
Bond to Concrete 0°F (-18°C)	ASTM D-5329	Pass
Resistance to Acid	ASTM D-896 Procedure 7.1 (N-8)	Pass - 50% Nitric Acid Pass - 50% Sulfuric Acid
Resistance to Hydrostatic Pressure	ASTM D-08.22 Draft 2	100 psi (equals 231 foot of head water)
Resistance to Salt Water (20% Sodium carbonate calcium chloride)	ASTM D-896 similar	No delamination, blistering, emulsification or deterioration
Resistance to Fertilizer (Undiluted 15/5/5, nitrogen/phosphorus/potash)	ASTM D-896 similar	No delamination, blistering, emulsification or deterioration

Resistance to Animal Waste	3-year exposure	No deterioration
Solids Content		100% - no solvents
Recycled Content	UL Validated	40% (post-consumer) (30% REACH compliant)
Shelf Life		10 years (sealed)
Specific Gravity		1.15 + .02

* Or alternatively not less than 77°F (25°C) above the manufacturer's maximum recommended application temperature

B. Roof Substrate Board

1. Impact resistant, nonstructural, fiber-reinforced, gypsum panels made from 95% recycled content. Securock Gypsum-Fiber Roof Board as marketed by American Hydrotech, Inc.
 - a. Miscellaneous
 - 1) Fasteners and Plates
 - a) Provide size and type in accordance with Factory Mutual and/or applicable codes and to maintain structural integrity. Only 3 inch round metal plates shall be used.
 - 2) Adhesive
 - a) Provide adhesive compatible with roof substrate board and insulation to comply with Factory Mutual and/or applicable codes and to maintain structural integrity.
 - 3) Vapor Barrier
 - a) Provide suitable vapor retarder as required by design professional.
2. Other approved fire rated type "X" gypsum roof substrate board.

C. Surface Conditioner

1. Asphaltic surface conditioner for concrete surfaces only
2. American Hydrotech, Inc., Surface Conditioner

D. Reinforcing

1. Spunbonded polyester fabric (standard duty) reinforcing sheet.
2. American Hydrotech, Inc., Flex Flash® F
3. 60-mil (1.5 mm) thick, uncured neoprene (heavy duty) reinforcing sheet.
4. American Hydrotech, Inc., Flex Flash® UN

E. Flashing

1. 60-mil (1.5 mm) thick, uncured neoprene sheet.
2. American Hydrotech, Inc., Flex Flash® UN
3. 157-mil (4 mm) thick, torch-grade, modified asphalt, reinforced flashing membrane.
4. American Hydrotech, Inc., Flex-Flash® MB
5. Two-component, liquid applied resin membrane flashing system.
 - a. American Hydrotech, Inc., HydroSeal Resin
 - b. poly methyl-methacrylate (PMMA) resin
 - c. American Hydrotech, Inc., HydroSeal Matrix
 - d. acrylic resin with integral chopped polymer fiber reinforcement
 - e. American Hydrotech, Inc., HydroSeal Flashing Accessories
 - f. resin based primers, additives, reinforcing fleece, surfacing topcoats

F. Adhesives/Sealant

1. Contact adhesive to bond elastomeric flashing together.
2. American Hydrotech, Inc., Splicing Cement
3. Contact adhesive to bond elastomeric flashing to an approved substrate.
4. American Hydrotech, Inc., Bonding Adhesive
5. Sealant to seal elastomeric flashing seam edge.
6. American Hydrotech, Inc., Lap Sealant
7. Tape to bond laps of uncured neoprene flashings
8. American Hydrotech, Inc., Seam Tape

G. Separation/Root Barrier Protection Course

1. Combination of a fiberglass reinforced rubberized asphalt protection sheet and polyethylene root barrier.
2. American Hydrotech, Inc., Hydroflex® 30 and Root Stop
3. Pressure-sensitive polyethylene tape for Rootstop and Rootstop HD
4. American Hydrotech, Inc. Root Stop Tape

H. Insulation

1. Refer to Section 07 54 23 – Mechanically Attached TPO Roofing System.

I. Drainage/Water Retention Component

1. Three-dimensional, molded panels of recycled polyethylene with drainage channels top and bottom sides and water retention reservoirs top side shall meet the following physical properties.
2. American Hydrotech, Inc., Gardendrain®
 - a. Gardendrain GR30

J. Filter Fabric

1. Non-woven, polymeric, geotextile fabric.
2. American Hydrotech, Inc., Systemfilter

K. Growing Media

1. Custom growing media mix capable of supporting vigorous growth of the specified vegetation, complying with the following specification.
2. American Hydrotech, Inc., Extensive LiteTop® Growing Media

Property	Extensive LiteTop Growing Media*
Grain Size Distribution (ASTM F1632 Method B)	
clay fraction (<0.002mm)	< 2 %
silt fraction (0.075-0.002mm)	< 8%
passing #200 sieve (0.075mm)	< 10%
passing #60 sieve (0.25mm)	5 – 25 %
passing #18 sieve (1.0mm)	15 – 45 %
passing #10 sieve (2.0mm)	25 – 60%
passing 1/8-inch sieve	30 – 75 %
passing 1/4-inch sieve	45 – 95%
passing 3/8-inch sieve	95 – 100 %
Density (ASTM E2399)	
Initial Media Density	55 lbs – 80 lbs/cf
Maximum Media Density	70 lbs – 90 lbs/cf

Water/Air Management (ASTM E2399)	
saturated water capacity	> 30%
air filled space (porosity)	> 10%
total pore space	> 40%
Water Permeability	
Hydraulic Conductivity	>12 in/hr
pH, Lime, and Salt Content	
pH (saturated paste)	6.0 – 8.0
salts content (water extract)	<2.5 mmhos/cm
Organics (LOI 550°C) (ASTM F1647)	
Organic Matter content	3 – 8 % by volume
Compost Fraction:	
1) Meet or exceed USEPA Class A standard, 40 CFR 503.13, Tables 1 & 3 (chemical contaminants) and 40 CFR 503.32(a) (pathogens) and/or be permitted in the state of origin to produce Class A material.	
2) Meet or exceed US Compost Council STA/TMECC criteria or equal for Class I or II stable, mature product.	
* Values shall be adjusted due to availability of local materials or special project conditions related to plant selection and/or environmental conditions.	

L. Erosion Control Materials

1. Erosion Control Mat
2. Biodegradable Erosion Control Matting: Composed of straw and/or coconut fiber stitched together with biodegradable thread forming top and bottom netting.
3. American Hydrotech, Inc., GardMat® LT
4. Long Term Erosion Control Mat: Composed of polypropylene netting
5. American Hydrotech, Inc., GardMat® N
6. Heavy-Duty Anchors
 - a. Plastic anchor disk with connected plastic stem and friction-fit plastic top disk used to fasten GardMat Erosion Control Mat or sedum carpet and tile.
 - b. American Hydrotech, Inc. Disk Anchors
7. Hydromulch
 - a. Wood fiber-based hydromulch with natural-based tackifier for use in securing sedum cuttings on roof. Where hydromulching equipment is available and has access to roof; hydromulch shall be mixed with tackifier and applied as wet slurry to cutting installations.
8. Dry Hydromulch
 - a. Wood fiber or straw-based hydromulch with integrally mixed guar-based tackifier. For use where hydromulching equipment and access is not possible. Dry hydromulch shall be applied in accordance with the Hydrotech Extensive Garden Roof® Plants Installation and Maintenance Guideline.

M. Vegetation/Plantings

1. Sempergreen Extensive Sedum Carpet
2. 17416 Germanna Hwy
3. Culpepper, VA 22701
4. (540) 399-5055
5. www.sempergreen.com

N. Filter Fabric

-
1. Water permeable polymeric fabric.
 2. American Hydrotech, Inc., Stone Filter Fabric
- O. Hardscape / Roof Ballast
1. Stone Ballast
 2. Well screened and washed stone gravel meeting ASTM D-448-80, gradations #2, 4 or 5 as directed by Dow Chemical Company and American Hydrotech, Inc.
- P. Miscellaneous
1. Metal Edging
 - a. Extruded aluminum edging perforated to allow water flow as shown on plans and details.
 - 1) American Hydrotech, Inc. GardenEdge® Metal Edge Restraint; size as
 - 2) American Hydrotech, Inc. GardenEdge® Aluminum Leveling Strips: available to accommodate sloped/level roof surfaces.
 2. Inspection Chambers
 - a. Aluminum and stainless steel over drain chambers perforated to allow water flow as shown on plans and details.
 - 1) American Hydrotech, Inc. GardenHatch® Inspection Chambers; size as noted on plans and details.
 - 2) Locate inspection chambers at roof drains
 3. Additional Ballast
 - a. Checker Block®: as manufactured by Hastings Pavement Co. LLC and as marketed exclusively by American Hydrotech, Inc. meeting the following properties:
 - b. Steel reinforced precast concrete
 - 1) Minimum 98 lbs per unit
 - 2) Nominally 24" x 24" x 4" deep
 - 3) Continuous and connected void spaces created by 16 truncated concrete pyramids joined by lower concrete connectors.
 - c. Stainless steel zip-ties as supplied by American Hydrotech, Inc.
 - d. Disk Anchors as supplied by American Hydrotech, Inc.

2.03 RELATED MATERIALS

- A. Metal counterflashing is typically required to provide protection to vulnerable flashing materials from damage due to gardening activities.

PART 3 - EXECUTION

3.01 INSPECTION

- A. The roofing contractor shall examine all surfaces to receive the roofing assembly to verify it is acceptable and proper for the application of the membrane. Refer to Green Roof Manufacturer's Pre-Installation & Application Guidelines.
- B. The roofing contractor shall not proceed with the installation of the roof membrane assembly until all roof defects have been corrected.

3.02 PREPARATION

- A. All surfaces shall be dry, smooth, free of depressions, voids, protrusions, clean and free of unapproved curing compounds, form release agents and other surface contaminants. (Edit to project requirements)
- a. Metal Deck with roof substrate board
 - b. Roof substrate board shall be fire rated type "X" board attached to minimum 22 gauge steel decking with adequate structural support.
 - 1) Minimum 1/2 inch thick substrate board shall be used over insulation.
 - c. Flat fill and tapered roof insulation shall be installed in accordance with layout indicated on shop drawings and insulation board manufacturer's minimum requirements.
 - d. Adequate number and type of fasteners and plates shall be used to comply with roof substrate and insulation board manufacturer's minimum requirements and applicable codes and to maintain structural integrity.
 - 1) Minimum of 10 fasteners and plates per full-size roof board shall be used.
 - e. Appropriate roof adhesive shall be used in accordance with adhesive manufacturer requirements to comply with applicable codes and maintain structural integrity.
 - 1) Size and spacing of adhesive beads shall be as required by adhesive manufacturer.
 - f. Roof substrate boards shall be installed such that all edge and end joints are supported by metal deck ribs and/or appropriate blocking.
 - g. Roof substrate board end joints of adjacent lengths shall be staggered.
 - h. Where required, a suitable vapor barrier membrane shall be applied as determined by the project design professional prior to installation of the roof substrate board and/or insulation.
 - i. Roof substrate board edges and ends shall be butt loosely in typical installations. Long, uninterrupted runs (greater than 200 feet) of roof substrate board may require slight gapping due to higher temperature gain. Gapping shall not exceed 3/16 inch and all such gaps shall be filled flush with the surface of the roof board with an appropriate sealant.
 - j. Roof substrate board shall be cut to size using a sharp utility knife and straightedge. The surface of the roof substrate board shall be scored with the utility knife and the board bent up sharply towards the score cut. A keyhole-type drywall saw shall be used for penetration cutouts and radii. A low rpm circular saw shall be used for 5/8 inch thick roof board.
- B. Substrate cleaning
- 1. Thoroughly sweep the substrate which is to receive the roof membrane.
 - 2. Substrate shall also be blown clean using an air compressor to remove any remaining loose debris.
 - 3. Final check to determine if concrete has been properly cleaned is to apply a test patch of Monolithic Membrane 6125 to the surface and check its adhesion.

3.03 INSTALLATION

- A. Surface conditioner application (to concrete substrates only)
- 1. Apply the surface conditioner only to concrete using a hand held sprayer evenly at a rate of 300 to 600 SF/gallon (7.4 - 14.7 m²/L) depending on surface texture. Surface conditioner shall "tan" the surface, not blacken it.
 - 2. Allow sufficient time for the surface conditioner to thoroughly dry prior to the membrane application.

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- B. Membrane preparation
 - 1. The membrane shall be heated in double jacketed, oil bath or hot air melter with mechanical agitation, specifically designed for the preparation of a rubberized asphalt membrane.
 - 2. Heat membrane until membrane can be drawn-free flowing at a temperature range between 350°F (176°C) and 375°F (190°C).
 - C. Detailing/Flashing
 - 1. All detailing and flashing shall be done in accordance with the manufacturer's standard guideline details.
 - 2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate.
 - 3. Roof substrate board joints shall be pre-detailed with membrane and fabric reinforcing prior to full fabric reinforced membrane application.
 - 4. All liquid-applied, resin flashings shall be applied over properly completed membrane flashing details in accordance with the manufacturer's standard guideline details.
 - D. Membrane Application
 - 1. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 90 mil minimum (approximately 2.3 mm), into which is fully embedded a layer of the spunbonded polyester fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at an average thickness of 125 mil (approx. 3.2 mm). Total membrane thickness is to be 215 mils average (approx. 5.5 mm), 180 mils minimum.
 - 2. Overlap fabric reinforcing sheet 1-2 inches (25.4 mm - 50.8 mm) with membrane between sheets.
 - 3. Pre-detailing of joints between plywood and roof substrate board decks is required.

3.04 SEPARATION/PROTECTION COURSE INSTALLATION

- A. Separation/Protection course shall be installed as follows:
 - 1. Embed the Hydroflex 30 separation/protection course into the membrane while it is still hot to insure a good bond. Installation of a separation course is necessary in order to carry out the water test.
 - a. Overlap adjoining sheet edges (dry) a minimum of 2"-3" (50.8 mm - 76.2 mm) to insure complete coverage.

3.05 MEMBRANE INTEGRITY TEST

- A. The roof area or portions thereof shall be leak tested by means of electronic testing or by ponding water at a minimum depth of 2" (50.8 mm) for a period of 48 hours to check the integrity of the membrane installation.
 - 1. VERIFY that the structure can support the deadload weight of a watertest before testing.
 - 2. If leaks should occur the water shall be drained completely and the membrane installation repaired.
- B. In the event of excessive damage to the membrane assembly, electronic beach detection testing shall be required prior to the placement of subsequent overburden.

3.06 GARDEN ROOF COMPONENTS INSTALLATION

- A. All garden roof components shall be installed per manufacturer's requirements.
- B. Root Barrier Protection. Root Stop shall be laid over the Hydroflex 30, lapping adjacent sheets 5 feet (1.5 m). A minimum 30 inch overlap is acceptable when Root Stop Tape is used to

continuously seal the lap edge. Root Stop shall be turned up all vertical roofed/flushed surfaces, installing additional material as required, to completely protect waterproofing and flashings.

- C. Insulation. Where specified, STYROFOAM® brand insulation shall be installed loose-laid in accordance with manufacturer's recommendations.
- D. Air Layer. When insulation and Moisture Mat are specified an air layer shall be required between the surface of the insulation and the water retention mat. A layer of Hydrodrain AL or 300 shall be installed over the insulation. The 4 inch (100 mm) salvage edge of the geotextile fabric overlaps adjoining sheets and can be held in place with duct tape.
- E. Moisture Mat. Where specified, a layer of Moisture Mat shall be installed over the root barrier (when no insulation is specified) or air layer/ insulation, lapping adjacent rolls a minimum of 4 inches (100 mm). The Moisture Mat shall be turned up all vertical, roofed/flushed surfaces a minimum of 6 inches (150 mm) beyond the anticipated growing media level. Any excess shall be trimmed down to the level of the growing media.
- F. Drainage/Water Retention Component.
 - 1. Gardendrain GR15 [Gardendrain GR30] [Gardendrain GR50] shall be installed with holes up, over the root barrier protection, water retention mat (if used) or STYROFOAM® insulation (if used). Adjacent panels shall be butt together. Gardendrain shall be cut to fit around penetrations, etc. with a heavy-duty utility knife or small toothed saw.
- G. Filter Fabric
 - 1. A layer of Systemfilter shall be laid over the Gardendrain, lapping adjacent rolls a minimum of 12 inches (300 mm). Enough material shall be left to be drawn up above the anticipated growing media level. Any excess shall be trimmed down to the level of the growing media.

3.07 HARDSCAPE/ACCESSORY INSTALLATION

- A. Stone and/or paver ballast shall be installed at all roof perimeters, building walls, penetrations, and access hatches and as required for vegetation free zones, proper wind design, fire breaks, and as walkway/maintenance paths.
 - 1. Ballast design shall be in accordance with Dow Chemical Company and American Hydrotech, Inc. requirements. CONTACT Hydrotech for ballasting recommendations.
- B. Checker Block® shall be installed per Hydrotech requirements and as shown on Hydrotech details.
 - 1. Checker Block® shall be installed where indicated on plans and as required per ballasting requirements established by American Hydrotech, Inc.
 - 2. Disk Anchors shall be installed in Checker Block® and elsewhere in Garden Roof to the pattern required per the ballasting requirements established by American Hydrotech.
 - 3. Stainless steel zip ties as supplied by American Hydrotech shall be used to connect Checker Block® units together as required by American Hydrotech, Inc.
- C. Metal edge restraints, precast curbing and all specified edging materials shall be installed as shown on plans and details.
- D. Drains shall be fitted with inspection/maintenance chambers and grills, built up to ensure access at growing media level as shown on plans and details.

3.08 GROWING MEDIA INSTALLATION

- A. LiteTop growing media shall be placed carefully to avoid damage or displacement of other materials such as walls, paving, drainage components, filter fabric, and roofing membrane.
- B. LiteTop growing media shall be placed to within 1 inch greater than final grade or to a depth of no greater than 8 inches and compacted as described below. For final grades less than 8

inches only one round of compaction shall be performed and remaining growing media loosely placed such that top of growing media exceeds final grade by 1 inch. For final grades greater than 8 inches, place growing media at no greater than 6 inches and repeat procedure until growing media has been compacted within 1 inch of final grade.

- C. Compaction shall be performed with a 300 – 400 lb. landscape. Mechanical compactors including plate compactors are not recommended.
- D. Where Checker Block is installed, roller compaction is not possible. Hand compaction shall be employed to properly compact media. Unless deeper media profile is specified, top of media shall be equal to or just higher than top of Checker Block® units.
- E. After compaction remaining growing media shall be placed at 1 inch greater than final grade and thoroughly watered or jetted over entire area. Low settled areas shall be filled with additional growing media and re-wet to achieve uniform prescribed final grade.
- F. Erosion Control Mat.
 - 1. The erosion control mat shall be installed directly over the growing media and properly anchored into place.
 - a. fastening pattern is based on local wind speed, building height and roof slope. Contact Hydrotech for specific guidelines.
 - b. Erosion control mat is not required when Sedum Carpet is installed; however, the Sedum Carpet shall be anchored in place as required.

3.09 VEGETATION INSTALLATION

- A. Vegetation planting shall be installed in accordance with the Hydrotech Extensive Garden Roof Plant Installation Guidelines.
- B. Plant materials shall not be installed between the fall frost date and the following spring frost date. Contact Hydrotech for fall and spring frost dates specific to the Project and plant material type.
- C. Growing media shall be thoroughly watered and saturated immediately prior to installing new plant material.
- D. Where Checker Block® is installed, media shall be properly placed before plant material is installed. Where InstaGreen sedum carpet is used, no gaps shall exist between the bottom of the sedum carpet and the media placed in the Checker Block® units.
- E. All vegetation shall be thoroughly watered and saturated immediately after installation. Media is saturated when water is seen flowing into roof drains from adjacent areas.

3.10 VEGETATION MAINTENANCE

- A. Contractor/Installer shall maintain plantings in accordance with the Hydrotech Extensive Garden Roof Maintenance Guidelines. Contact Hydrotech for specific maintenance requirements.
- B. Maintenance activities shall include, but are not limited to, the following:
 - 1. Periodic on-roof monitoring of vegetation
 - 2. Watering to maintain proper growing media moisture content (especially during periods of hot and dry weather)
 - 3. Weeding to remove unwanted vegetation from planted areas and vegetation free zones.
 - 4. Removal of debris
 - 5. Reporting and photo-documentation of progress of vegetation during maintenance and warranty period.
- C. Maintenance shall begin immediately after vegetation installation and shall continue through final acceptance and turn-over of the project to the owner.
- D. Maintenance activities shall continue throughout the two-year warranty period (from date of vegetation installation) to keep vegetation warranty in effect.

END OF SECTION

**SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Hollow metal doors
 - 2. Hollow metal frames
 - 3. Door accessories

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 04 20 00 – Unit Masonry
 - 2. Section 08 44 13 – Glazed Aluminum Curtain Walls
 - 3. Section 08 71 00 – Door Hardware
 - 4. Section 08 80 00 – Glazing

1.04 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.05 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus
 - 2. ASTM E 152 – Standard Methods of Fire Tests of Door Assemblies
 - 3. ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 4. ASTM A 568 & A 569 – Standard Specification for Steel, Sheet, Carbon, Hot-Rolled, Commercial Quality.
 - 5. ASTM A 653 – Standard Specification for Steel, Sheet, Zinc-Coated (Galvannealed) by the Hot-Dip Process
 - 6. ASTM A 924 – Standard Specification for General Requirements for Steel, Sheet, Metallic Coated by the Hot-Dip Process
 - 7. ASTM D 1735 - Standard Practice for Testing Water Resistance of Coating Using Water Fog Apparatus
- B. American National Standards Institute (ANSI):

1. ANSI/UL 10B Fire Tests of Door Assemblies
2. ANSI/NFPA 80 Standards for Fire Doors and Fire Windows
3. ANSI/NFPA252 Fire Tests of Door Assemblies
4. ANSI A250.3 – Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
5. ANSI A250.4 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
6. ANSI A250.6 (SDI 107) – Hardware on Standard Steel Doors (Reinforcement-Application)
7. ANSI A250.7 – Nomenclature for Steel Doors and Steel Door Frames
8. ANSI A250.8 (SDI-100) – Recommended Specifications for Steel Doors & Frames
9. ANSI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
10. ANSI/DHI A115 Specifications for Hardware Preparations in Standard Steel Doors and Frames
11. ANSI/DHI A115.IG Installation Guide for Doors and Frames

C. Steel Door Institute (SDI):

1. SDI 105 – Recommended Erection Instructions for Steel Frames
2. SDI 106 – Recommended Standard Door Type Nomenclature
3. SDI 108 – Recommended Selection and Usage Guide for Standard Steel Doors
4. SDI 109 – Hardware for Standard Steel Doors & Frames
5. SDI 110 – Standard Steel Doors & Frames for Modular Masonry Construction
6. SDI 111 – Recommended Standard Details for Steel Doors and Frames
7. SDI 112 – Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors & Frames
8. SDI 122 – Installation and Troubleshooting Guide for Standard Steel Doors and Frames
9. SDI 124 – Maintenance of Standard Steel Doors and Frames

A. Fire Protection:

10. UL 10B Fire Tests of Door Assemblies (Neutral test pressure)
11. UL 10C Standard for Safety for Positive Pressure Fire Tests of Door Assemblies
12. NFPA 252 Fire Tests of Door Assemblies (Neutral test pressure)
13. UBC 7-2-1997 Positive Pressure Fire Tests of Door Assemblies
14. NFPA 80 Standard for Fire Doors and Fire Windows

1.06 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.07 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance and temperature-rise ratings, and finishes for each type of steel door and frame specified.
- C. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details.
3. Frame details for each frame type, including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Details of glazing frames and stops showing glazing.
8. Details of conduit and preparations for electrified door hardware and controls.

D. Qualification Data: For testing agency.

E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.08 QUALITY ASSURANCE

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Doors shall be provided to conform with the American with Disabilities Act Accessibility Guidelines (ADAAG) and State and Local Regulations. These requirements supersede Technical Specifications of this Section.

1.09 DELIVERY, STORAGE & HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.10 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Curries Door, an ASSA ABLOY Group Company.

2. Steelcraft; an Ingersoll-Rand Company.
3. Ceco Door Products, an ASSA ABLOY Group Company.
4. Winsor Republic Builders Products.
5. Amweld Building Products.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 (ZF120) zinc-iron-alloy (galvannealed) coating designation.
- C. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.
- F. Grout: Comply with ASTM C 476, with a slump of 4 inches (102 mm) for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- H. Glazing: Comply with requirements in Division 8 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities. This is to be field applied by the contractor. This is only to be applied when using antifreeze agents in grouting of frames.

2.03 STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - a. Thermal-Rated (Insulated) Doors: Exterior doors shall be fabricated with thermal-resistance materials such as polystyrene or polyurethane.
 - 1) Locations: Exterior doors and interior doors where indicated.
 3. Vertical Edges for Single-Acting Doors: Bevel edge only.
 - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
 6. Top of Door shall be Capped flush & Smooth without seam to Prevent water intake.
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Exterior Doors: Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2, seamless design, minimum 0.0635-inch-thick (16 gauge) galvanized steel sheet faces.
 2. Doors in exterior locations shall be Galvanized with an A60 coating in accordance with ASTM A924 and A653. The zinc-alloy coating shall be a dull matte surface treated for paint adhesion.
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
 3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.
- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 DOOR ACCESSORIES

- A. Vision Lite System: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.05 STEEL FRAMES

- A. General: Provide metal frames for doors, transoms, sidelights, borrowed lites, and other openings. Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet. A60 zinc-alloy coating.
1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
 2. Frames for Steel Doors: 14 gauge.
 3. All exterior frames shall be Galvanized. Bituminous coating to be field applied by the contractor when using antifreeze agents during grouting. The zinc-alloy coating shall be a dull matte surface treated for paint adhesion.
- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
 2. Frames for interior doors shall be 16 gauge.
- D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
 3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.
- E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- F. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- G. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.
- H. Plaster Guards: Formed from same material as frames, not less than 0.016-inch (0.4-mm) thick.

- I. Electrical Conduit Boxes: Any Frames containing electrical wires for Access Control or Monitoring are to be welded in throat of frame by Frame Supplier.

2.06 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

2.07 FABRICATION

- A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Standard Steel Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
- C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
 3. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
 4. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors:
 - a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 24 inches apart, except for fire rated frames space anchors as required by labeling authority.
 - b. Anchors Set in Masonry: Use adjustable anchors designed for friction fit against the frame and for extension into masonry not less than 10 inches. Use one of the following type:
 - 1) Wire Loop type of 3/16 inch diameter wire.
 - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.
 - c. Anchors for Stud Partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
 - d. Anchors for Frames Set in Prepared Opening:
 - 1) Steel pipe spaces with ¼ inch inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 2 inches wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for ¼ inch flat head bolts to pass through frame and spacers.
 - e. Anchors for windows and other continuous frames set in stud partition:
 - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 4 feet long.
 - 2) Anchors spaced 24 inches on centers maximum.

- f. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.
- 7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - c. All frames shall be provided with rubber silencers if not in hardware schedule.
- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 - 1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
 - 2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
 - 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 3. Provide loose stops and moldings on inside of doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.08 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish standard steel door and frames after assembly.
 - 2. No measureable latent VOC emissions exist in products at the time of installation.
- B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

- E. Factory Finishing for Interior Embossed Wood Grain Doors: The wood grain face sheets shall be cleaned, phosphatized and prime painted with stain absorbing primer. The door faces and edges shall be stained using conventional stains and clear coated in the factory. The clear coat shall contain UV inhibitors and be graffiti resistant.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory or shop.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry."
 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 5. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
 6. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.
 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- D. Galvanized Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 31 00 - ACCESS DOORS & FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Wall access doors and frames

1.03 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.04 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- C. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.06 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products for one of the following:
1. APS Access Panel Solutions, Inc.
 2. Nystrom Building Products Co.
 3. Milfab
 4. Acudor
 5. Karp Associates, Inc.

2.02 MATERIALS

- A. Stainless Steel Plates, Shapes, and Bars: 304 #4 – Brushed finish.

2.03 ACCESS DOORS AND FRAMES

- A. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
1. Size: 24x24
 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with exposed face flange of frame.
 3. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
 4. Hinges: Continuous piano hinge.
 5. Latch: Cylinder lock and key.

2.04 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 inch wide around perimeter of frame.
 2. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

3.03 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

**SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Aluminum curtain wall systems, complete with reinforcing, shims, anchors, and attachment devices.
 - 2. Accessories necessary to complete Work.
- B. Products Furnished But Not Installed Under this Section:
 - 1. Inserts and anchoring devices which are to be built into structure.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 4 – Masonry Construction
 - 2. Division 5 – Steel Construction
 - 3. Section 06 10 00 – Rough Carpentry
 - 4. Section 07 26 30 – Spray Foam Insulation Air Barrier
 - 5. Section 07 92 00 – Joint Sealants
 - 6. Section 08 71 00 – Door Hardware
 - 7. Section 08 80 00 – Glazing
 - 8. Section 08 71 13 – Automatic Door Operators

1.04 REFERENCES

- A. Reference Standards:
 - 1. Aluminum Association (AA):
 - a. DAF-45 - Designation System for Aluminum Finishes.
 - 2. American Architectural Manufacturers Association (AAMA):
 - a. Aluminum Curtain Wall Design Guide Manual.
 - b. 501.2 - Field Check of Metal Curtain Walls for Water Leakage.
 - c. 2605 - Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - d. 606.1 - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
 - e. 607.1 - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

- f. 608.1 - Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
 - g. 701.2 - Specifications for Pile Weatherstripping.
 - h. Manual #10 - Care and Handling of Architectural Aluminum From Shop to Site.
3. American National Standards Institute (ANSI):
 - a. Z97.1 - Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
 4. American Society for Testing and Materials (ASTM):
 - a. A36 - Structural Steel.
 - b. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - c. A525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - d. A526 - Sheet Steel, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
 - e. B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - f. B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - g. B308 - Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
 - h. C716 - Installing Lock-Strip Gaskets and Infill Glazing Materials.
 - i. C920 - Elastomeric Joint Sealants.
 - j. E283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
 - k. E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - l. E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - m. E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.
 - n. E774 - Sealed Insulating Glass Units.
 5. Consumer Product Safety Commission (CPSC):
 - a. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
 6. Federal Specifications (FS):
 - a. TT-P-645A - Primer, Paint, Zinc Chromate, Alkyd Type.
 7. Flat Glass Marketing Association (FGMA):
 - a. Glazing Manual.
 8. Steel Structures Painting Council (SSPC):
 - a. SP2 - Hand Tool Cleaning.
 - b. SP3 - Power Tool Cleaning.
 - c. Paint 12 - Cold-Applied Asphalt Mastic (Extra Thick Film).

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data:

1. Submit manufacturer's descriptive literature for each manufactured products.
 2. Include information for factory finishes, accessories and other required components.
 3. Include color charts for finish indicating manufacturer's standard colors available for selection.
 - 4.
 5. Shop Drawings:
 6. Submit drawings indicating elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, member connections, and thickness of various components.
 7. Show following items:
 - a. Elevations
 - b. Details of special shapes.
 - c. Reinforcing.
 - d. Drainage details and flow diagrams.
 - e. Anchorage system.
 - f. Interfacing with building construction.
 - g. Provisions for system expansion and contraction
 - h. [Thermal breaks.]
 8. Indicate glazing details, methods, [locations of various types and thickness of glass] [, emergency breakout locations,] and internal sealant requirements.
 9. Clearly indicate locations of exposed fasteners and joints for Architect's acceptance.
 10. Clearly show where and how manufacturer's system deviates from Contract Drawings and these Specifications.
- C. Samples:
1. Submit manufactures samples indicating quality of finish in required colors.
 2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
- D. Test Reports: Submit certified copies of previous tests reports by independent laboratory substantiating performance of system. Include other supportive data as necessary.
- E. Certificates:
1. Submit manufacturer's certification stating that installed system is in compliance with specified requirements.
- F. Manufacturer's Installation Instructions: Submit manufacturer's printed installation instructions.
- G. Warranty: Submit specified warranties.
- H. Sample Warranty: Sample copy of manufacturer's warranty.
- I. Close-Out Document Submittals
1. Warranty: Signed warranty.
 2. Operations & Maintenance Data: Maintenance instructions.

1.07 QUALITY ASSURANCE

- A. Single Source Responsibility:
1. Provide curtainwall systems that are products of a single manufacturer.
- B. Qualifications:
1. Engineer Qualifications: Professional Structural Engineer registered in State where Project is located.
 2. Installer Qualifications: Certified in writing by system manufacturer as qualified for specified systems.

1.08 DELIVERY, STORAGE & HANDLING

- A. Protect finished surfaces to prevent damage.
- B. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.
- C. Do not leave coating residue on surfaces.
- D. Deliver glass units with manufacturer's labels intact on interior side of glass. Ensure labels indicate glass thickness, unit location, glass strength and orientation of units in vertical position.
- E. Protect glass edges and corners to prevent chipping, cracking, and other similar damages.

1.09 PROJECT CONDITIONS

- A. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

1.10 PERFORMACE REQUIREMENTS

- A. General Standard: In addition to requirements shown or specified, comply with applicable provisions of Aluminum Curtain Wall Design Guide Manual for design, materials, fabrication and installation of component parts.
- B. Design Requirements:
 - 1. Metal stick framed systems with interior and exterior exposed metal framing.
 - 2. Operable vent with sight line concealed from the exterior.
 - 3. System manufacturer shall provide low profile entrance frames as an integral part of the curtain wall system.
 - 4. System manufacturer shall provide curtainwall systems, including necessary modifications to meet specified requirements and maintaining visual design concepts.
 - 5. Fabricate glazing systems for exterior glazing at vision areas and exterior glazing at spandrel areas.
 - 6. Perimeter conditions shall allow for installation tolerances, expansion and contraction of adjacent materials, and sealant manufacturer's recommended joint design.
 - 7. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
 - 8. Requirements shown by details are intended to establish basic dimension of unit, sight lines and profiles of members.
 - 9. Do not assume glass, sealants, and interior finishes contribute to framing member strength, stiffness, or lateral stability.
 - 10. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
 - 11. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
 - 12. Allow for expansion and contraction due to structural movement without detriment to appearance or performance.
 - 13. System shall be internally drained to exterior of wall. Water entering joints and condensation occurring within system will be evacuated without infiltration to interior. No visible weep holes allowed.
 - 14. Provide concealed fastening.
 - 15. Metal faces are required to be visually flat under all lighting conditions, subject to acceptance of Architect.
 - 16. Use rigid isolators to maintain flatness of face cap.
 - 17. Provide uniform color and profile appearance at components exposed to view.
 - 18. Provide interior closed cell polymeric sponge gasket with sealed corners, with maximum 30% compression when glazed, to create a water and air seal.
 - 19. Provide pre-punched pressure plates to ensure correct quantity and spacing of fasteners.

20. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

C. Performance Requirements:

1. Air infiltration: Air leakage shall not exceed 0.01 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
2. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 15.0 psf.

D. Structural Requirements:

1. Wind loading:
2. Deflection under uniform loading: When tested in accordance with ASTM E330 at design pressure, maximum deflection of exterior member shall not exceed $L/175$ of span or $3/4$ inch or $L/240 + 1/4$ " for spans over 13'-6".
3. Parallel to wall and corner mullion deflections: 75% of glass edge bite or $3/8$ inch, whichever is less.
4. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from:
 - a. Anchors to building structure and
 - b. Horizontal glazing rails or interior trim which are in actual contact with compression flange.
5. Do not regard points of contraflexure as lateral braces or as end points of unbraced length; unbraced length is actual distance between effective lateral braces as defined above.
6. Where framing member reaction is resisted by continuous element, maximum assumed effective length of the resisting element is 4 times bearing length, but not more than 12 inches.

- E. Thermal Requirements: Framing systems shall accommodate expansion and contraction movement due to surface temperature differential of 180°F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance or other detrimental effects.

F. Interface:

1. Furnish inserts and anchoring devices which need to be preset and built into structure to appropriate trade.
2. Supply on timely basis to avoid delay in Work.
3. Instruct other trades of proper location and position.
4. Furnish setting drawings, diagrams, templates and installation instructions.

1.11 COORDINATION

A. Pre-installation Meeting:

1. Arrange with Construction Manager, Architect and representatives of window and sealant manufacturer to visit Project site [factory] before beginning glazing operations to analyze site conditions, and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
2. Discuss following items:
 - a. Weather conditions under which work will be done.
 - b. Anticipated frequency and extent of joint movement.
 - c. Joint design.
 - d. Glazing procedures.

1.12 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
- B. See Division 1 – Warranties, for additional warranty requirements.
- C. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.
- D. Warranty shall cover following:
 - 1. Complete watertight and airtight system installation within specified tolerances.
 - 2. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement or structural loading.
 - 3. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.
- E. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 5 years from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Accepted Manufacturers (* indicates the basis of design)
 - 1. Oldcastle (previousl Vistawall), Terrell, TX*
 - 2. EFCO Corporation, Monett, MO
 - 3. Kawneer Company, Inc., Norcross, GA
 - 4. Tubelite, Inc., Reed City, MI
 - 5. Or Architect approved equal

2.02 INSTALLATION SCHEDULE

- A. Refer of Frame Types on Drawing A601-C. Frame Types C1 thru C5
- B. Reliance SS Wall - 2 1/2" x 7 1/4", mullion profiles; Structurally TAPE Glazed window wall system. pressure glazed, front set, interior loaded, stick wall system; available with butt glazed vertical option; can accommodate 1" glazing
- C. Refer of Frame Types on Drawing A601-C. Frame Type C6
- D. Reliance SS Wall - 2 1/2" x 6", mullion profiles; Structurally TAPE Glazed window wall system

2.03 FRAMING MATERIALS AND ACCESSORIES

- A. Aluminum:
 - 1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
- B. Internal Reinforcing:
 - 1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
 - 2. Shapes and sizes to suit installation.
 - 3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.
- C. Inserts and Anchorage Devices:

1. Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
 2. Hot-dip galvanize steel assemblies after fabrication, comply with ASTM A123, 2.0 ounce minimum coating.
- D. Fasteners:
1. Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.
 2. Series 300 stainless steel for exposed locations. Cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.
 3. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is not acceptable.
 4. Provide concealed fasteners wherever possible.
 5. For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.
- E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.
- F. Shims: Non-staining, non-ferrous, type as recommended by system manufacturer.
- G. Protective Coatings: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.
- H. Glazing Gaskets:
1. Compression type design, exterior replaceable, extruded neoprene. Interior is a closed cell sponge tape gasket.
 2. Comply with ASTM C509 or C864.
 3. Profile and hardness as necessary to maintain uniform pressure for watertight seal.
 4. Manufacturer's standard black color.
- I. Exterior Column Covers: (See Drawing details for Column Covers/Trim)
1. Type: Aluminum sheet, 1/8 inch thick, suitably reinforced on concealed surface for surface flatness, or prefabricated sandwich panels at manufacturer's option.
 2. Surface flatness: 0.015 inch maximum deviation when measured with 6 inch rule.
 3. Squareness: 0.002 inch maximum for each inch of length at panel edge.
 4. Anchorage: Allow for expansion and contraction, to minimize oil canning and distortion.

2.04 GLASS AND GLAZING ACCESSORIES

- A. Refer to Section 08 80 00.

2.05 SYSTEM FABRICATION

- A. Take accurate field measurements to verify required dimensions prior to fabrication.
- B. Location of exposed joints are subject to Architect's acceptance.
- C. Provide rigid, thermal break isolators to prevent exterior and interior aluminum framing members from being in contact with each other.
- D. Fabricate components in accord with approved shop drawings. Remove burrs and ease edges. Shop fabricate to greatest extent practicable to minimize field cutting, splicing, and assembly. Disassemble only to extent necessary for shipping and handling limitations.
- E. Steel Components:
1. Clean surfaces after fabrication and immediately prior to application of primer in accord with SSPC-SP2 or SSPC-SP3 at manufacturer's option.
 2. Apply specified shop coat primer in accord with manufacturer's instructions to provide 2.0 minimum dry film thickness.

- F. Fabricate components true to detail and free from defects impairing appearance, strength or durability.
- G. Fabricate components to allow for accurate and rigid fit of joints and corners. Match components carefully ensuring continuity of line and design. Ensure joints and connections will be flush and weathertight. Ensure slip joints make full, tight contact and are weathertight.
- H. Reinforce components as required at anchorage and support points, at joints, and at attachment points for interfacing work.
- I. Provide structural reinforcing within framing members where required to maintain rigidity and accommodate design loads.
- J. System design and sealants to accommodate internal weep and drainage system not visible to the exterior.
- K. Allow for adequate clearance around perimeter of system to enable proper installation and for thermal movement within system.
- L. Separate dissimilar metals with protective coating or preformed separators to prevent contact and corrosion.
- M. Provide framing members to rigidly glaze spandrel panels and column covers within framing system.
- N. Provide special shapes and filler pieces with tight corners.

2.06 FINISHES

- A. Color Anodized:
 - 1. Conforming to AA-M12C22A31 and AAMA 611.
 - 2. Architectural Class I, etched, medium matte, dark bronze colored anodic coating, 0.7 mil minimum thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and applicable provisions of AAMA Aluminum Curtain Wall Design Guide Manual.
- B. Align assemblies plumb and level, free of warp or twist, aligning with adjacent Work.
- C. Tolerances:
 - 1. Limit variations from plumb and level:
 - a. 1/8 inch in 20'-0" vertically and horizontally.
 - b. 1/4 inch in 40'-0" either direction.
 - 2. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
 - a. 1/16 inch where surfaces are flush or less than 1/2 inch out of flush and separated by not more than 2 inches.
 - b. 1/8 inch for surfaces separated by more than 2 inches.
 - 3. Step in face: 1/16 inch maximum.
 - 4. Jog in alignment: 1/16 inch maximum.
 - 5. Location: 1/4 inch maximum deviation of any member at any location.
 - 6. Tolerances are not accumulative.
- D. Provide attachments and shims to permanently fasten system to building structure.
- E. Anchor securely in place, allowing for required movement, including expansion and contraction.

- F. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with protective coating or preformed separators to prevent contact and electrolytic action.
- G. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weathertight construction.
- H. Glazing:
 - 1. Install glazing gaskets and sealants in accordance with manufacturer's instructions without exception, including surface preparations. Refer to Section 08800 for additional requirements.

3.03 FIELD QUALITY CONTROL

- A. Field Tests: Independent testing laboratory will perform [air infiltration,] [water infiltration,] [and] hose test; refer to Section 01411 for requirements.

3.04 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, and other foreign materials.
- B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 63 00 - SKYLIGHT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Domed skylight for curb mounted applications:
 - a. Structural design, engineering and fabrication of complete metal framed skylight system, including aluminum framing, integral closures, trim, perimeter flashing and surface regrets as indicated on Drawings.
 - b. Glazing for metal framed skylight system including gaskets, sealants, spacers, blocking and related materials.
 - c. Fasteners, anchors and related reinforcement of framing system as required to resist design loads.
 - d. Installation of entire metal framed skylight system.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 5 – Metal framing
 - 2. Section 06 10 00 – Rough Carpentry
 - 3. Section 07 54 23 – Mechanically Attached TPO Roofing System
 - 4. Section 07 62 00 – Sheet Metal Flashing and Trim

1.04 REFERENCES

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM C509 Cellular Elastomeric Preformed Gasket and Sealing Material.
 - b. ASTM C794 Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
 - c. ASTM C864 Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
 - d. ASTM C1036 Specification for Flat Glass.
 - e. ASTM C1048 Specification for Heat-Treated Flat Glass, Kind HS,.Kind FT Coated and Uncoated Glass.
 - f. ASTM D1149 Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimen).
 - g. ASTM E283 Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
 - h. ASTM E330 Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

- i. ASTM E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
 - j. ASTM E773 Test Method for Seal Durability of Sealed Insulating Glass Units.
 - k. ASTM E774 Standard Specification for Sealed Insulating Glass Units.
2. Aluminum Association (AA):
 - a. AA Specifications for Aluminum Structures.
 3. American Architectural Manufacturers Association (AAMA):
 - a. AAMA 501 Methods for Test for Metal Curtain Walls.
 - b. AAMA 603-98 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - c. AAMA 2604-98 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - d. AAMA 611-98 Specification for Anodized Architectural Aluminum.
 - e. AAMA GDSG-1 Glass Design for Sloped Glazing.
 - f. AAMA SDGS-1 Structural Design Guidelines for Aluminum Framed Skylights.
 - g. AAMA TSSGG-1 Two-Sided Structural Glazing Guidelines for Aluminum Framed Skylights.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products. Include manufacturer's air and water resistance test reports showing compliance with requirements specified performance requirements. Test reports must show evidence that system experienced no uncontrolled water leakage after 150% positive and negative structural overload (ASTM E330) when system is retested in accordance with ASTM E331 at a static pressure of 12 psf (573 Pa). Include both published data and specific data prepared for this project.
- C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures.
 1. Submit shop drawings for approval prior to fabrication. Include detailed plans, elevations, and details of framing members, glazing materials, sealants, fasteners, anchors and thicknesses and types of formed flashing and closures and relationship with adjacent materials. Indicate maximum horizontal and vertical forces at rafters.
 2. Calculations: Submit calculations certified by a professional engineer for review prior to fabrication.
- D. Samples: Submit selection and verification samples for finishes, colors and textures.
 1. Aluminum Finish: Submit color charts or range samples for initial color selection. Submit finished sample of color selected for use on metal coupons.

2. Glazing Materials: Submit a verification sample, 12" square, of the specified glass, including any integral tint, color, coating, or frit pattern specified. Submit standard sealant colors for selection and approval.
- E. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- F. Certification for Structural Sealant: Submit written documentation from sealant manufacturer stating that the sealant selected has been tested for adhesion and compatibility on representative samples of metal, glass and other glazing components, and that the sealant joint design and application procedures shown on the shop drawings are suitable for this project. Include list of recommended cleaning methods, priming recommendations and results of adhesion tests for sealants proposed for use on the project.
- G. Sample Warranty: Sample copy of manufacturer's warranty.
- H. Close-Out Document Submittals
 1. Warranty: Signed warranty.
 2. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
 1. Measurements: Take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress; work from "guaranteed dimensions" and allow for field trimming of perimeter flashing if taking field measurements before fabrication is not possible.
- B. Qualifications:
 1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 - a. Installer: Manufacturer of skylight system, or a qualified installer, shall erect and glaze the system.
 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving application method.
 3. Manufacturer: Skylight systems shall be manufactured by a firm with a minimum of ten (10) years experience in the fabrication and installation of custom aluminum framed skylights.

1.08 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Sequence deliveries to avoid delays, but minimize onsite storage.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Protect materials from damage from sunlight, weather, excessive temperatures and construction operations.

1.09 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Circular domed skylight unit tested to compliance with AAMA\WDMA\CSA\101\I.S.2\A1440 as required by the International Building Code.

1.10 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
- B. See Division 1 – Warranties, for additional warranty requirements.
- C. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- D. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official.
1. Skylight System Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace work which exhibits defects in materials or workmanship and guaranteeing weathertight and leak free performance. "Defects" are defined to include, but is not limited to, uncontrolled leakage of water, abnormal aging or deterioration.
 2. Finish Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace work which exhibits defects in finish. "a Defect" is defined as: abnormal aging or deterioration and failure to perform as required. (For painted finishes, defects may also be defined to include peeling, chipping, chalking or fading.)
 - a. Warranty Period for Anodized Finish: One (1) year from date of application for film integrity.
 - b. Warranty Period for Baked Enamel Finish: One (1) year from date of application for film integrity.
 - c. Warranty Period for Fluoropolymer Finish: Five (5) years from date of application for color and film integrity.
 3. Glazing Material Warranty: Provide written warranty signed by manufacturer, agreeing to repair or replace glazing materials which exhibit defects in materials or workmanship. "Defects" are defined to include delamination, [seal failure,] [or deterioration of film coatings.]
 - a. Warranty Period: Five (5) years from date of manufacture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Accepted Manufacturers (* indicates the basis of design)
WASCO part of Velux Commercial*
85 Spencer Dr., Unit A
Wells, ME 04090
Telephone: (800) 888-3589
www.velux.com
- B. Proprietary Product(s)/System(s): DDCCM-96.
American Skylights
2865 Market Loop
Southlake, TX 76092
1. CCM-FG 96" Diameter
- C. Or Architect approved equal

2.02 METAL-FRAMED SKYLIGHTS

- A. Materials: For each type of material required for the work of this Section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturer of the primary materials.

2.03 CIRCULAR DOMED SKYLIGHT UNITS

- A. Glazing Options:
1. Outer Dome - Clear
 2. Inner Dome - Clear.
- B. Finishes:
1. Color Anodic Coating, Class 1: AAM1 OC22A44 dark bronze coating electrolytically deposited complying with AAMA 606.1, 0.7 mil thick minimum.
- C. Glazing Requirements:
1. Glass shall conform to applicable requirements of ASTM C1036 and ASTM C1 048.
 2. Glass strengths shall be determined using AAMA Glass Design for Sloped Glazing Guidelines.
 3. Glaze in accordance with GANA Glazing Manual and glass fabricator's guidelines.
- D. Glazing Gaskets and Blocking:
1. Continuous Cushion Below Glazing Materials: Provide extruded, dense EPDM black rubber gasket with 60 plus or minus 5 Shore A durometer complying with ASTM C864.
 2. Continuous Spacer Above Glazing Materials: Provide extruded, closed-cell, sponge EPDM black rubber gasket complying with ASTM C509.
 3. Ozone Resistance: Fabricate gaskets of material to withstand one part per million ozone for 500 hours at 20 percent elongation at 100°F when tested in accordance with ASTM D1149.
- E. Anchors and Fasteners:
1. Provide cadmium plating for lag, sleeve and stud bolt anchors not exposed to the weather.
 2. Provide anchors fabricated of stainless steel for anchors exposed to the weather.
 3. Reinforce butt, mitered and expansion joint framing member splices with internal aluminum splice plates where possible; mechanically fastened with stainless steel truss head fasteners in accordance with the skylight manufacturer's standard connection details.
- F. Sealants:
1. Skylight manufacturer shall be responsible for the selection of sealants. Surfaces shall be cleaned and primed as required to assure proper adhesion. Sealants shall be applied in accordance with sealant manufacturer's guidelines and joint dimensions shown on approved shop drawings.
 2. Exterior metal to glass corner and cap seals shall be black in color. Exposed metal to metal joints shall be sealed with a standard color silicone sealant.
 3. Sealants shall exhibit adequate adhesion to samples of metal and glass when tested in accordance with C794.
 4. Structural sealants shall be compatible with all contact components.

2.04 RELATED MATERIALS

- A. Related Materials: Refer to other sections listed in Related Sections paragraph herein for related materials.

2.05 SOURCE QUALITY

- A. Source Quality: Obtain metal-framed skylight materials from a single manufacturer.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

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

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

3.03 PREPARATION

- A. Preparation: Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed and notify Contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.04 INSTALLATION

- A. Skylight Installation:
1. Match profiles, sizes and spacings indicated on approved shop drawings. Ensure that weep and condensation control system operates properly. Do not perform structural silicone sealant work when the metal temperature is below 32 degrees F (0 degrees C) without written approval from silicone manufacturer.
 2. Coordinate installation with adjacent work such as roofing, sheet metal and other work to ensure a complete weatherproof assembly. Anchor work securely to supporting structure, but allow for differential and thermal movement.
 3. Isolate between aluminum and dissimilar metals with a protective coating or plastic strip to prevent electrolytic corrosion.
- B. Site Tolerances: All support and adjacent construction will be held to within + 1/2" of theoretical.
- C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.05 FIELD QUALITY REQUIREMENTS

- A. Site Tests [Installation and Post Installation Testing]: [Specify applicable test requirements to be performed during and/or after product installation. See AAMA 501.2 for field water test procedures]
- B. Perform field water test at completion of installation, and correct any leaks discovered before leaving site.

3.06 ADJUSTING

- A. Adjusting: During installation, remove labels, part number markings, sealant smears, handprints, and construction dirt from all components. Touch-up damaged coatings and finishes and repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.

3.07 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
1. Clean exposed surfaces including metal and glass using non-abrasive materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully cleaned.
 2. Reclean as necessary to prevent damage. Protect completed work from damage and deterioration and inspect immediately before final acceptance of project.

3.08 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This section includes the following:
 - 1. Hinges
 - 2. Lock cylinders and keys
 - 3. Lock and latch sets
 - 4. Bolts
 - 5. Push/Pull plates
 - 6. Closers
 - 7. Overhead stops
 - 8. Kick plates
 - 9. Smoke seals
- C. Regarding electrical hardware:
 - 1. Factory wiring diagrams are to be provided for all openings with electrical hardware.
 - 2. The hardware supplier shall supply a written description of the operation of each electrical door as part of their submittals.
 - 3. Electrical hardware shall be provided from the manufacturer of the lock or exit device. No hardware shall be forwarded to a secondary source for modification or electrification.
 - 4. All power transfers shall be supplied with factory wiring inside the hardware (similar to Von Duprin EPT power transfers). No power transfers shall be supplied without the wiring already in the device.
- D. Where new hardware is being furnished for existing doors or for new doors in existing frames, it shall be the responsibility of the hardware supplier to review the existing doors and frames and notify the architect of any problems prior to ordering any materials.
- E. It is the responsibility of the hardware supplier to properly size all hardware.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 08 11 13 – Hollow Metal Doors & Frames
 - 2. Section 08 44 13 – Glazed Aluminum Curtain Walls
 - 3. Section 08 71 13 – Automatic Door Operators
 - 4. Section 08 80 00 – Glazing

1.04 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Product data including manufacturer's technical product data for each item of door hardware and other information necessary to show compliance with requirements.
- C. Manufacturer's Installation Instructions: Provide manufacturer's installation instructions.
- D. Hardware Schedule: Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size, and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - 2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- F. Templates: Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawing of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- G. Sample Warranty: Sample copy of manufacturer's warranty.
- H. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.
 - 2. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 - 3. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

1.06 QUALITY ASSURANCE

- A. The hardware supplier shall be a direct representative for the factories the hardware is being obtained from.
- B. Single Source Responsibility: Obtain each type of hardware from a single manufacturer.
- C. Qualifications:
 - 1. Supplier Qualifications: A recognized architectural door hardware supplier that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
 - a. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

1.07 DELIVERY, STORAGE & HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.\
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set number of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representative of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.
- F. Provide a pre-installation meeting with the general contractor reviewing the installation of all hardware.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to, the following:
 - 1. Butts and Hinges:
 - a. Mckinney
 - b. Hager
 - c. Stanley
 - 2. Lock and Latchsets:
 - a. Sargent – 8200 series
 - b. Schlage –L Series
 - c. Best – 45H series
 - 3. Stops:
 - a. H.B.Ives Company
 - b. Glynn Johnson Corp.
 - c. Hager – 236 Series
 - 4. Overhead Closers:

- a. LCN – 4040 Series
 - b. Sargent – 351 Series
 - c. Best – D4550
5. Kick, Mop, and Armor Plates:
- a. Rockwood Mfg
 - b. H.B. Ives Company
 - c. Hager
6. Overhead Stops:
- a. Glynn Johnson Corp.
 - b. Sargent
 - c. Hager
7. Automatic Door Operators and Wall Actuators: (See Section 08 71 13)
- a. LCN – 4600 series
 - b. Staley – 4900 series
8. Exit Devices and Accessories:
- a. Sargent – 88 Series
 - b. Von Duprin – 99 Series
 - c. Best – Apex series
9. Threshold and Weatherstrip
- a. National Guard
 - b. Hager
 - c. Pemko

2.02 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the “Hardware Schedule” at the end of this Section. Products are identified by using hardware designation numbers of the following:
1. Manufacturer’s Product Designation: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article “Manufacturers” in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.03 MATERIALS AND FABRICATION

- A. Manufacturer’s Name Plate: Do not use manufacturers’ products that have manufacturer’s name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
1. Manufacturer’s identification will be permitted on rim of lock cylinders only.
- B. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer’s standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware unit for finish designations indicated.
- C. Fastener: provide hardware manufactured to conform to published templated, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match

hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

2.04 HINGES, BUTTS, AND PIVOTS

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements:
 - 1. For metal doors and frames install machine screws into drilled and tapped holes.
 - 2. For wood doors and frames install wood screws.
 - 3. For fire-rated wood doors install #12 x 1 1/4-inch (32mm), threaded-to-the-head steel wood screws.
 - 4. Finish screw heads to match surface of hinges or pivots
- C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Out-Swing Exterior Doors: Nonremovable pins.
 - 2. Interior Doors: Nonrising pins.
 - 3. Tips: Flat button and matching plug, finished to match leaves, except where hospital tip (HT) indicated.
- D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges per door leaf for doors 90 inches (2250mm) or less in height and one additional hinge for each 30 inches (750mm) of additional height.

2.05 LOCK CYLINDERS AND KEYING

- A. Keying System: Key all new locks/cylinders as determined in keying meeting with the owner.
 - 1. Provide 2 keys per cylinder and 6 masterkeys each set and 6 grand masterkeys.
 - 2. Removable cores as specified.

2.06 LOCKS, LATCHES, AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
 - 1. Provide flat lip strikes for locks with 3-piece, antifriction latch bolts as recommended by manufacturer.
 - 2. Provide extra long strike lips for locks used on frames with applied wood casing trim.
 - 3. Provide recess type top strikes for bolts locking into head frames, unless otherwise indicated.
- B. Lock Throw: Provide 5/8-inch (16mm) minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
 - 1. Provide 1/2-inch (13mm) minimum throw of latch for other bored and preassembled types of locks and 3/4-inch (19mm) minimum throw of latch for mortise locks. Provide 1-inch (25mm) minimum throw for all dead bolts.
- C. Flush Bolt Heads: Minimum of 1/2-inch (13mm) diameter rods of brass, bronze, or stainless steel with minimum 12-inch (300mm) long rod for doors up to 84 inches (2100mm) in heights. Provide longer rods as necessary for doors exceeding 84 inches (2100mm) in height.
- D. Exit Device Dogging: Except on fire-rated doors where closers are provided on doors equipped with exit devices, equip the unit with keyed cylinder dogging device to keep the latch bolt retracted, when engaged. Dogging with an allen wrench will not be acceptable.

2.07 PUSH/PULL UNITS

- A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.
- B. Concealed Fasteners: Provide manufacturer's special concealed fastener system for installation, thru-bolted for matched pairs but not for single units.
- C. CLOSERS AND DOOR CONTROL DEVICES
- D. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
 - 1. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
 - 2. Provide parallel arms for all overhead closers, except as otherwise indicated.
- E. Access-Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped, provide adjustable units complying with ANSI A117.1 provisions for door opening force and delayed action closing.
- F. Combination Door Closers and Holders: Provide units designed to hold door in open position under normal usage and to release and close door automatically under fire conditions. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.

2.08 DOOR TRIM UNITS

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
- B. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.
- C. Fabricate protection plates not more than 2 inches less than door width on the push side by the height indicated.
 - 1. Metal Plates: Stainless steel, .050 (U.S. 16 gage) (1.6mm).

2.09 HARDWARE FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (for push-pull units if no latch or lock sets).
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. The designations used in schedules and elsewhere to indicate hardware finishes are the industry recognized standard commercial finishes, except as otherwise noted.
 - 1. Rust-Resistant Finish: For iron and steel base metal required for exterior work and in areas shown as "High Humidity" areas (and also when designed with the suffix-RR), provide 0.2ml (0.005mm) thick copper coating on base metal before applying brass, bronze, nickel, or chromium plated finishes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publication, except as specifically indicated or required to comply with governing regulation and except as otherwise directed by Architect.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Section. Do not install surface mounted items until finishes have been completed on the substrates involved.
 - C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
 - D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
 - E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
 - F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.02 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

3.03 HARDWARE SCHEDULE

- A. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.

3.04 PROJECT OPENING/DOOR SCHEDULE:

Heading #01 (Set #01)

Opening Description:
 1 Single Door #101.1

B3	1	Continuous Hinges	780-112HD 99" Actual Length Properties: Special Length = 99	CLR	HA
ED1	1	Exit Device	AD 8513 F ETL	32D	SA
A01	1	Closer	4642 REG	AL	LC
WS1	1	Wall Stop	236W	US32D	HA
AC1	1	Actuator Package	8310-3860T		LC
DS1	1	Door Sweep	200 NA 36"		NA
T1	1	Saddle Threshold	424 36" PA	AL	NA
N1	1	Note (By Others)	Gasketing by door supplier		NOTE

Heading #02 (Set #02)

Opening Description:
1 Single Door #101.2

B3	1	Continuous Hinges	780-112HD 99" Actual Length Properties: Special Length = 99	CLR	HA
ED1	1	Exit Device	AD 8513 F ETL	32D	SA
CL1	1	Closer	351 PS	EN	SA
DP1	1	Drop Plate	351-D	EN	SA
SK1	1	Spacer Kit	581-1	EN	SA
DS1	1	Door Sweep	200 NA 36"		NA
T1	1	Saddle Threshold	424 36" PA	AL	NA
N1	1	Note (By Others)	Gasketing by door supplier		NOTE

Heading #03 (Set #03)

Opening Description:
1 Single Door #102.1
1 Single Door #103.1

B2	6	Hinges	BB1279 4 ½ X 4 ½	US26D	HA
L65	2	Privacy Set	49 8265 LNL	26D	SA
CL1	2	Closer	351 PS	EN	SA
KP1	2	Kick Plate	190S 8" x 34"	US32D	HA
SN1	6	Silencer	Q146		SF01

Heading #04 (Set #04)

Opening Description:
1 Single Door #101.3

B1	3	Hinges	BB1279 4 ½ X 4 ½ NRP	US26D	HA
L04	1	Lockset	8204 LNL	26D	SA
CL2	1	Closer	351 PSH	EN	SA
KP2	1	Protection Plate	190S 34" x 34"	US32D	HA
G1	1	Gasketing	160 V 1 x 36" 2 x 84"		NA
DS1	1	Door Sweep	200 NA 36"		NA
T1	1	Saddle Threshold	424 36" PA	AL	NA

Heading #05 (Set #05)

Opening Description:
1 Single Door #105.1
1 Single Door #106.1

B1	3	Hinges	BB1279 4 ½ X 4 ½ NRP	US26D	HA
L04	1	Lockset	8204 LNL	26D	SA
CL2	1	Closer	351 PSH	EN	SA
G1	1	Gasketing	160 V 1 x 36" 2 x 84"		NA

DS1	1	Door Sweep	200 NA 36"		NA
T1	1	Saddle Threshold	424 36" PA	AL	NA

Heading #06 (Set #06)

Opening Description:

1 Other Door #104.1

ED2	1	Exit Device	8813 G ETL	36D	SA
N2	1	Note (By Others)	Self closing gate hinges & hardware		NA

END OF SECTION

**SECTION 08 71 13 - AUTOMATIC DOOR OPERATORS
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Electromechanical low-energy powered door operators, opening force not exceeding 8.5 lb-force (38 N) Middle-Swing Operator by Dor-O-Matic

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 08 44 13 – Glazed Aluminum Curtain Walls
 - 2. Section 08 71 00 – Door Hardware Schedule for specific operator

1.04 REFERENCES

- A. Reference Standards:
 - 1. ANSI/BHMA A156.19 – American National Standard for Power Assist & Low-Energy Power Operated Doors.
 - 2. UL 325 – Standard for Door, Drapery, Gate, Louver and Window Operators and Systems.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Manufacturer's catalog data, detail sheets and specifications.
- C. Sample Warranty: Sample copy of manufacturer's warranty.
- D. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.

2. Operations & Maintenance Data: Operating and maintenance instructions, parts lists and wiring diagrams. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide all door operators from a single manufacturer
- B. Qualifications:
 1. Installer Qualifications: Factory-trained with minimum 3 years experience.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Accepted Manufacturers (* indicates the basis of design)
 1. LCN*
 2. Stanley
 3. Or Architect approved equal.

2.02 OPERATORS

- A. Operation: Push button, push plate, switch-activated, manual or field-programmable manual/electric power assisted Push N' Go opening; comply with ANSI A156.19 and UL 325.
 1. Manual opening force: 8.5 lb-force (38 N) maximum.
 2. Closing force: 5 lb-force (22 N).
 3. Factory-set door hold-open voltage.
 4. Manual "Off/Auto/Hold-Open" switch.
 5. Fail safe: In event of power failure, make door operate manually with controlled spring close as though equipped with a #3 manual door closer, without damage to operator components.
 6. Provide adjustment by microprocessor control in a self-contained housing for:
 - a. Opening speed.
 - b. Backcheck speed.
 - c. Hold-open, from 1 to 30 seconds.
 - d. Closing speed.
 - e. Opening force.
 - f. Acceleration during opening and recycling, for soft start.
 - g. Door will safely stop and reverse if an object is encountered in the opening cycle.
- B. Equipment: Completely electromechanical; comply with ANSI A156.19 and UL 325.
 1. Control box and motor/gear box: Contained in aluminum housing; precision-machined gears and bearing seats and all-weather lubricant, mounted on vibration isolators. No exposed gears.
 - a. Design for surface-applied application.
 - b. Design for interior application.
 - c. Design for exterior application.
- C. Gears: Manufactured by operator manufacturer specifically for operators.
- D. Motor: DC permanent magnet motor with shielded ball bearings. Stop motor when door stops or is fully open and when breakaway is operated.
- E. Door operating arm: Forged steel, attached at natural pivot point of door.
 1. Exposed arms: Factory-painted and finished to match operator enclosure.

- F. Overhead concealed butt hung. Provide concealing arm channel.
- G. "Off/Auto/Hold-Open" switch: Three-position rocker or key type and slide arm for top of door.
- H. Control circuits for actuators and safeties: Low-voltage, NEC Class II.
- I. Service conditions: Satisfactory operation between -30 degrees F (-34 degrees C) and 160 degrees F (71 degrees C).
- J. Power supply required: 115 VAC (15 amp circuit breaker, one per unit).
- K. Microprocessor control: 115 VAC. Do not use microswitches.
- L. Surface-Applied Mounting: On surface of door frame/wall, mounted 1" (25.4 mm) above top of door.
- M. Provide bottom loading header for access to controls and removable components without removal of door or operator.
- N. Finish of Exposed Headers: Anodized (matching curtain wall assembly).

2.03 ACTIVATORS

- A. Make: PBS-1 by BEA
- B. Dimensions: 4.75"x4.75"x0.625" square
- C. Description: Handicap with PUSH TO OPEN
- D. Material: Stainless steel.
- E. Provide post for mounting remote exterior location

2.04 MARKINGS

- A. Decals: Visible from either side, instructing the user as to the operation and function of the door.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that door openings and doors are properly installed and ready for installation of
 - 1. Door operators.
- B. Verify that electrical service is available, properly located and of proper type.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions; comply with ANSI A156.19.
- B. Verify that electrical connections are made correctly and with dedicated grounding.

3.03 ADJUST

- A. Adjust door operators for proper operation, without binding or scraping and without excessive noise.
- B. Supply Owner/Contractor with keys if required.

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors; interior and exterior.
 - 2. Curtain wall framing.
- B. This Section includes hardware for the following:
 - 1. Display case shelving components.
 - 2. Sliding transaction window hardware.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 08 44 13 – Glazed Aluminum Curtain Walls

1.04 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications or deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surface of glass.
- F. Specific Hazardous Locations: The following shall be considered specific hazardous locations for purposes of glazing.
 - 1. Glazing in ingress and means of egress doors.

2. Glazing adjacent to a door and within the same wall plane as the door whose nearest vertical edge is within 24 inches of the door in a closed position and whose bottom edge is less than 60 inches above the floor or walking surface, unless an intervening interior permanent wall is between the door and the glazing.
3. Glazing in fixed panels having a glazed area in excess of 9 square feet with the lowest edge less than 18 inches above the finish floor level or walking surface within 36 inches of such glazing, unless a horizontal member not less than 1-1/2 inches in width is located between 24 inches and 36 inches above the walking surface.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Submit manufacturer's technical data for each glass type and glazing materials required, including installation and maintenance instructions.
- C. Samples:
 1. 12-inch square, for each type of glass product indicated, other than monolithic clear float glass.
 2. 12-inch long samples of each color required for each type of sealant or gasket exposed to view.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Manufacturer's Certificates:
 1. Certificate on shading coefficient.
 2. Certificate on "R" value when value is specified.
- F. Sample Warranty: Sample copy of manufacturer's warranty, as specified in this section.
- G. Close-Out Document Submittals
 1. Warranty: Signed warranty.
 2. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass, laminated glass and insulated glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coating: Where solar-control low-E coatings of a primary glass manufacturer that has established a certified fabricator

program is specified, obtain sputter-coated solar-control low-E-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Qualifications:
 - 1. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.

1.08 DELIVERY, STORAGE & HANDLING

- A. Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Carefully store material, as directed, in a safe place where breakage can be reduced to a minimum. Deliver sufficient glass to allow for normal breakage. Glazing compounds shall arrive at the project site in labeled containers which have not been opened.

1.09 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Install liquid sealants at ambient and substrate temperatures above 40 degrees F.

1.10 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacturer, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.
- B. Glass Design: Glass thicknesses as indicated are for detailing only. Confirm glass thicknesses by analyzing Project loads and in service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
 - 1. Select glass thickness to withstand dead loads, winds loads and snow loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7.
 - 2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 - 3. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm.
- C. Thermal Movement: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on materials' actual surfaces temperatures due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Safety Glazing Products: Comply with testing requirements in Consumer Product Safety Commission CPSC 16 CFR 1201.
 - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Certification Council or another certification agency acceptable to authorities having jurisdiction.
 - 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide

glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual".
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- F. Insulating-Glass Certification Program: Permanently marked on either spacers or on at least one component lite of units with appropriate certification label of the following testing and inspection agency:
1. Insulating Glass Certification Council.

1.11 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
- B. See Division 1 – Warranties, for additional warranty requirements.
- C. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- D. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate, f.o.b. point of manufacturer, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.
- E. Manufacturer's Warranty on Laminated Glass: Submit written warranty signed by laminated glass manufacturer agreeing to furnish replacements for laminated glass units that deteriorate, f.o.b. point of manufacturer, freight allowed project site within specified warranty period indicated below. Warranty shall cover deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
1. Warranty Period: 5 years from date of Substantial Completion.
- F. Manufacturer's Warranty on Coated Glass: Submit written warranty signed by coated glass manufacturer agreeing to furnish replacements for coated glass units that deteriorate, f.o.b. point of manufacturer, freight allowed project site within specified warranty period indicated below. Warranty shall cover deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Primary Glass; provide products from one of the following (* indicates the basis of design):
1. Vitro Architectural Glass*
 2. Guardian Industries Corp.
 3. PPG Industries, Inc.
 4. LOF / Pilkington
 5. AFG Industries, Inc.
- B. Laminated Glass: Provide laminated glass from one of the following:
1. Laminated Glass Corp.
 2. Guardian Industries Corp.
 3. AFG Industries, Inc.
 4. Northwestern Industries, Inc.
- C. Fabricators: Subject to compliance with requirements, provide glass from one of the following (* indicates the basis of design):
1. Vitro Architectural Glass*
 2. Guardian Industries Corp.
 3. PPG Industries, Inc.
 4. Pilkington
 5. AFG Industries, Inc.

2.02 GLASS PRODUCTS

- A. Primary Glass Products:
1. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.
 2. Clear Float Glass: Type I (transparent flat glass), Class 1 (clear), Quality q3 (glazing select).
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass), Quality q3, of class, kind, and condition indicated.
1. Fabrication process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 3. For uncoated glass, comply with requirements for Condition A.
 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is required or indicated.
- C. Laminated Glass Products:
- a. General:
 - b. Laminated Glass Products: Comply with ASTM C 1172; Refer to primary and heat-treated glass requirements relating to glass products comprising laminated glass products.

- c. Provide clear polyvinyl butyral (PVB) plasticized resin sheeting for laminating panes of glass showing no tendency to bubble, discolor or lose physical or mechanical properties after laminating and installation, clear, unless otherwise indicated, one piece, no seams.
 - d. Use 0.060 inch thick PVB for Acoustical Glazing.
 - e. Laminating Process: Fabricate by laminating lites with interlayer in autoclave with heat plus pressure.
- D. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Provide Kind FT (fully-tempered) where safety glass is required or indicated.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Duel seal, with primary and secondary sealants as follows:
 1. Polyisobutylene and silicone.
 5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
 - a. Spacer Material: Aluminum with mill or clear anodic finish.
 - b. Desiccant: Manufacturer's standard material.
 - c. Corner Construction: Manufacturer's standard corner construction.
- E. Low-E Insulating Glass:
1. Product Basis of Design: Solarban 60 Solar Control Low-E Glass
 2. Selection: Solarban 60 (2) Clear + Clear
 3. Overall thickness: 1" insulated glass
 4. Outboard Lite: 1/4" VE1-2M Low E #2 Surface Heat-Strengthened
 5. Air Space: 1/2" with black silicone seal
 6. Inboard Lite: 1/4" Clear Heat-Strengthened
 7. Safety Glazing Units: See drawings for locations
 8. Performance Requirements:
 - a. System U Factor: 0.39
 - b. Visible Lite Transmittance: 63.3%
 - c. Visible Light Reflectance Exterior: 11%
 - d. Visible Light Reflectance Interior: 12%
 - e. Winter Nighttime U-Value: 0.29
 - f. Summer Daytime U-Value: 0.26
 - g. Light to Solar Gain: 1.79
 - h. Solar Heat Gain Coefficient: 0.39

2.03 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements.
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Elastomeric Glazing Sealants: As recommended in writing by sealant and gasket manufacturers. Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrate. Refer to Division 7 – Section “Joint Sealants”.
1. VOC emissions from adhesives and sealants must not exceed the VOC and chemical components limits of the LEED-NC, Version 2.2, Indoor Environmental Quality, Credit 4.1, Low-Emitting Materials: Adhesives & Sealants. This requirement shall supersede and take precedence over materials defined in this Section.

2.04 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.05 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene, ASTM C 864.
 2. EPDM, ASTM C 864.
 3. Thermoplastic polyolefin rubber, ASTM C 1115.
 4. Any material indicated above.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
1. Neoprene.
 2. EPDM.
 3. Thermoplastic polyolefin rubber.
 4. Any material indicated above.

2.06 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Compressible Filler Rod: Shall be closed-cell or waterproof jacketed rodstock of synthetic rubber or plastic foam with proven compatibility with sealants used. Rod shall be flexible and resilient with 5-10 PSI compression strength for 25 percent deflection.

2.07 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass framing members.

3.02 PREPARATION FOR GLAZING

- A. Clean the glazing channel or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

3.03 INSTALLATION

- A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air tight, deterioration of glazing materials, and other defects in the Work.
- B. Protect glass from edge damage at all times during handling, installation, and operation of the building.
- C. Glazing channel dimensions as shown are intended to provide for necessary minimum bite on the glass, minimum edge clearance, and adequate sealant thicknesses with reasonable tolerances. The glazier is responsible for correct glass size for each opening within the tolerances and necessary dimensions established.
- D. Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing and their technical representatives except where more stringent requirements are shown or specified.
- E. Comply with "Glazing Manual" by Flat Glass Marketing Association and the manufacturers of the glass and glazing materials except as shown and specified otherwise.

- F. Inspect each piece of glass immediately before installation and eliminate those which have observable edge damage or face imperfections.
- G. Unify appearance of each series of lights by setting each piece to match others as nearly as possible. Inspect each piece and set with pattern, draw, and bow oriented in the same direction as other pieces.

3.04 GLAZING

- A. Install setting blocks of proper size at quarter points of sill rabbet. Set blocks in thin course of the heel bead compound.
- B. Provide spacers insides and out and of proper size and spacing for glass sizes larger than 50 united inches, except where gaskets are used for glazing. Provides 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width; except with sealant tape, use thickness slightly less than final compressed thickness of tape.
- C. Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in the channel at the heel of jambs and head (do not leave voids in the sill channels) except as otherwise indicated, depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.
- D. Do not attempt to cut, seam, nip, or abrade glass which is tempered, heat strengthened or coated.
- E. Force sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- F. Tool exposed surfaces of glazing liquids and compounds to provide a substantial "wash" away from the glass. Install pressurized tapes and gaskets to protrude slightly out of the channel, so as to eliminate dirt and moisture pockets.
- G. Clean and trim excess glazing materials from the glass and stops or frames promptly after installation and eliminate stains and discoloration.
- H. Where wedge shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs or by proven adhesives including embedment of gasket tail in cured heel bead.

3.05 CURE, PROTECTION, AND CLEANING

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.
- B. Protect exterior glass from breakage immediately upon installation by attachment of crossed streamers to framing held away from glass. Do not apply markers to surfaces of glass.
- C. Remove and replace glass which is broken, chipped, cracked, abraded, or damaged in other ways during the construction period including natural causes, accidents, and vandalism.
- D. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.
- E. Wash and polish glass on both faces not more than 4 days prior to Owner's acceptance of the work in each area. Comply with glass manufacturer's recommendations.

END OF SECTION

SECTION 09 22 00 - NON-LOAD BEARING STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. System Description:
 - 1. Non-load-bearing steel framing members for interior framing systems (e.g., partition walls, supports for partition walls, framed soffits, furring, suspension system for drywall ceilings, etc.)
 - 2. Refer to Division 5 and Structural Drawings for framing of skylight well.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 5 - Cold-Formed Metal Framing for exterior and interior load-bearing and exterior non-load-bearing wall studs
 - 2. Section 09 28 13 – Cementitious Backing Boards
 - 3. Section 09 29 00 – Gypsum Board

1.04 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Furnish product data sheets for review.
- C. Close-Out Document Submittals
 - 1. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.06 QUALITY ASSURANCE

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.01 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
1. Dietrich Metal Framing; Pittsburgh, PA
 2. Clark Steel Framing Industries, Cincinnati, OH
 3. Consolidated Systems, Inc., Columbia, SC
 4. Dale/Incor Industries of Florida, Ft. Lauderdale, FL
 5. Dale Industries, Dearborn, MI
 6. Marino/Ware: Div. of Ware Industries, Inc., South Plainfield, NJ
 7. The STEEL Network, Inc., Raleigh, NC
 8. Unimast, Ind., Franklin Park, IL
 9. Or Architect Approved manufacturer.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
- C. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
- D. Protective Coating: ASTM A 653, G40 hot-dip galvanized zinc coating, unless otherwise indicated.

2.02 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16 inch wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth.
1. Minimum Base-Metal Thickness:
 - a. Partition Walls: Not less than 20 gauge.
 - b. Studs at Door Jambes: Not less than 18 gauge.
 - c. Soffit & Miscellaneous Framing: Not less than 25 gauge.
- B. Slip-Type Head Joints: (For any wall type indicated to go to underside of deck):
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing complying with ASTM A 653 or ASTM A 568, length and width indicated, and with a minimum base metal (uncoated) thickness as follows:

1. Minimum Base-Metal Thickness: Not less than 20 gauge.
 2. Width: 6 inches.
 3. Mounting Height: As required by detail.
- D. Cold-Rolled Channel Bridging: 16 gauge bare-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness: As indicated on Drawings, or if not indicated, not less than 20 gauge.
 2. Depth: As indicated on Drawings.
- F. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
 2. Minimum Base Metal Thickness: Not less than 25 gauge.
- G. Z-Shaped Furring: With slotted or nonslotted web, fabricated from steel complying with ASTM A 653 or ASTM A 568, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum bare-metal thickness 25 gauge, and depth required to fit insulation thickness indicated.

2.03 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates. Provide screws only.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Obtain dimensions and locations from other trades, and provide openings and enclosures for accessories, specialties, equipment and ductwork.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Follow manufacturer's installation instructions.
- C. Cut members by shearing or sawing.

- D. Install members in single piece lengths except that tracks may be spliced, butt-welded, or each length anchored to a common building frame element.
- E. Install insulation in framing spaces of insulated assemblies made inaccessible after erection.
- F. Install bracing at terminations in assemblies.
- G. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate above suspended ceilings. Where studs are indicated to terminate above suspended ceilings provide bracing or extend studs to underside or structure overhead. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Stud Spacing: Install studs at spacing as shown on the Drawings, or if not shown, install at 16-inches o.c..
 - 2. Soffit Framing for Shower Areas: Install studs at spacing of 12-inches o.c. to provide sufficient support for moisture resistant gypsum board.
 - 3. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 4. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs. Install two studs at each jamb, unless otherwise indicated.
 - 5. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 6. Corners: Frame corners with three studs.
 - 7. Fire-Resistance-Rated Construction: Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rated test.
 - 8. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 9. Curved Partitions:
 - a. Cut top and bottom runners through leg and web at 2-inch interval for arc length. In cutting lengths of runners, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
 - b. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
 - c. Support outside (cut) leg of runners by clinching a 1-inch high by 0.0209-inch thick steel sheet strip to inside of cut legs using metal lock fasteners.
 - d. Attach runners to structural elements at floor and ceiling with fasteners located 2-inches from ends and spaced 24-inches o.c.
 - e. Position studs vertically with open sides facing in the same direction and engaging floor and ceiling runners. Begin and end each arc with a stud and space intermediate studs equally along arcs at stud spacing recommended by gypsum board manufacturer for radii indicated. Attach studs to runners with 3/8-inch long pan head framing screws. On straight lengths at ends of arcs, place studs 6-inches o.c. with last stud left free standing.
- D. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
1. Erect insulation specified in Division 7 Section "Building Insulation" vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- F. Supports Required by Other Trades:
1. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, toilet stall partitions, grab bars, toilet accessories, urinal screens, markerboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items supported by stud construction.
 2. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION

SECTION 09 28 13 - CEMENTITIOUS BACKING BOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Cement backer board panels and accessories.

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Section 09 22 00 – Non-Load Bearing Steel Framing
 - 2. Section 09 29 00 – Gypsum Board
 - 3. Section 09 30 00 – Tiling

1.04 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. A108.11, American National Standard for Interior Installation of Cementitious Backer Units.
 - 2. A118.1, American National Standard Specifications for Dry-Set Portland Cement Mortar.
 - 3. A118.4, American National Standard Specifications for Latex-Portland Cement Mortar.
 - 4. A118.9, Test Methods and Specifications for Cementitious Backer Units.
 - 5. A136.1, American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile.
- B. American Society for Testing and Materials (ASTM):
 - 1. C 473, Test Methods for Physical Testing of Gypsum Panel Products.
 - 2. C 1325, Specification for Fiber-Mat Reinforced Non-Asbestos Cement Interior Substrate Sheets.
 - 3. C 1002, Specification for Steel Drill screws for the Application of Gypsum Panel Products or Metal Plaster Bases.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.

- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
B. Product Data: Furnish product data sheets for review including the following:
1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.

1.07 QUALITY ASSURANCE

- A. Qualifications:
1. Installer Qualifications: Minimum of 2 years experience with installation of similar products.

1.08 DELIVERY, STORAGE & HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store boards flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Manufacturer: United States Gypsum Company.
B. Products listed below manufactured by the following are considered equal:
1. Fin Pan, Inc.
 2. National Gypsum Company.

2.02 BACKERBOARD

- A. Basis-of-Design Product:
1. DUROCK Cement Board as manufactured by United States Gypsum Company.
 - a. Thickness: 5/8 inch
 - b. Width: As required
 - c. Length: As required
 - d. Edges: Tapered
- B. The following products are considered equal, subject to compliance with the specifications:
1. ProTEC Cement Board as manufactured by Fin Pan, Inc.
 2. PermaBase Cement Board as manufactured by National Gypsum Company.

2.03 FASTENERS

- A. Wood Framing & 22 gauge, or lighter Steel Framing Fasteners:
 - 1. Cement backer board Hi-Lo thread screws (No. 8), wafer head, corrosion resistant, 1-5/8" long, and complying with ASTM C 1002.
- B. Steel Framing Fastener for 20 gauge, or heavier, steel framing:
 - 1. Drill point screws (No. 8) wafer head, corrosion-resistant, 1-5/8" long, and complying with ASTM C 1002.

2.04 JOINT TREATMENT

- A. Joint Tape: 2" Wide Alkali-resistant fiberglass mesh tape intended for use with cement board.
- B. Bonding Materials: Latex-Portland cement mortar or dry-set (thin-set) mortar, for joint treatment complying with ANSI A108.1 or A118.4 standards.
- C. Flexible Sealant: As recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 ENVIRONMENTAL CONDITIONS

- A. Temperatures within the building shall be maintained within the range of 40 to 100 degrees F.
- B. Wood framing shall approximate the moisture content it will reach in service by allowing the enclosed building to stand as long as possible prior to the application of the cement board.

3.03 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.04 INSTALLATION

- A. Install in accordance with manufacturer's instructions and ANSI A108.11.
- B. Space fasteners maximum 8-inch o.c. for walls, 6-inch o.c. for ceilings, with perimeter fastener at least 3/8-inch and less than 5/8-inch from ends and edges. Drive screws so that bottomd of heads are flush with panel surface to ensure firm panel contact with framing. Do not overdrive fasteners.
- C. Boards shall be placed with a minimum 1/4 inch (6 mm) clearance from the floor surfaces and other horizontal tile termination locations, including above tub edges. This gap shall be free of adhesive and grout and filled with a flexible sealant.
- D. Boards shall be placed with a minimum 1/8 inch (3 mm) clearance from wall and cabinet bases, and other horizontal tile termination locations, including above tub edges. This gap shall be free of adhesive and grout and filled with a flexible sealant.
- E. Joints shall be reinforced with 2 inches (51 mm) wide, high-strength, coated, alkali-resistant, glass fiber reinforcing tape embedded into a Latex-Portland Cement mortar or Dry-Set (thin-set) mortar and allowed to dry thoroughly.
- F. For large tiled areas, movement/control joints shall be provided in accordance with ANSI A108, Section AN-3.7 or as indicated on drawings.

- G. Wall tiles complying with ANSI A137.1 are attached to the board with flexible Type I mastic adhesives complying with ANSI A136.1, or acrylic or latex-modified thinset mortars complying with ANSI A118.4, in accordance with ANSI A108.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Interior gypsum board.
 - 2. Interior gypsum board for plaster finish
 - 3. Fasteners, trim, adhesives and accessories.
 - 4. Reveal moldings.
 - 5. Drywall finishing
 - 6. Plaster finishing

1.03 RELATED SECTIONS

- A. Section includes, but is not limited to:
 - 1. Division 5 - Cold Formed (Load Bearing) Metal Framing
 - 2. Section 09 22 00 – Non-Load Bearing Framing
 - 3. Section 09 28 13 – Cementitious Backing Boards

1.04 REFERENCES

- A. Reference Standards:
 - 1. ASTM: The American Society for Testing and Materials
 - 2. FS: Federal Specification
 - 3. ANSI: American National Standards Institute
 - 4. UL: Underwriters Laboratories
 - 5. GA: Gypsum Association (GA)

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.

- B. Product Data: Furnish product data sheets for review.
- C. Close-Out Document Submittals
 - 1. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Fire Resistance Rated Applications: Provide UL listed or ASTM E 119 tested materials, accessories, and application procedures to comply with the rating, UL Design Number, or Gypsum Association File Number indicated.
- B. Sound Transmission Class (STC) Rated Applications: Provide materials and installation procedures identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.
- C. Single Source Responsibility: Obtain components for gypsum board shaft-wall assemblies from a single manufacturer for each type of assembly required. Coordinate with Section 09100 – Non-Load Bearing Wall Framing.
- D. Qualifications:
 - 1. Installer Qualifications: Installer shall specialize in the type of gypsum board work required and shall have a minimum of 5 years of documented successful experience.

1.08 DELIVERY, STORAGE & HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.09 PROJECT CONDITIONS

- A. Environmental Requirements: Comply with gypsum board manufacturer's printed temperature and ventilation requirements during application and finishing. Ventilate installation areas to relieve excess moisture.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD

- A. Subject to compliance with requirements, provide products from one of the following:
 - 1. National Gypsum Co.
 - 2. American Gypsum Co.
 - 3. CertainTeed Gypsum, Inc.
 - 4. USG Corp.
 - 5. Georgia Pacific (G-P) Gypsum LLC
 - 6. Lafarge North America, Inc.
 - 7. Temple.
 - 8. PABCO Gypsum Building LLC
 - 9. PABCO Gypsum
 - 10. Canadian Gypsum Company
 - 11. Temple-Inland Forest Products Corp.
 - 12. United States Gypsum Co.

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- B. All wallboard shall be 5/8 inch, except as otherwise noted.
 - C. Gypsum Board: Paper faced gypsum as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
 - 1. Basis-of-Design: Product: G-P Gypsum; "ToughRock Gypsum Board"
 - 2. Application: Use for vertical surfaces and ceilings, unless noted otherwise
 - 3. Thickness: 5/8 inch or 1/2"
 - 4. Long Edges: Tapered.
 - D. High Impact Board (See drawings for locations): ASTM C 1396, Type X and Hard Body Impact ASTM C 1629, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels, with core type and in thickness indicated, and with long edges tapered. Refer to Finish Plan and Finish Schedule on Drawings.
 - 1. Basis-of-Design: Product: G-P Gypsum; " ToughRock Abuse-resistant Gypsum Wallboard"
 - 2. Application: Use for vertical surfaces and ceilings, unless noted otherwise
 - 3. Thickness: 5/8 inch
 - 4. Long Edges: Tapered.
 - E. Flexible Board: Shall be used in areas for bending to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Basis-of-Design: Product: G-P Gypsum; " ToughRock FlexRocGypsum Board"
 - 2. Application: Use for areas that require , unless noted otherwise
 - 3. Thickness: 1/4 inch
 - 4. Long Edges: Tapered.

2.02 FASTENERS

- A. Steel Drill Screws: Gypsum board manufacturer's recommended types and sizes for substrates involved.
 - 1. ASTM C 1002, Type "G", Type "S", or Type "W" for steel studs less than 0.33 inch thick.
 - 2. ASTM C954, for steel studs from 0.33 inch to 0.112 inch thick.

2.03 ADHESIVES

- A. Fastening and Laminating Adhesive:
 - 1. Gypsum board manufacturer's recommended type for substrates involved.
 - 2. Do not use adhesive containing benzene, carbon tetrachloride, or trichloroethylene.

2.04 TRIM

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized steel.
 - 2. Shapes:
 - 3. Cornerbead: Use at outside corners.
 - 4. Bullnose Bead: Use where indicated.
 - 5. LC-Bead: J-Shaped, exposed long flange receives joint compound. Use at exposed panel edges.
 - 6. L-Bead: L-shaped, exposed long leg receives joint compound with tear away bead. Use where gypsum board abuts or intersects dissimilar material.
 - 7. U-Bead: J-shaped, exposed short flange does not receive joint compound. Use where indicated.

8. Expansion (Control) Joints: Galvanized steel one piece with V-shaped slot and removable strip covering opening. Product shall be similar to:
 - a. 0.093 Zinc Control Joint by Gold Bold Gypsum Wallboard Products
 - b. 093 Control Joining by Dietrich Metal Framing
 - c. No. 093 Drywall Control Joint by Alabama Metal Industries Corp.

2.05 ACCESSORIES

- A. Sound Attenuation Insulation: Specified in Section 07210 – Building Insulation.
- B. Isolation Strips for Structural Members: To be installed for any location where drywall abuts a structural member. This includes both wall and ceiling locations.

2.06 SURFACE PREPARATION MATERIALS

- A. Plaster Bonding Agent: ASTM C-631; Applied to drywall surfaces in preparation for veneer plaster finish.
 1. Equal to Larsen Plaster-Weld Plaster Bonding Agent
 2. Or Architect approved equal

2.07 JOINT TREATMENT MATERIALS

- A. Joint Tapes: ASTM C 475; plain or perforated.
- B. Joint Compound: ASTM C 475; ready-mixed dust control joint compound.
 1. Sheetrock Brand Dust Control Lightweight All-Purpose Joint Compound (Plus 3) or approved equal.
- C. Special Edged Gypsum Board: Gypsum board manufacturer's special joint treatment materials.

2.08 PLASTER FINISH

- A. Materials: Basis of Design USG; Imperial (2) coat plaster system.
 1. Acceptable (2) coat materials from other manufacturers by:
 2. Georgia-Pacific
 3. National Gypsum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates to which gypsum board system attaches or abuts, preset steel door frames, cast in anchors, and structural framing, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board system construction. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 CONSTRUCTION TOLERANCES

- A. Do not exceed 1/8 inch in 8 feet variation from plumb or level in any exposed line or surface, except at joints between boards do not exceed 1/16 inch variation between planes or abutting edges or ends. Shim as required to comply with specified tolerances.

3.03 GYPSUM BOARD INSTALLATION

- A. Apply gypsum board to framing and furring members in accordance with ASTM C 840 or GA 216 and the requirements specified herein.
- B. Apply gypsum board with separate panels in moderate contact face side out; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length. Cut out gypsum board as required to make neat close joints around openings.
- C. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece.
- D. Surfaces of gypsum board and substrate members may be bonded together with an adhesive, except where prohibited by fire ratings.
- E. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer.
- F. Control Joints: Provide control joints in gypsum board partitions, bulkheads, ceilings, and soffits as follows:
 - 1. Locate joints at points of maximum stress and/or at points of natural weak planes, such as openings, juncture or dissimilar materials, and at re-entrant corners.
 - 2. Locate joints in interior walls directly over building control and expansion joints.
 - 3. Install control joints where partitions or soffits abut structural elements or dissimilar construction.
 - 4. Construction changes within plane of partition or ceiling.
 - 5. Partition or furring run exceeds 30 feet, unless otherwise noted.
 - 6. Ceiling dimensions exceed 40 feet in either direction.
 - 7. Expansion or control joints occur in exterior wall.
- G. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments. Provide $\frac{1}{4}$ to $\frac{1}{2}$ inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.
 - 1. Fit gypsum panels around ducts, pipes, conduits, etc.
 - 2. Where partitions intersect steel joists, steel girders, and other structural members projecting below underside of floor/roof decks, cut gypsum panels to fit profile formed by structural members.
- I. Arches and Bending Radii: For curved partitions, install gypsum panels as follows:
 - 1. Select gypsum panel lengths and cut them as required to produce one unbroken panel covering each curved surface plus 12 inch long straight sections at ends of curves and tangent to them.
 - 2. Wet gypsum panels on surfaces that will become compressed when panels are installed over a curve and where curve radius prevents using dry panels. Comply with the gypsum board manufacturer's recommendations relative to curve radii, wetting methods, stacking panels after wetting, and other preparations that practice installing wetted gypsum panels.
 - 3. Apply gypsum panels horizontally with wrapped edges perpendicular to studs. On convex sides of partition, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around the curve. On concave side, start fastening panels to the stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced at 12 inches o.c.
 - 4. For double layer construction, apply gypsum board base layer horizontally and fasten to studs with screws spaced 16 inches o.c.. Center gypsum board face layers over joints in base layer and fasten to studs with screws spaced 12 inches o.c.

5. Allow wetted gypsum panels to dry before applying joint treatment.
- J. Adhesive Application to Interior Masonry or Concrete Walls: Apply in accordance with ASTM C 840, System VI or GA 216.
- K. Application of Gypsum Board to Steel Framing and Furring: Apply in accordance with ASTM C 840, System VIII or GA 216.
- L. Application of Impact Resistant Gypsum Board: Apply in accordance with the applicable system of ASTM C 840 as specified or GA 216. Follow manufacturer's written instructions on how to cut, drill and attach board.
- M. Fasteners: Fasten gypsum board to supports and furring with steel drill screws of required size and spacing as recommended by the gypsum board manufacturer.
 1. Space fasteners in panels that are tile substrates a maximum of 8-inches o.c.
 2. Space fasteners a maximum of 12-inches o.c. for vertical applications.
 3. Multiple-layer Work:
 4. Mechanically fasten both layers.
 5. Stagger vertical joints in multiple layer Work. Offset joints not less than 10 inches.

3.04 TRIM INSTALLATION

- A. Coordinate installation of trim progressively with gypsum board installation where trim is of type required to be installed prior to, or progressively with installation of gypsum board.
- B. Securely fasten trim pieces in accordance with manufacturer's printed instructions.
- C. Install cornerbeads at external corners. Install LC-Bead (J-Bead) beads at unprotected (exposed) edges and where gypsum board abuts dissimilar materials. Use single unjointed lengths unless otherwise approved by the A/E.
 1. Miter corners of semi-finishing type casing and trim beads.
- D. Install control joint trim in accordance with ASTM C 840, where indicated.
- E. Install reveal molding where indicated and in accordance with manufacturer's printed instruction.
- F. Comply with joint compound manufacturer's recommended drying time for the relative humidity and temperature at time of application. Allow minimum of 24 hours drying time between applications of joint compound.
- G. Except Type X Gypsum Board: Joint compound treatment is not required on gypsum board surfaces installed above suspended ceiling lines.
- H. Type X Gypsum Board: Install joint and corner reinforcing and trim, and one coat of joint compound over joints, fastener heads, and metal flanges above suspended ceiling lines.

3.05 LEVELS OF GYPSUM BOARD FINISH

- A. General: Finish panels to levels indicated below, in accordance with ASTM C 840/ GA-214, for locations indicated.
 1. Level 1 Finish: Joints and angles, provide tape embedded in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges will be acceptable.
 2. Level 2 Finish: Joints and angles, provide tape embedded in joint compound and provide one separate coat of joint compound over the tape and fastener heads. Cover accessories with one coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges will be acceptable. Joint compound applied over the body of the tape at the time of tape embedment will be considered a separate coat of joint compound and will satisfy the conditions of this level.
 3. Level 3 Finish: Joints and angles, provide tape embedded in joint compound and provide two separate applications of joint compound over all joints, angles, and fastener heads. Accessories shall be covered with two separate coats of joint compound. Joint compound to be smooth and free of tool marks and ridges.

4. Level 4 Finish: Joints and angles, provide tape embedded in joint compound and provide three separate coats of joint compound over all joints, angles, and fastener heads. Accessories to be covered with three separate coats of joint compound. Joint compounds to be smooth and free of tool marks and ridges.
 5. Level 5 Finish: Provide tape embedded in joint compound over joints and angles, and provide three separate coats of joint compound over all joints, angles, and fastener heads. Cover accessories with three separate coats of joint compound. Joint compounds to be smooth and free of tool marks and ridges. Apply a skim coat. Remove excess material; leave a film covering the paper.
 6. Plaster Finish: Apply bonding agent over drywall surfaces. Provide tape embedded in joint compound over joints and angles as required by veneer plaster construction. Scratch in a tight, thin coat of Basecoat Plaster over entire area, immediately doubling back with plaster from same batch to full thickness of 1.6 to 2.4 mm (1/16" to 3/32"). Fill all voids and imperfections. Leave the surface rough and open by cross-raking with a fine-wire rake or broom to provide proper bond of the finish coat. Allow the basecoat to set and partially dry to provide proper suction for the finish coat. If basecoat has dried, you may dampen (not saturate) the surface with water by means of a tank sprayer to control suction. Finish coat materials are applied by scratching in and doubling back with selected finish plaster, gauged lime-putty, to achieve a smooth, dense surface for decoration, free of surface blemishes. For textured finishes, floating on textures with additional material is conducted once the surface has become firm, using water sparingly.
- B. Schedule for Levels of Gypsum Board Finish:
1. Level 5: Gypsum board surfaces, unless otherwise indicated.
 2. Level 4: Ceiling plenum areas, concealed areas, and where indicated unless a higher level of finish is required for fire-resistance-rated assemblies.
 3. Plaster Finish: Gypsum board surfaces on skylight well.

3.06 SEALING

- A. Acoustical Sealant at Non-Rated Assemblies: ASTM C 919.
1. Install continuous bead of acoustical sealant at gypsum board perimeter.
 2. Seal wherever gypsum board abuts dissimilar materials.
 3. Seal spaces between gypsum board and all penetrating items.
 4. Seal where partitions intersect open concrete coffers, joists, and other structural members.

3.07 PATCHING

- A. Immediately after drywall installation, hanging, taping and sanding has been completed the Drywall Contractor Supervisor shall visit the project site and inspect all work. When fully completed and any defects corrected he shall notify the painting contractor that the area is ready to be painted. The Painting Contractor shall then complete a thorough and complete inspection of all surfaces to be finished and mark any and all defects he feels are unacceptable and report these defects to the Construction Manager in writing. The drywall contractor shall then remedy all defects before finishes are applied.

3.08 CLEANING

- A. Promptly remove any residual joint compound from adjacent surface not indicated to receive texture.

3.09 WASTE MANAGEMENT

- A. Separate gypsum waste in accordance with the Waste Management Plan.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Floor preparation.
 - 2. Cementitious underlayment.
 - 3. Waterproofing.
 - 4. Crack isolation.
 - 5. Porcelain floor tile
 - 6. Glazed Ceramic Wall tile
 - 7. Tile setting materials and accessories for a complete installation.

1.03 RELATED SECTIONS

- A. Related Work Specified Elsewhere:
 - 1. Section 03 30 00 – Cast-in-Place Concrete
 - 2. Section 07 92 00 – Joint Sealants for sealing of expansion, contraction, control and isolation joints in tile surfaces.
 - 3. Section 09 28 13 – Cementitious Backing Board for backer units installed on substrate for ceramic tile.

1.04 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499), plus joint width indicated.
- B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.
- C. SUBMITTALS
- D. In accordance with Division 1 – Submittal Procedures.
- E. Product Data: Furnish product data sheets for review.

- F. Shop drawings: Indicating tile patterns and locations and widths of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- G. Samples: For each type of tile and grout indicated. Include samples of accessories involving color selection.
- H. Close-Out Document Submittals
 - 1. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.06 QUALITY ASSURANCE

- A. Work done under this Section of the Specifications shall be performed by mechanics skilled and experienced in the class of work involved. Workmanship shall be in accordance with best trade practices, and surface shall be true to line and free from waves and other imperfections. Joints between tiles shall be maintained uniform and even and properly grouted.
- B. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Metal edge strips.
- E. Conform to Tile Council of North America, Inc. (TCA): 2005 HANDBOOK for Ceramic Tile Installation.
- F. Qualifications:
 - 1. Installer Qualifications: Acceptable to manufacturer and have documented experience on at least five (5) projects of similar nature within the past five (5) years.

1.07 DELIVERY, STORAGE & HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does not contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.08 PROJECT CONDITIONS

- A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.
- B. Maintain temperatures at 50 degrees F. or more in tiled areas during installation and for seven (7) days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.09 PERFORMANCE REQUIREMENTS

- A. Traffic Level Performance: System shall meet traffic level performance extra heavy commercial when tested in accordance with ASTM C 627 Evaluating Ceramic Tile Floor Installations.
- B. Static Coefficient of Friction: For tile installed on walkway surfaces, provide product with the following values as determined by testing identical products per ASTM C1028:
 - 1. Level Surfaces: Minimum 0.6.
 - 2. Step Treads: Minimum 0.6.
 - 3. Ramp Surfaces: Minimum 0.8.

1.10 EXTRA STOCK

- A. Upon completion of Work, the Contactor under this Section shall deliver extra tile and trim, consisting of not less than three (3) percent of the total quantity of each type, size, pattern, and color installed to the Owner for use in future repair and maintenance work.
- B. Store in location where directed by Construction Manager.
- C. Ensure materials are boxed and identified by manufacturer, type, and color.

1.11 COORDINATION

- A. Pre-installation Meeting: Before beginning tile installation, conduct a conference at project site with the Construction Manager and Architect to review to following:
 - 1. Installation methods
 - 2. Pattern layouts.
 - 3. Joint locations.
 - 4. Surface preparation.
 - 5. Edge protection and pre-fabricated movement joint profiles.
 - 6. Crack isolation techniques.

1.12 WARRANTY

- A. The manufacturer of the installation materials for the floor tile shall warrant that the system will not transfer cracks from the substrate through the tile and will maintain the bond between the tile and substrate, when subjected to horizontal movement of cracks up to 1/8-inch, when properly applied, using approved materials, all applicable building code regulations and applicable standards, for a period of ten (1) years from the date of Substantial Completion.
- B. The tile manufacturer shall warrant the performance of the tile for ten (10) years, from the date of Substantial Completion, when installed per ceramic tile manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other

appearance characteristics, provide specific products or materials complying with the following requirements:

1. As indicated by manufacturer's designations for selections by Architect from manufacturer's full range.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- F. Size: Product sizes indicated on the drawings must be met. Cutting of materials to achieve listed sizes must be done in the factory and result in a rectified edge. Field cutting will not be accepted.

2.02 TILE PRODUCTS

- A. See finish drawings for the finish schedule and locations showing tile Manufacturer (Basis of Design), module size, product name and color.
- B. Accepted Manufacturers:
 1. Flat Porcelain Tile (**FT1**):
 - a. Caesar – B.O.D.
 - 1) Collection: Foundry 26
 - 2) Color: Rail
 - 3) Size: 12" x 24"
 - b. Crossville Corp.
 - 1) Collection: Altered State
 - 2) Color: Melting Point
 - 3) Size: 12" x 24"
 - c. Dal-Tile Corp.
 - 1) Collection: Diplomacy
 - 2) Color: Dark Gray (DP3)
 - 3) Size: 12" x 24"
 2. Glazed Ceramic Tile (**WT1**):
 - a. Dal-Tile Corp. – B.O.D.
 - 1) Collection: Linear – Color Wheel
 - 2) Color: Matte Biscuit (K775)
 - 3) Size: 4" x 12"
 - b. Crossville
 - 1) Collection: Color by Numbers
 - 2) Color: Three hour tour – Satin finish
 - 3) Size: 4" x 12"
 - c. Stonepeak
 - 1) Collection: Shadows
 - 2) Color: Matte White
 - 3) Size: 4" x 12"
 3. Products of other manufacturers will be considered for acceptance provided they equal or exceed the material requirements and functional qualities of the specified product.

Alternate manufactures that wish to be considered must submit and be approved during bidding.

- C. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as selected from manufacturer's standard shapes. Provide base and trim pieces as required for a complete installation as shown on the Drawings. If not indicated on Drawings, provide the following:
 - 1. Internal Corners: Field-butteted square corners, except use internal cove and cap angle pieces designed to fit with stretcher shapes.

2.03 SETTING MATERIALS

- A. Dry-Set Portland Cement Modified Mortar: ANSI A118.11
 - 1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.11.
- B. Thin-Set Crack Isolation Setting System: ANSI A118.12.
- C. Chemical-Resistant, Water-Cleanable, Ceramic Tile-Setting and Grouting Epoxy: ANSI A118.3.
 - 1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 140 degrees F. (60 degrees C.) and 212 degrees F. (100 degrees C.), respectively, as certified by mortar manufacturer for intended use.

2.04 GROUTING MATERIALS

- A. Accepted Manufacturers:
 - 1. Mapei (www.mapei.com/US)
 - 2. ProSpec. (www.prospec.com)
 - 3. Bostik Inc. (www.bostik-us.com)
 - 4. Custom Building Products (www.custombuildingproducts.com)
- B. Portland cement modified grout, complying with ANSI A118.7. This grout shall be used for all tile joints excluding floors and walls in Toilet Rooms.
- C. One hundred percent solids epoxy grout, complying with ANSI A118.3. This grout shall be used for tile joints in both floors and walls in all Toilet Rooms.
 - 1. Grout joint shall be coved at the base joint where wall tile and floor tile meet.
- D. Colors: As selected from manufacturer's standards.

2.05 MISCELLANEOUS MATERIAL

- A. Portland Cement Mortar Bed: As recommended by membrane manufacturer, as required to provide positive drainage to floor drains.
- B. Latex Modified Floor Patch and Leveler: Provide product specifically approved for materials and installations indicated by the tile and grout manufacturers. Manufacturer's standard cement-based product designed specifically for patching and filling cracks, voids, seams, and depressions from featheredge up to ½-inch deep.
 - 1. VersaPatch; TEC Specialty Construcdtion Brands, Inc.
 - 2. Or Architect Approved equal.
- C. Waterproof Membrane / Shower Pan Membrane:
 - 1. General: Provide products that comply with ANSI A118.10.
 - 2. Polyethylene – Sheet Waterproofing: Manufacturer's standard proprietary product consisting of composite sheets, 60 inches wide by a nominal thickness of 0.030 inches,

composed of an inner layer of non-plasticized, chlorinated polyethylene sheet faced on both side with +laminated, high-strength, non-woven polyester material, designed for embedding in latex-portland mortar and as the substrate for latex-portland cement mortar setting bed.

- a. NobleSeal TS; Noble Company
3. Membrane Waterproofing: Manufacturer's standard proprietary product consisting of acrylic emulsion modified with a polyurethane dispersion waterproofing mesh, designed to be applied using a nap roller, trowel, or airless sprayer. Membrane must be applied in two coats. First coat, 25 mils wet. Second coat, applied at right angles to first coat, 25 mils wet. Total thickness of 50 mils wet, curing to a dry film thickness of 30 mils.
 - a. HydraFlex; TEC Specialty Construction Brands, Inc.
- D. Sealants: Provide manufacturer's standard chemically curing elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Section 07920 – Joint Sealants.
1. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- F. Crack Isolation Membrane: Shall be a one or two component acrylic based system designed to isolate substrate cracks up to 1/8 inch.
1. TA-324 Triple Flex; TEC Specialty Products, Inc.
 2. TA-329 Crack Isolation Membrane; TEC Specialty Products, Inc.
 3. HydraFlex; TEC Specialty Products, Inc.
 4. 1Flex Mortar; TEC Specialty Products, Inc.
 5. UniFlex #916; C-Cure.
 6. NobleSeal TS; Noble Company
- G. Metal Edge Strips: Zinc alloy or stainless steel, 1/8 inch at top edge with integral provision for anchorage to substrate, unless otherwise indicated.
1. External Corners: Schluter Schiene , 3mm Aluminum (Basis of Design) *color to be chosen by architect from manufacturer's full range of colors
 2. Tile – to – Sealed Concrete Transition Strip: Schluter Reno-Ramp/-K *color to be chosen by architect from manufacturer's full range of colors.

2.06 PROJECT COLORS AND PATTERNS

- A. Colors, surface textures, and other appearance characteristics shall be as selected by the Architect. Selections shall be made from among manufacturer's price groupings as indicated on the Drawings.
- B. Architect shall select colors of grout from all available price groups.

2.07 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer's written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installing tile, inspect new surfaces which are to receive tile covering. Notify the Construction Manager in writing of defects or conditions that will interfere with or prevent a satisfactory tile installation. Do not proceed with installation until such defects or conditions have been corrected.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. The starting of installation work in a room or space shall imply acceptance of the surfaces to receive the tile in that space.

3.02 PREPARATION

- A. Due to some of the existing floor conditions, all floor prep required to all concrete slabs are the responsibility of the flooring contractor. Use trowelable leveling and patching compounds to fill cracks, holes, and depressions in substrates to receive new flooring material.
- B. Clear away debris; scrape up cementitious deposits from surface that would prevent bond, including curing compounds, paint, oils, waxes, and sealers. Broom clean or vacuum surfaces to be covered immediately before installation.

3.03 LAYOUT

- A. Layout expansion joints and other sealant filled joints, including control, contraction, and isolation joints, where indicated, or if not indicated, at spacings and locations recommended in TCA "Handbook for Ceramic Tile Installations" during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.
 - 1. Prepare joints and apply sealants to comply with requirements of Specification Section 07920, Sealants and Caulking.
- B. Lay out tilework so as to minimize cuts less than one-half tile in size.
- C. Locate cuts in both walls and floors so as to be least conspicuous.
- D. Lay out tile wainscots to next full tile beyond dimensions shown.
- E. Align wall joints to give straight, uniform grout lines, plumb and level.
- F. Align floor joints to give straight uniform grout lines parallel with walls.
- G. Make joints between tile sheets same width as joints within sheets so extent of each sheet is not apparent in finished work.
- H. Porcelain tile can have large variances in sizing. Do not mix sizes and types of tiles in pattern areas. Joints that do not line up or joint widths that vary will be unacceptable.

3.04 WORKMANSHIP

- A. Supply first-class workmanship in tilework.
- B. Use products in strict accordance with recommendations and directions of manufacturer.
- C. Proportion mixes in accordance with latest ANSI standard specifications.
- D. Smooth exposed cut edges.
- E. Be sure cut edges are clean before installing tiles.

- F. Fit tile carefully against trim and accessories, also around pipes, electrical boxes, and other built-in fixtures so that escutcheons, plates, and collars will completely overlap cut edges.
- G. When using glazed tile sheets, minimize tearing sheets apart by drilling pipe holes as much as possible.
- H. Be sure tilework is free of grout film upon completion.

3.05 INSTALLATION

A. General:

1. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
2. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation". Comply with TCA installation methods indicated in ceramic tile installation schedules.
3. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
4. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations do plates, collars, or covers overlap tile.
5. Jointing Pattern: Lay tile in grid patterns, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions.

B. Waterproofing Installation

1. Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.
2. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
3. Waterproofing floor membranes and/or shower pan membranes shall extend 3 inches minimum above finished floor.

C. Floor Installation

1. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.
2. Joint Widths: Install tile on floors with the following joint widths:
 - a. Paver Tile: 1/8 inch.
3. Metal Edge Strips: Install at locations where exposed edge of tile flooring meets carpet or other flooring which finishes flush with the top of tile.

D. Wall Tile Installation

1. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
2. Joint Widths: Install tile on walls with the following joint widths:
 - a. Paver Tile: 1/8 inch.

3.06 GROUTING

- A. Grouting shall be installed in accordance with ANSI A108.10 and the manufacturer's recommended procedures and precautions during application and cleaning, unless noted otherwise.
- B. Where noted, for chemical-resistant epoxy grouts, comply with ANSI A108.6.
- C. Rinse tilework thoroughly with clean water before and after using chemical cleaners.

3.07 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chapped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
 - 1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 - 2. Prohibit foot and wheel traffic from tiles floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleans from tile surfaces.

3.08 PROTECTION

- A. The Contractor installing tile shall make such provisions as necessary to protect the tile against damage of any kind after installation. Damaged tile that appears in the finish work prior to turning the building over to the Owner is to be repaired or replaced by this Contractor without further cost to the Owner. Protect adjoining areas and surfaces and clean up everything at completion. Remove scrap, debris, and surplus material as it accumulates.

3.09 FLOOR TILE INSTALLTION SCHEDULE

- A. Tile Installation with Crack Isolation: Interior floor installation over concrete; thin-set mortar; TCA F125A-05. This method shall be used at all locations other than areas requiring waterproofing membrane.
 - 1. Tile Type: Porcelain or Ceramic paver tile.
 - 2. Thin-Set Crack Isolation Mortar or Sheet Membrane System: ANSI A118.12.
 - 3. Grout: Polymer-modified Portland cement grout; ANSI A118.7.
- B. Tile Installation with Waterproofing Membrane: Interior floor installation over concrete; thin-set mortar bonded to waterproof membrane; TCA F122-05. This method shall be used at all locations where tile is installed in kitchens, toilet rooms and shower rooms on elevated slabs.
 - 1. Tile Type: Porcelain or Ceramic paver tile.
 - 2. Waterproofing Membrane: Polyethylene-Sheet or Liquid Applied; ANSI A118.10.
 - 3. Thin-Set Mortar: Portland cement modified mortar; ANSI A118.11.

4. Grout: One hundred percent solids epoxy grout, complying with ANSI A118.3.

3.10 WALL TILE INSTALLTION SCHEDULE

- A. Tile Installation: Interior wall installation over glass mat water-resistant gypsum backer board over metal studs; thin-set mortar; TCA W245-05.
 1. Tile Type: Porcelain or Ceramic tile.
 2. Waterproofing Membrane: Polyethylene-Sheet or Liquid Applied; ANSI A118.10. (at walls in Toilet Rooms only).
 3. Thin-Set Mortar: Portland cement modified mortar; ANSI A118.11.
 4. Grout: One hundred percent solids epoxy grout, complying with ANSI A118.3 at toilet rooms & kitchens. Polymer-modified Portland cement grout; ANSI A118.7 at all other locations.
- B. Tile Installation: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202-05.
 1. Tile Type: Porcelain or Ceramic tile.
 2. Thin-Set Mortar: Portland cement modified mortar; ANSI A118.11.
 3. Grout: One hundred percent solids epoxy grout, complying with ANSI A118.3 at toilet rooms & kitchens. Polymer-modified Portland cement grout; ANSI A118.7 at all other locations.

END OF SECTION

SECTION 09 54 01 - LINEAR WOOD CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section Includes:
 - 1. Wood veneer ceiling planks.
 - 2. Concealed grid suspension system.
 - 3. Wire hangers, fasteners, main runners, wall angle moldings and accessories.

1.03 RELATED SECTIONS

- A. Related Sections:
 - 1. Section 09 54 23 – Lineal Metal Ceilings
 - 2. Divisions 23 – HVAC
 - 3. Division 26 Sections – Electrical Work

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - 3. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 4. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 5. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 6. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 7. ASTM E 1264 Classification for Acoustical Ceiling Products.
- B. CISCA Seismic Zones (0-2) (3-4) Ceilings and Interior Systems Construction Association Guidelines for Seismic Restraint for Direct Hung Suspended Ceiling Assemblies

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.

- C. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3, Installation.
- D. Samples: Minimum 3-1/2 inch or 5-1/2 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner.
- E. Shop Drawings: Layout and details of ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.
- F. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- G. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less
 - 2. HPVA (Hardwood Plywood and Veneer Association) certification and audit program per ASTM E-84 tunnel test.
- C. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.
- D. Linear Wood, as with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern, or possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- E. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store ceiling components in a dry interior location in their cartons prior to installation to avoid damage. Store cartons in a flat, horizontal position. The protectors between the panels should not be removed until installation.
- B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Panels must not be exposed to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.
- C. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

1.08 PROJECT CONDITIONS

- A. Wood veneer ceiling materials should be permitted to reach room temperature and have a stabilized moisture content for a minimum of 72 hours before installation.

- B. The wood veneer panels should not be installed in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.
- C. As interior finish products, the wood veneer panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

1.09 WARRANTY

- A. Wood Veneer Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Ceiling Panels: Defects in materials or factory workmanship.
 - 2. Grid System: Rusting and manufacturing defects.
- B. Warranty Period:
 - 1. Wood veneer panels: One (1) year from date of installation.
 - 2. Grid: Ten years from date of installation.
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.10 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
 - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Ceiling Panels:
 - 1. Armstrong World Industries, Inc. – Basis of Design
 - 2. Certainteed
 - 3. Equals approved by the Architect in writing.
- B. Suspension Systems:
 - 1. Armstrong World Industries, Inc. – Basis of Design
 - 2. Certainteed
 - 3. Equals approved by the Architect in writing.

2.02 WOOD VENEER CEILING UNITS

- A. Ceiling Panels Type "LW":
 - 1. Basis of Design: WOODWORKS Linear Veneered Planks, 6440W1 NMP, as manufactured by Armstrong World Industries

2. Veneers: Natural Variations Maple
3. Size: 96in x 3-3/4in x 3/4in
4. Edge Banding and Trim: To match face veneer
5. Noise Reduction Coefficient (NRC): ASTM C 423
 - a. Nominal 4-1/2" Module - 0.65 with acoustical backing
6. Flame Spread: ASTM E 1264; Class A.

2.03 SUSPENSION SYSTEMS

- A. Components: All linear carriers shall be commercial quality hot dipped galvanized steel as per ASTM A 653. Linear carriers are double-web steel construction with concealed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Linear carriers shall have rotary stitching.
 1. Structural Classification: ASTM C 635, Heavy Duty.
 2. Color: Black, unless noted otherwise.
 3. Clips: Integral, factory-applied, spring steel clips on linear carriers in sufficient number to receive 8 foot linear wood (nominal 4 inch) (nominal 6 inch) planks.
 4. Acceptable Product: HD Linear Carrier as manufactured by Armstrong World Industries, Inc.
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least three times design load, but not less than 12 gauge.
- D. Accessories/Edge Moldings and Trim:
 1. Linear Splices, Item #5843, for splicing planks together end-to-end

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.
- B. Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION

- A. Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines; approved construction drawings; with the authorities having jurisdiction; and in accordance with the manufacturer's installation instructions, WoodWorks Linear Installation Instructions, LA-297076.
- B. Suspend linear carriers from overhead construction with hanger wires spaced 4 feet on center along the length of the linear carrier. Install hanger wires plumb and straight. Hanger wires shall not be installed in convenience holes. Install linear carriers 24 inches on center (or less).
- C. Install wall moldings at intersection of suspended ceiling and vertical surfaces.

- D. Follow the instructions found in "WoodWorks Linear Installation Instructions", LA-297076, for border treatment of the WoodWorks Linear planks.
- E. Install sound control accessory panels above entire area of Linear Wood Ceiling system.

3.04 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

09 54 23 - LINEAL METAL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. This Section includes linear metal pans and specially engineered suspension systems. Interior or (protected horizontal) exterior linear metal ceiling system (fire-rated) (non-fire-rated) assemblies, consisting of pre-finished aluminum or steel pans mounted to a carrier system and incorporating lighting fixtures and air handling components as applicable to the particular project design.
- B. Linear metal ceiling are to match in dimension, finish, installation, etc. the linear wood ceiling system installed at interior locations.

1.03 RELATED SECTIONS

- A. Related Sections include the following:
 - 1. Division 5 – Light Gauge Metal Framing
 - 2. Section 09 54 01 – Linear Wood Ceilings
 - 3. Division 26 – Electrical

1.04 REFERENCES

- A. ASTM C635 or C636: Manufacturing and Installation of Suspended Ceilings.
- B. Underwriters Laboratories Inc.: Fire Resistance Directory, Design Nos. D218, P230, and P267.
- C. ASTM E119: Fire Tests of Building Construction and Materials.
- D. ASTM C423: Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures
- B. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
- C. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3, Installation.
- D. Samples: Minimum 3-1/2 inch or 5-1/2 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner
- E. Samples: Submit representative sample of color and finish of all exposed materials.
- F. Shop drawings:
 - 1. Reflected ceiling plans: Contractor shall indicate layout arrangement of ceiling design, dimensions and locations of related integrated lighting and air distribution components.

2. Contractor shall provide a layout drawing locating the light gauge metal framing member attached to the metal roof decking.
 3. Contractor shall coordinate installation and support of recessed light fixtures and furnish and install all necessary accessories, items, components required for complete installation.
 4. Installation drawings: Detail complete installation including carrier system, connections between carriers and pans, details of level changes and/or changes in pattern, installation of related lighting and air distribution components, access requirements, sound absorption requirements, and fire rating requirements when applicable.
- G. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- H. Manufacturer's data: Submit manufacturer's catalog cuts or standard drawings showing details of system with project conditions clearly identified and manufacturer's recommended installation instructions, including independent lab report on wind testing.
- I. Maintenance materials: Submit one percent of amount of linear metal ceiling components installed.
- J. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of materials: Deliver materials in original unopened packages, clearly labeled with manufacturer's name, item description, specification number, type, and class as applicable.
- B. Inspection: Promptly inspect delivered materials, file freight claims for damage during shipment, and order replacement materials as required. Any damaged materials shall be promptly removed from the job site.
- C. Storage: Store in manner that will prevent warpage, water damage, or damage of any kind. Prevent interference to/by other trades and any other adverse job conditions due to storage locations or methods.
- D. Handling: Handle in such a manner as to ensure against racking, distortion, or physical damage of any kind.

1.07 QUALITY ASSURANCE

- A. Subcontractor qualifications: Installer shall have not less than three years of successful experience in the installation of linear metal ceiling systems on projects with requirements similar to requirements specified.
- B. Requirements of regulatory agencies: Codes and regulations of authorities having jurisdiction.
- C. Source quality control.
1. Test reports: Manufacturer will provide test certification for minimum requirements as tested in accordance with applicable industry standards and/or to meet performance standards specified by various agencies.
 2. Changes from system: System performance following any substitution of materials or change in assembly design must be certified by the manufacturer.
- D. Delete below if work of this Section is not extensive or complex enough to justify a preinstallation conference. If retaining, coordinate with Division 1 Section "Project Meetings."

1.08 PROJECT CONDITIONS

- A. Existing conditions: (Include specific alteration work requirements for project.)
- B. Environmental requirements: Building shall be enclosed with windows and exterior doors in place and glazed, and roof water-tight before installation of linear metal ceiling system and

related ceiling components. Climatic condition range of 60 °F (16 °C) to 85 °F (29 °C) and relative humidity of not more than 70%.

- C. Coordination with other work:
 - 1. Mechanical work: Ductwork above ceiling shall be complete and permanent heating and cooling systems operating to climate conditions prior to installation of linear metal ceiling components.
 - 2. Electrical work: Installation of conduit above ceiling shall be complete before installation of linear metal ceiling components.
 - 3. Fire protection work: Fire protection lines and/or equipment occurring above ceiling shall be completed and tested before linear metal ceiling components are installed.
- D. Protection: Protect completed work above ceiling system from damage during installation of linear metal ceiling components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Ceiling Panels:
 - 1. Basis of Design: Armstrong World Industries, Inc.
 - 2. Certainteed
 - 3. Or equal approved by the Architect in writing

2.02 LINEAR METAL ASSEMBLY

- A. Ceiling Panels Type "LM":
 - 1. Basis of Design: METALWORKS Linear Exterior, 5490 FXMP, as manufactured by Armstrong World Industries
 - 2. Color: Effects Maple
 - 3. Planks: 4" Unperforated
 - 4. Size: 96" x 4" x 5/8"
 - 5. Fire Rating: Class A
- B. Support system:
 - 1. Special Installation Note! – Installation for this project will involve furnishing and installing the ceiling panel clips directly to the light gauge metal framing as indicated on the drawing details. It is not necessary to provide a suspended carrier system.
 - a. Installer shall provide direction as to location of the supporting light gauge framing. Refer to Submittals.
 - b. Installer shall coordinate support of light fixtures.
- C. Accessories: Furnish and install all accessories as required for complete exterior installation. Including but not limited to:
 - 1. Carrier Molding
 - 2. Pressure Springs
 - 3. Panel Splices
 - 4. Filler Strips
 - 5. Pan retainer clip
 - 6. Seismic clip
 - 7. Mechanical fasteners: Material and finish to match item to which installed; type and size as required for particular installation.

2.03 FABRICATION

- A. Pans: Edges formed to snap onto carrier members and provide positive locking mechanism with no additional fasteners; factory-finished to match approved samples.
- B. Support system: Formed and fabricated for mechanical connection with adjoining section and pre-punched holes for [direct suspension] or [mechanically fastened in place].

PART 3 - EXECUTION

3.01 INSPECTION

- A. For exterior ceiling applications only, Examine areas to receive linear metal ceiling system for conditions that will adversely affect installation.
- B. Do not start work until unsatisfactory conditions are corrected.
- C. Work to be concealed: Verify work above ceiling suspension system is complete, tested, and installed in manner that will not affect layout and installation of linear metal ceiling system.
- D. Exterior* wind bracing to be approved by a registered professional engineer licensed by the state where the product is being installed.
- E. *Exterior refers to horizontal applications such as soffits and drive-throughs—not intended for fascias or facade use.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
- B. Coordination: Coordinate and schedule installation of linear metal ceiling system with work of other trades affected by this installation, with particular attention given to electrical work required to be installed and operating before ceiling work can begin.

3.03 INSTALLATION

- A. Reference: Install in accordance with approved shop drawings and manufacturer's instructions. Follow architects' details for thermal and building expansion joint treatments.
- B. Carrier system:
 - 1. Adjustment: Align support system straight, level, and in required position
 - 2. Mechanical fasteners: Where required, install in manner that will provide completed assembly to conform to project design requirements.
- C. Pans:
 - 1. General: Snap metal pans into position; splice end-to-end with integral splice.
 - 2. End plugs: When pan ends are visible, install end plugs flush with end surface.
- D. Lighting components: Refer to Electrical Drawings and Specifications.
- E. Exterior installation: Install hanger reinforcements, compression posts and other structural components as required per structural engineer's evaluation

3.04 CLEANING

- A. PARALINE pans: Clean painted pans with nonabrasive, non-solvent-based commercial cleaner. Clean polished finishes with nonabrasive, quick-drying glass cleaner. A soft cotton cloth is recommended.
- B. Immediately remove any corrosive substances or chemicals that would attack painted finish.
- C. Touch up all minor scratches and spots, as acceptable, or replace damaged sections when touch-up is not permitted.

- D. Removal of debris: Remove all debris resulting from work of this section.

END OF SECTION

**SECTION 09 65 13 - RESILIENT BASE & ACCESSORIES
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Substrate preparation
 - 2. Wall base
 - 3. Accessories for a complete installation

1.03 RELATED SECTIONS:

- A. Related Sections:
 - 1. Section 04 20 00 – Unit Masonry
 - 2. Section 09 29 00 – Gypsum Board
 - 3. Section 09 90 00 – Paints and Coatings

1.04 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Furnish product data sheets, including installation instructions, for review.
- C. Samples: For each type of product indicated.
- D. Close-Out Document Submittals
 - 1. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.06 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Regulatory Requirements: Comply with local regulations controlling the use of volatile organic compounds for installation products.

1.07 DELIVERY, STORAGE & 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. Store tiles on flat surfaces.

1.08 PROJECT CONDITIONS

- A. Maintain 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 time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After post installation period, maintain 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.
- D. Coordinate installation of resilient base and transition strips with all the flooring systems specified.

1.09 EXTRA STOCK

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.
- B. Contractor shall deliver this extra stock to a location at the Owners direction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Johnsonite
 - 2. Roppe Corporation
 - 3. Mercer Products Company
 - 4. Flexco

2.02 COLORS

- A. Colors: As selected by Architect from manufacturer's full range.

2.03 RESILIENT WALL BASE

- A. Wall Base:
1. Description: Resilient wall base shall be manufactured from a homogeneous composition of polyvinyl chloride (PVC), high quality additives, and colorants designed to meet the performance and dimensional requirements of ASTM F 1861, Type TV, Group 1 (solid) Standard Specification for Resilient Wall Base.
 2. Type (Material Requirement): TV (Vinyl).
 3. Style: Cove (with top-set toe).
 4. Minimum Thickness: 0.125 inch minimum.
 5. Heights: As indicated on Finish Schedule.
 6. Lengths: Coils in manufacturer's standard length.
 7. Outside Corners: Job formed.
 8. Inside Corners: Job formed.
 9. Hardness: ASTM D 2240, Shore A, not less than 90.
 10. Fire Resistance:
 - a. ASTM E 84/NFPA 255 (Steiner Tunnel Test) – Class C.
 - b. ASTM E 648/NFPA 253 (Critical Radiant Flux) – Class 1.
 - c. ASTM E 662/NFPA 258 (Smoke Density) – 450 or less.
 11. Surface: Smooth.
 12. Flexibility: Will not crack, break, or show any signs of fatigue when bent around a 1/4" diameter cylinder.
- B. Description: Reducer strip for resilient floor covering, or similar transitions of flooring materials.

2.04 INSTALLATION MATERIALS

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

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates to receive new flooring material.

1. Due to some of the existing floor conditions, all floor prep required to all concrete slabs are the responsibility of the flooring contractor.
- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
1. Do not install resilient products until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

- A. Resilient Wall Base
1. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 2. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 3. Install on solid substrate backing.
 4. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 5. Scribe to door frames and other interruptions.
 6. Do not stretch wall base during installation.
 7. Align tops of adjacent sections.
 8. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
 9. Job-Formed Corners:
 - a. Outside Corner: Wrap base around corner after using cove base groover tool to make V-shaped vertical cut in back of base at corner without removing more than half of the wall base thickness. Form without producing discoloration (whitening) at bends.
 - b. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum surfaces thoroughly.
 3. Damp-mop surfaces to remove marks and soil.
 4. Re-install loose products.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION

SECTION 09 77 01 - FRP WALL LINER PANEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. FRP wall liner panels.
 - 2. Moldings, adhesives and accessories.
- B. Refer to Room Finish Schedule for locations of FRP wall liner panel.

1.03 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.04 SUBMITTALS

- A. In accordance with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Furnish product data sheets, including installation instructions, for review.

1.05 DELIVERY, STORAGE & HANDLING

- A. Deliver materials in original packages or containers bearing brand name and identification of manufacturer.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from one of the following:
 - 1. NUDO Products, Inc.
 - 2. Marlite
 - 3. Kemlite Company, Inc.
 - 4. Or Architect Approved equal.

2.02 FRP WALL LINER PANELS

- A. Basis-of-Design Product: "Fiber-Lite .090 Liner Panel" as manufactured by NUDO Products, Inc.; Product No. LP-F9. Color to be selected from manufacturer's full range available.

2.03 ADHESIVES

- A. Laminating Adhesive:
1. FRP panel manufacturer's recommended type for substrates involved.
- B. Silicone Sealant:
1. Silicone sealant as recommended by manufacturer.

2.04 MOLDINGS

- A. Vinyl Moldings for .090 Panel:
1. Cap: Product No. V-1 (NUDO Products, Inc.)
 2. Division Bar: Product No. V-3 (NUDO Products, Inc.)
 3. Inside Corner & Cove: Product No. V-5 (NUDO Products, Inc.)
- B. Color to be selected from manufacturer's full range available.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates to which RFP panels attach to or abut, with installer present for compliance with requirements for installation tolerances and other conditions affecting performance of the installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 CONDITIONING

- A. Panels should be opened and allowed to acclimate for 48 hours prior to installation.

3.03 INSTALLATION

- A. Install all panels in strict accordance with manufacturer's printed installation instructions. All trim molding must provide for a minimum 1/8" expansion space to insure proper installation.

3.04 CLEANING

- A. Wipe down panels using a damp cloth and mild soap solution or cleaner. Refer to the manufacturer's specific cleaning recommendations. Do not use abrasive cleaners.

END OF SECTION

SECTION 09 90 00 - PAINTS AND COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes surface preparation and field application of paints, stains, varnishes for the following:
 - 1. Exposed interior and exterior items and surfaces.
 - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

1.03 RELATED SECTIONS

- A. Related Sections:
- B. Section 04 20 00 – Unit Masonry
 - 1. Division 5 – Steel Framing
 - 2. Section 08 11 13 – Hollow Metal Doors and Frames
 - 3. Section 09 29 00 – Gypsum Board

1.04 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.05 REFERENCES

- A. ASTM International:
 - 1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 - 2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- B. Painting and Decorating Contractors of America:
 - 1. PDCA - Architectural Painting Specification Manual.
- C. SSPC: The Society for Protective Coatings:
 - 1. SSPC - Steel Structures Painting Manual.
- D. VOC emissions from adhesives and sealants must not exceed the VOC and chemical components limits of the LEED-NC, Version 2.2, Indoor Environmental Quality, Credit 4.2, Low-Emitting Materials: Paints & Coatings. This requirement shall supersede and take precedence over materials defined in this Section.

- E. VOC emissions from paints and coatings must not exceed the VOC and chemical components limits of the LEED-NC, Version 2.2, Indoor Environmental Quality, Credit 4.2, Low-Emitting Materials: Paints & Coating. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
 - 1. Interior paint: Comply with GS-11.
 - 2. Exterior paint: comply with OH EPA VOC.
- F. Ohio: New VOC (Volatile Organic Compounds) regulations for paints went into effect on 1/1/09 in Ohio. These regulations are similar to those that have been implemented in the The Ozone Transport Commission (OTC) regions. Under the new regulations, lower VOC limits will be in effect for 54 coatings categories, such as flats, non-flats, primers, stains, varnishes and industrial maintenance coatings. All coatings sold, specified for use or used within the regulated areas must comply with these VOC limits. For additional information on the new VOC regulations - EPA website at: epa.state.oh.us
- G. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.

1.06 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.07 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Furnish product data sheets, including installation instructions, for review.
- C. Certification: By the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- D. Samples:
 - 1. Submit two paper chip samples, 3 x 5 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
 - 2. Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 6 x 6 inch in size.
- E. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.
 - 2. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.08 QUALITY ASSURANCE

- A. Container Label: Include manufacturer's name, type of paint, brand name, project color designation, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- B. Qualifications:

1. Installer Qualifications: Company specializing in performing work of this section with minimum 5 years experience.
2. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.09 DELIVERY, STORAGE & HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 PROJECT CONDITIONS

- A. Do not apply finish coats until paintable sealant is applied.
- B. Back prime wood trim before installation of trim.
- C. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- D. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- E. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- F. Minimum Application Temperature for Varnish: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

1.11 PERFORMANCE REQUIREMENTS

- A. VOC Content: Determine VOC (Volatile Organic Compound) content of solvent borne and waterborne paints and related coatings in accordance with EPA Method 24 or ASTM D3960.
- B. VOC emissions from paints and coatings must not exceed the VOC and chemical components limits of the LEED-NC, Version 2.2, Indoor Environmental Quality, Credit 4.2, Low-Emitting Materials: Paints & Coating. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements.
 1. Interior paint: Comply with GS-11.
 2. Exterior paint: Comply with GS-11.
- C. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.12 EXTRA STOCK

- A. Deliver to the owner an extra stock of paint consisting of an additional 3 percent, but not less than one gallon of each color, type, and surface texture used. Such extra stock shall be tightly sealed in clearly marked. Obtain Owner's signature acknowledging receipt of extra stock and submit signed receipt to Construction Manager.
- B. Label each container with color, type, texture, room locations, and in addition to manufacturer's label.
- C. Contractor shall deliver this extra stock to a location at the Owners direction.

1.13 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
- B. See Division 1 – Warranties, for additional warranty requirements.
- C. Furnish five year manufacturer warranty for paints and coatings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of this specification, including VOC limits, provide products from one of the following manufacturers: (* Basis of Design).
1. Sherwin-Williams*
 2. ICI Paints
 3. Benjamin Moore & Co.
 4. Pittsburgh Paints

2.02 SCHEDULE - SHOP PRIMED ITEMS FOR SITE FINISHING

- A. Metal Fabrications Section 05 50 00: Exposed surfaces of lintels, roof ladders, elevator pit ladders, pipe railings, and bollards.
- B. Metal Stairs Section 05 51 00: Exposed surfaces of stringers, and exposed vertical risers.
- C. Metal Railings Section 05 52 00: Metal railings.

2.03 SCHEDULE - EXTERIOR SURFACES

- A. Preservation Treated Wood:
1. 1 Coat: A-100 Exterior Latex Wood Primer, B42W41; 1.4 mils dft/ct
 2. 2 Coats: Duration Exterior Latex Satin Coating; 2.8 mils dft/ct
- B. Cementitious Panels & Trim:
1. 1 Coat: Loxon Exterior Acrylic Masonry Primer, A24W300; 3.2 mils dft/ct
 2. 2 Coats: Duration Exterior Latex Satin Coating; 2.8 mils dft/ct
- C. Concrete Block (High Build Coating):
1. 1 Coat: S-W Loxon Acrylic Block Surfacer, LX01 Series (50-100 sq ft/gal)
 2. 2 Coats: S-W Loxon XP, LX11 Series (14.0-18.0 mils wet, 6.5-8.4 mils dry)
- D. Steel – Shop Primed:
1. Touch-Up: Pro-Cryl Universal Primer; 2 - 4 mils dft
 2. 2 Coats: Duration Exterior Latex Satin Coating; 2.8 mils dft/ct
- E. Steel – Galvanized:
1. 1 Coat: Pro-Cryl Universal Primer; 2 - 4 mils dft
 2. 2 Coats: Duration Exterior Latex Satin Coating; 2.8 mils dft/ct

2.04 SCHEDULE - INTERIOR SURFACES

- A. Wood - Painted:
1. 1 Coat: PrepRite Classic Primer; 1.6 mils dft
 2. 2 Coats: ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series; 1.6 mils dft/ct
- B. Medium Density Fiberboard (MDF):
1. 1 Coat: PrepRite ProBlock Latex Primer, B51 Series; 1.4 mils dft/ct
 2. 2 Coats: ProClassic Waterborne Acrylic Semi-Gloss, B31 Series; 1.4 mils dft/ct
- C. Wood – Transparent:
1. 1 Coat: Minwax 250 Stain

-
2. 2 Coats: Water based Polyurethane Varnish, A68 Series.
- D. Concrete Block:
1. 1 Coat: PrepRite Block Filler B25W25; 8 mils dft
 2. 2 Coats: ProMar 200 Zero VOC interior Latex Semi-Gloss; 1.6 mils dft/ct
- E. Steel – Primed (Hollow Metal Doors & Frames):
1. Touch-Up: Pro-Cryl Universal Acrylic Primer, B66-310 Series; 2 – 4 mils dft/ct
 2. 2 Coats: ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series; 1.6 mils dft/ct
- F. Steel Metal Deck – Primed only; NOT Galvanized
1. 1 Coat: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series; 2-4 mils dry
 2. 2 Coats: Waterborne Acrylic Egg-Shell Dry Fall, B42W2
- G. Steel Metal Deck – Galvanized
1. Clean Deck First: Use a Clean and Etch No Rinse Pre-Paint cleaner to clean galvanized roof deck. The deck needs to be free of the oily coating. Perform a calcium chloride test to ensure the deck is clean and ready for primer and paint.
 2. 1 Coat: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series; 2-4 mils dry
 3. 2 Coats: Waterborne Acrylic Egg-Shell Dry Fall, B42W2
- H. Metals (Aluminum, Zinc-Coated or Galvanized):
1. 1 Coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series; 2 – 4 mils dft/ct
 2. 2 Coats: ProClassic Waterborne Acrylic Semi-Gloss Enamel, B31 Series; 1.6 mils dft/ct
- I. Gypsum Board Walls:
1. 1 Coat: Harmony Interior Latex Primer; 1.3 mils dft
 2. 2 Coats: Harmony Interior Latex Eg-Shel; 1.6 mils dft/ct
- J. Gypsum Board Soffits & Ceilings:
1. 1 Coat: Harmony Interior Latex Primer; 1.3 mils dft
 2. 2 Coats: Harmony Interior Latex Flat; 1.6 mils dft/ct
- K. Gypsum Board (Under Vinyl Wall Covering):
1. 1 Coat: PrepRite Pre-Wallcovering Primer; 1-1.5 mils dft
- L. Existing Metal Labeled for Electrostatic Coating:
1. Two coats Poly-Epoxy Semi-Gloss Electrostatic Enamel @ 1.2-1.6 mil dft: 387-516 sq ft/gal
 2. Manufactured by SW
- M. Paint exposed surfaces, except where schedules indicate the surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item of a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color of finish, the Architect will select from standard colors or finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

2.05 ITEMS TO NOT BE PAINTED:

- A. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items not to be painted include the following factory-finished components:
 - a. Architectural woodwork and casework.
 - b. Acoustic materials.
 - c. Toilet enclosures.
 - d. Plastic laminate casework.
 - e. Finished mechanical and electrical equipment.
 - f. Light fixtures.
 - g. Distribution cabinets.
 2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Pipe spaces.
 - e. Duct shafts.
 3. Finished metal surfaces include the following:
 - a. Pre-finished aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper.
 - e. Bronze and brass.
 4. Operating parts not to be painted include moving parts of operating equipment such as the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 5. Labels: Do not paint over Underwriter's Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

2.06 COMPONENTS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
 2. For good flow and brushing properties.
 3. Capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
- C. Thinners, when used, shall be only those recommended for the purpose by the manufacture of the material to be thinned and also approved by the architect.

2.07 ACCEPTANCE OF SPECIFICATION

- A. By submitting a proposal, the Contractor has reviewed the bidding documents with the painting contractor and accepts the Specifications as sufficient to produce approved painting results. If

the painting sub contractor contends that the materials or number of coats specified will not produce satisfactory results, he shall so notify the Construction Manager directly or indirectly through the Bidding Contractor 10 days prior to respect of bids for proper action.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify surfaces are ready to receive work as instructed by product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. Test shop applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Plaster and Gypsum Wallboard: 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Concrete Floors: 8 percent.

3.02 PREPARATION

- A. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- B. Marks: Seal with shellac those which may bleed through surface finishes.
- C. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- D. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- E. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.
- F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry before painting.
- H. Copper Surfaces Scheduled for Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
- I. Copper Surfaces Scheduled for Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
- J. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- K. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- L. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- M. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- N. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or

- sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- O. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
 - P. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
 - Q. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
 - R. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.
 - S. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
 - T. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
 - U. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with tinted primer.
 - V. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.03 EXISTING WORK

- A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.04 APPLICATION

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
- C. Sand wood and metal surfaces lightly between coats to achieve required finish.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.
- F. Prime concealed surfaces of interior and exterior woodwork with primer paint.
- G. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.
- H. Finishing Mechanical And Electrical Equipment:
 - 1. Refer to Section 15075 and Section 16075 for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.
 - 2. Paint shop primed equipment. Paint shop finished items occurring at interior areas.
 - 3. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 4. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
 - 5. Paint interior surfaces of air ducts visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
 - 6. Paint exposed conduit and electrical equipment occurring in finished areas.
 - 7. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

8. Color code equipment, piping, conduit, and exposed duct work in accordance with color schedule. Color band and identify with flow arrows, names, and numbering.
9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

- A. The right is reserved by the Owner, Construction Manager and Architect to invoke the following material testing procedure when and as often as he deems necessary during the period of field painting.
 1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of contractor.
 2. Testing laboratory will perform appropriate tests for one of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, wash ability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance, and quantitative materials analysis.
 3. A test patch for adhesion may also be required. The procedure for the test patch is as follows:
 - a. An area that represents the worst condition of the existing paint is selected.
 - b. The surface is prepared as appropriate for the repaint work.
 - c. The new coating or coating system is applied. The coating is allowed to cure for at least 7 days at 75 degrees F. or according to the coating manufacturer's instructions.
 - d. After proper curing the adhesion is tested using an acceptable method such as the Adhesion by taped test (ASTM D 3359).
- B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove noncomplying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the 2 coatings are noncompatible.

3.06 CLEANING

- A. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.
- B. During the progress of work, remove from site all other rubbish created during the course of the painting work at the end of each day.
- C. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods and scraping, using care not to scratch or otherwise damage surfaces.
- D. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct damage by cleaning, repairing and repainting, as acceptable by Construction Manager and Architect.
- E. Provide "Wet Paint" signs as required to protect newly painted surfaces. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
- F. At the completion of work of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

**SECTION 10 28 13 - TOILET ACCESSORIES
(Café Building Only)**

PART 1 - GENERAL

1.01 SUMMARY

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. System Description:
 - 1. Section includes toilet accessories; shower accessories; and utility room accessories.
- B. Section includes, but is not limited to:
 - 1. Grab bars
 - 2. Soap dispenser
 - a. Wall mounted
 - 3. Trash receptacle
 - a. Free-standing trash receptacle
 - 4. Toilet tissue dispenser
 - a. Surface mounted toilet tissue dispenser
 - 5. Feminine Products
 - a. Recessed sanitary napkin disposal
 - 6. Hooks
 - a. Clothes hook
 - 7. Mop and broom holder
 - 8. Baby changing station
 - 9. Lighted Mirrors
- C. See drawings for location, this includes BUT NOT LIMITED TO the following:
 - 1. A101-C Floor Plan (Enlarged plan details)
 - 2. A103-C Finish Plan (Interior elevations)

1.03 RELATED SECTIONS

- A. Related Sections
 - 1. Division 26 – Electrical

1.04 REFERENCES

- A. ASTM International:

1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 7. ASTM C1036 - Standard Specification for Flat Glass.
- B. Federal Specification Unit:
1. FS A-A-3002 - Mirrors, Glass.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: Furnish product data sheets, including installation instructions, for review.
- C. Close-Out Document Submittals
1. Warranty: Signed warranty.
 2. Baby Changing Station Warranty: Submit manufacturer's 5-year limited warranty on materials and workmanship and 5- year replacement warranty against vandalism agreeing to repair or replace unit that fails to perform as intended from date of substantial completion.
 3. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer Qualifications: Minimum five (5) years documented experience producing products specified.

1.08 DELIVERY, STORAGE & HANDLING

- A. Ship products in manufacturer's standard protective packaging with vinyl coating on exposed surfaces.
- B. Storage and Protection: Store products in manufacturer's protective packaging until installation.

1.09 COORDINATION

- A. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.10 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
B. See Division 1 – Warranties, for additional warranty requirements.
C. Manufacturer's standard warranty against defects in product workmanship and materials.
D. Mirrors: Manufacturer's 15-year warranty against silver spoilage of mirrors.
E. Baby Changing Station Warranty: Manufacturer's 5-year limited warranty on materials and workmanship and 5- year replacement warranty against vandalism agreeing to repair or replace unit that fails to perform as intended from date of substantial completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers:
1. Bobrick Washroom Equip., Inc.
 2. Basis-of-design products are Bobrick Washroom Equipment, Inc
 3. American Specialties, Inc.
 4. Bradley Corp.
 5. Elcoma Metal Fabricating (grab bars only).
 6. Accessory Specialties, Inc.
- B. Toilet Accessories
1. General: Provide toilet accessories as indicated or scheduled. Install units at locations and heights as indicated, plumb and level, firmly anchored, in accordance with manufacturer's written instructions. If mounting height is not indicated, confirm with Architect prior to installation.
- C. Fabrication
1. General: Stamped names or labels on exposed faces of toilet accessory units are not permitted. Wherever locks are required for particular type of accessory, provide same keying throughout project. Furnish two keys for each lock, properly identified.
- D. Grab Bars
1. Provide stainless steel grab bars with wall thickness not less than 18 gage and as follows:
 - a. Mounting: Concealed.
 - b. Gripping Surface: Manufacturer's standard non-slip texture.
 - c. Size: Outside diameter 1-1/2 inch by dimensions indicated.
 - d. Product: Bobrick B-6806 series of configuration and dimensions shown; or, subject to compliance with requirements, equivalent products of other approved mfrs.
- E. Soap Dispensers:
1. Wall Mounted:
 - a. Auto Operated Liquid soap dispenser; surface mounted, stainless steel construction with refill window and 27 fl. oz. capacity.
 - b. Product: Bobrick B-2013; or, subject to compliance with requirements, equivalent products of other approved mfrs.

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- F. Trash Receptacles
1. Free-standing Trash Receptacle
 - a. Waste Receptacle — 18-8 S, type-304, 16-gauge (1.6mm) stainless steel with satin finish. All-welded construction. 1/2" (13mm) recessed bottom equipped with four 1-1/2" (40mm) diameter x 3/4" (19mm) high, heavy-duty rubber feet.
- G. Toilet Tissue Dispenser
1. Surface Mounted Toilet Tissue Dispenser
 - a. Jumbo-roll toilet tissue dispenser door and cabinet shall be type-304 stainless steel with satin-finish: door shall be 18 gauge (1.2mm); cabinet shall be 20 gauge (1.0mm). Cabinet shall be equipped with a tumbler lock keyed like other Bobrick washroom accessories. Door shall have a wide viewing slot to reveal toilet tissue supply inside cabinet. Dispensing mechanism shall be constructed of high-impact ABS shall accommodate two toilet tissue rolls up to 10" (255mm) diameter with 3" (75mm) diameter core; and be equipped with a sliding access panel that exposes one roll at a time. Spindles shall be convertible in the field to dispense 2-1/4" (55mm) diameter core rolls by removing outer spindles furnished in-place.
 - 1) Product: Bobrick B-2892; or subject to compliance with requirements, equivalent products of other approved mfrs.
- H. Feminine Products
1. Sanitary Napkin Disposal (Recessed)
 - a. Recessed sanitary napkin disposal shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Door shall be secured to cabinet with a full-length stainless steel piano-hinge and equipped with a tumbler lock keyed like other Bobrick washroom accessories. Unit shall have a self-closing panel covering disposal opening. Panel shall have bottom edge hemmed for safety, be secured to door with a spring-loaded, full-length stainless steel piano-hinge, and equipped with an international graphic symbol identifying sanitary napkin disposal. Unit shall be furnished with a removable, leak-proof molded polyethylene receptacle. Receptacle shall have a capacity of 1.2-gal. (4.6-L)
 - b. Product: Bobrick B-353; or, subject to compliance with requirements, equivalent products of other approved mfrs.
- I. Hooks:
1. Robe Hook
 - a. Coat Hook shall be stainless steel with satin finish, Flange is 2"x2", projects 1-5/8" from wall.
 - 1) Product: Bobrick B-76717; or subject to compliance with requirements, equivalent products of other approved mfrs.
- J. Mop and Broom Holder
1. Mop and Broom Holder shall be type 304, 22-gauge stainless steel satin finish; Anti-slip mop holders have spring load rubber cam that grip handles
 - a. Product: Bobrick B-223x36; or subject to compliance with requirements, equivalent products of other approved mfrs.
- K. Stainless Steel Shelf
1. Shelf shall be 18 gauge, type 304 stainless steel with satin finish, 5" wide x 18" long, 3/4" return edges, front edge is hemmed for safety. Brackets are 16 gauge

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- a. Product: Bobrick B-295; or subject to compliance with requirements, equivalent products of other approved mfrs.
- L. Baby Changing Station
- 1. Horizontal Mounted Design Model KB110-SSRE as manufactured by Koala Kare Products, a Division of Bobrick, Englewood, CO, 877-284-3906
 - 2. Sanitary Liner Refills: Case of 500 absorbent paper liners with soil-resistant plastic backing. (KB150-99)
 - 3. Materials:
 - a. Materials/Finishes: 18 gauge, type 304 satin stainless steel exterior finish with grey polyethylene interior.
 - b. Hinges: reinforced, full-length steel-on-steel.
 - c. Mounting supports: multiple, 11-gauge steel.
 - d. Operation: hidden pneumatic gas spring mechanism for safe open/close motions.
 - 4. Accessories:
 - a. Integral, built-in Liner Dispenser for use with 3-ply chemical-free biodegradable 13" x 19" sanitary liners.
 - b. Replaceable snap-lock protective holding straps.
 - c. Molded graphic instructions and safety messages in 6 languages and Braille. Identifying door plaque.
 - d. Optional antimicrobial polyethylene.
- M. Lighted Mirrors
- 1. LED Lighted Mirror Fixture; forward facing task lighting combined with halo of soft, ambient light on all four sides.
 - a. Product: Electric Mirror 6101 Associated Blvd, Suite 101 Everett, WA 98203; www.electricmirror.com; or, subject to compliance with requirements, equivalent products of other approved mfrs.
 - 1) Novo Model NOV2-36.00x42.00-L7CSDH-WG2-30K
 - 2) 36"W x 42" x 1.75"D
 - 3) 120 VAC, 120W
 - 4) Replacement LEDs
 - 5) CCT 3,000 kelvin

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Prepared openings are sized and located in accordance with shop drawings. Reinforcement and anchoring devices are correct type and are located in accordance with shop drawings.
- B. Installer's Examination:
 - 1. Installer shall examine conditions under which construction activities are to be performed, then submit written notification if such conditions are unacceptable. Transmit two copies of installer's report to Construction Manager within 24 hr of receipt. Installation activities before unacceptable conditions have been corrected is prohibited. Installation indicates installer's acceptance of conditions.

3.02 INSTALLATION

- A. Verify locations of all toilet accessories with Owner prior to installation.
- B. Install toilet accessories plumb and level in accordance with shop drawings and manufacturer's printed installation instructions.
- C. Locate toilet accessories at heights specified by Americans with Disabilities Act.
- D. Dispensers and cabinets shall be installed with screws, cement or clamps, as applicable. Provide solid blocking backup behind all fixtures.

3.03 CLEANING

- A. Remove manufacturer's protective vinyl coating from sight-exposed surfaces 24 hours before final inspection.
- B. Clean surfaces in accordance with manufacturer's recommendations.

3.04 PROTECTION OF INSTALLED PRODUCTS

- A. Protect products from damage caused by subsequent construction activities.
- B. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.

END OF SECTION

SECTION 10 81 11 - ELECTRIC HAND DRYERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Warm air, self-contained electric hand dryers

1.03 RELATED SECTIONS

- A. Related Sections:
 - 1. Division 26 - Electrical

1.04 REFERENCES

- A. ASTM International:
 - 1. ICC/ANSI A117.1 - American National Standard for Accessible and Useable Buildings and Facilities; 1998.

1.05 BID REQUIREMENTS

- A. If Contractor discovers an apparent conflict or discrepancy between portions of the Contract Documents that appears to be inconsistent or is not reasonably inferred from the intent of the Contract Documents, the Contractor shall include in their bid the most stringent and demanding, or highest cost requirement.
- B. Pre-Bid Exceptions: If, for any reason, you deem the designed system is not appropriate or feasible, submit this concern, proposed modification, qualification and / or exception to the drawings and specifications with your bid proposal.

1.06 SUBMITTALS

- A. In accordance with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Furnish product data sheets, including installation instructions, for review.
- C. Shop Drawings: Shop Drawings showing dimensions, method of attachment, and required supports.
- D. Wiring Diagrams: Electrical wiring diagrams for connection of hand dryers.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- F. Upon Architect's Request:
 - 1. Sample Warranty: Sample copy of manufacturer's warranty.

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- G. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.
 - 2. Operations & Maintenance Data: Operation & maintenance instructions. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.07 QUALITY ASSURANCE

- A. Equipment certified by Underwriters Laboratory, Inc., with UL labels.
- B. Comply with ICC/ANSI A117.1.
- C. Qualifications:
 - 1. Manufacturer Qualifications: Minimum ten (10) years documented experience producing products specified.

1.08 DELIVERY, STORAGE & HANDLING

- A. Ship products in manufacturer's standard protective packaging with vinyl coating on exposed surfaces.
- B. Storage and Protection: Store products in manufacturer's protective packaging until installation.

1.09 COORDINATION

- A. Coordinate the Work with placement of internal wall reinforcement to receive anchor attachments.

1.10 WARRANTY

- A. See Section 01 77 00 – Closeout Procedures, for additional close out submittal information.
- B. See Section 01 78 36 – Warranties, for additional warranty requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Excel Dryer, Inc.
 - 2. American Dryer
 - 3. SaniFlow
- B. Basis-of-design products is the Xlerator by Excel Dryer, Inc.

2.02 ELECTRIC HAND DRYER

- A. Hand Dryer: Warm air, rapid drying electric hand dryer; Xlerator; surface mounted; entire dryer internally grounded.
 - 1. Warranty Period: 5 years; limited warranty.
 - 2. Controls: Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed, or in 35 seconds if hands not removed.
 - 3. Cover: One piece, vandal resistant, fiberglass reinforced white resin (Bulk Molding Compound).

4. Image: Custom digital image as selected by Architect.
5. Air Intake: Inlet openings on bottom of cover.
6. Air Outlet: Delivers focused air stream at average hand position of 4 inches (102 mm) below air outlet.
7. Noise Reduction Nozzle: 1.1 noise reduction nozzle.
8. Wall Plate: Injection molded, rib reinforced plate with metal L brackets to attach cover, with ten 5/16 inch (8 mm) diameter holes for surface mounting to wall and three 7/8 inch (22 mm) diameter holes for electrical wiring; bottom hole suitable for surface conduit.
9. Nominal Size: 11-3/4 inches (298 mm) wide by 12-11/16 inches (322 mm) high by 6-11/16 inches (170 mm) deep. Weight: 16 pounds (7.3 kg).
10. Power Source: 110/120 volt, 12.5 amp, 60 Hz
11. Combination Motor and Blower: Series commutated, through-flow discharge, vacuum type; 5/8 HP, 20,000 RPM. Air flow rate: 16,000 linear feet per minute (81 meters per second) at air outlet, 14,000 linear feet per minute (71 meters per second) at average hand position of 4 inches (102 mm) below air outlet.
12. Heater: Nichrome wire element, mounted inside blower housing to be vandal proof.
13. Heater Safeguard: Automatic resetting thermostat to open when air flow is restricted and close when air flow is resumed.
14. Air Temperature: 135 degrees F (55 degrees C) measured at average hand position of 4 inches (102 mm) below air outlet. Air Heater Output: 900 watts.
15. All metal parts coated according to Underwriters Laboratories, 1nc. requirements.
16. Mount at the following heights above floor surface:
 - a. ADA Height: 37 inches (940 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 1. Do not begin installation until substrates have been properly prepared.
 2. If substrate preparation is the responsibility of another installer, notify the Construction Manager of unsatisfactory preparation before proceeding.
- B. Installer's Examination:
 1. Installer shall examine conditions under which construction activities are to be performed, then submit written notification if such conditions are unacceptable. Transmit two copies of installer's report to Construction Manager within 24 hr of receipt. Installation activities before unacceptable conditions have been corrected is prohibited. Installation indicates installer's acceptance of conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install dryers at specified heights.
- C. Install dryers securely to supporting substrate so that fixtures are level and aligned with each other. Use type and length of fastener as recommended by manufacturer for type of substrate.

3.03 CLEANING

- A. Remove manufacturer's protective vinyl coating from sight-exposed surfaces 24 hours before final inspection.
- B. Clean surfaces in accordance with manufacturer's recommendations.

3.04 PROTECTION OF INSTALLED PRODUCTS

- A. Inspect installation to verify secure and proper mounting. Test each dryer to verify operation, control functions, and performance. Correct deficiencies. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.
- B. Protect installed driers until completion of project.
- C. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 82 00 – LOUVERED ROOF TOP EQUIPMENT SCREENS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions.
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. Section includes, but is not limited to:
 - 1. Installation of pre-finished louvered mechanical screen assembly
 - 2. Structural connection to support steel provided
 - 3. Access entry assembly

1.03 RELATED SECTIONS

- A. See Division 5 Section "Structural Metal Framing" for structural framing supporting louver sections

1.04 PERFORMANCE REQUIREMENTS

- A. Design: Design louvers, including comprehensive engineering analysis by a qualified engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 30 lb./sq. ft. (1435 Pa), acting inward or outward.

1.05 SUBMITTALS

- A. In accordance with Division 1 – Submittal Procedures.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For equipment screens and accessories.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show frame profiles and blade profiles, angles, and spacing.
- D. Deferred Engineering Submittal:
 - 1. Submit to Architect the design shop drawings stamped by Ohio licensed Engineer. Shop drawings shall include all design calculations, details, methods and connections that indicate compliance with performance requirements stated within this Section and compliance with design loads required in the 2017 Ohio Building Code.
- E. Samples: For each type of metal finish required.
- F. Warranty: Submit specified warranties

- G. Close-Out Document Submittals
 - 1. Warranty: Signed warranty.
 - 2. Operations & Maintenance Data: Maintenance instructions.

1.06 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Provide curtainwall systems that are products of a single manufacturer.
- B. Qualifications:
 - 1. Engineer Qualifications: Professional Structural Engineer registered in State where Project is located.
 - 2. Installer Qualifications: Certified in writing by system manufacturer as qualified for specified systems.

1.07 COORDINATION

- A. Pre-installation Meeting:
 - 1. Arrange with Construction Manager, Architect and representatives of window and sealant manufacturer to visit Project site [factory] before beginning glazing operations to analyze site conditions, and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
 - 2. Discuss following items:
 - a. Weather conditions under which work will be done.
 - b. Connections to supporting frame work.
 - c. Conditions of project at time of installation.
 - d. Overhead hoisting requirements and project site conditions.
 - e. Warranty, touch-up materials and close-out procedures

1.08 WARRANTY

- A. See Division 1 – Closeout Procedures, for additional close out submittal information.
- B. See Division 1 – Warranties, for additional warranty requirements.
- C. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be free from defective materials, defective workmanship and agreeing to replace components which fail within 1 year from date of Substantial Completion.
- D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 5 years from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

2.01 MANUFACTURES

- A. Accepted Manufacturers (* indicates the basis of design)
 - 1. Architectural Louvers Co. (Harray, LLC)*
 - 2. Industrial Louvers, Inc.
 - 3. Roof Screen Manufacturing
 - 4. Or Architect approved equal

2.02 MATERIALS

- A. Aluminum Extrusions: ASTM B 221M, Alloy 6063-T5.
- B. Aluminum Sheet: ASTM B 209M, Alloy 3003 with temper as required for forming.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 2. FABRICATION, GENERAL
- D. Join concealed frame members to each other and to fixed louver blades with fillet welds concealed from view 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.

2.03 EXTRUDED-ALUMINUM ROOF TOP EQUIPMENT SCREEN

- A. Horizontal Blade Louvered Roof Top Equipment Screen
 - 1. Basis-of-Design Product: Architectural Louvers Co. (Harray, LLC); Model V2KS. Subject to compliance with requirements, provide the specified product or comparable product by one of the following:
 - a. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.
 - 2. Louver Blade Depth: 2 inches (50 mm)
 - 3. Blade Profile: Plain blade with center baffle.
 - 4. Blade Nominal Thickness: Not less than 0.063 inch (1.6 mm).
 - 5. Framing Support Nominal Thickness: Not less than 0.125 inch (3.2 mm)
 - 6. Louver Performance Requirements:
 - a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver assembly.
 - b. Horizontal Drag Coefficient: Not greater than 0.66 on a cross sectional profile, allowing for a 34% reduction in wind load imposed horizontally upon supporting structural framing.

2.04 ALUMINUM FINISHES

- A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.
 - a. Standard Kynar color – Dark Bronze

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Locate and place equipment screens 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 weather-tight connection.
- C. Provide perimeter reveals and openings of uniform width to allow for thermal expansion, as indicated.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

END OF SECTION

SECTION 20 05 00 - GENERAL REQUIREMENTS

A. General

1. Specifications are applicable to all contractors and/or subcontractors for all mechanical systems in Divisions 01, 20, 22, and 23.
2. This contractor is also referred to the architectural, structural, electrical and all other drawings and specifications pertinent to this project and fully coordinate with all other trades, owner and architect requirements. All of the above-mentioned drawings and specifications are considered a part of the contract documents.
3. Conform to all Instructions to Bidders, general and special conditions of contract as specified by architect and/or owner.
4. Before submitting a bid, each contractor is requested to visit the job site to familiarize themselves with construction condition, check facilities and conditions and make all necessary observations and measurements. Note conditions under which work is to be performed and take all items into consideration in bid. No consideration will be given for his failure to do so.
5. Systems are to be complete and workable in all respects, placed in operation and properly adjusted.
6. Each contractor shall provide for his own clean up, removal and legal disposal of all rubbish daily.
7. Each contractor shall protect his work, his existing and adjacent property against weather.
8. Each contractor shall protect his work, materials, apparatus and fixtures from damage. Any work damaged by failure to provide protection required, shall be removed and replaced with new material at the contractor's expense.
9. Each contractor must confirm all utility company requirements and connection points in field, prior to starting work. Each contractor shall include cost of utility companies work in their bid.
10. Each contractor must confirm size, location and materials at point of tie in connections in the field prior to rough-in of new work.
11. Arrange for and obtain owner's and insurance representative's permission for any service shutdowns.
12. Each contractor shall be solely responsible for construction means, methods, sequences of construction and the safety of workmen.
13. No piping, ductwork, wiring, etc., shall be installed or routed above or below electrical panels and equipment, through elevator equipment rooms or elevator shafts or stairways unless these items serve these areas only.
14. All contractors shall coordinate with the electrical contractor and obtain a written approval identifying the electrical characteristics of all mechanical equipment prior to ordering of equipment. No additional payment will be made for lack of contractor coordination of electrical characteristics.
15. Each contractor shall include modifying existing conditions to complete the project. During construction, the contractors may uncover an existing condition that will have to be modified. Any such work which comes under the jurisdiction of this contractor shall be done by this contractor without extra cost to the owner and project.
16. Work related to the existing building shall be coordinated to minimize interference or interruption of normal building use by the owner. Refer to architectural plans for phasing requirements.
17. Ceiling grid systems shall not be supported from ductwork, heating or plumbing lines or any other utility lines, and vice versa. Each utility and the ceiling grid system shall be a separate installation and each shall be independently supported from the building structure – concrete, steel or masonry. Where interferences occur, in order to support ductwork, piping, ceiling grid systems, etc., trapeze type hangers or supports shall be employed which shall be located so as not to interfere with access to such mechanical equipment as valves, regulators, mixing boxes, fire dampers, etc.

Work Coordination and Scope

1. Each contractor under this division shall familiarize himself with the work to be done under other divisions of this specification and their related drawings and shall so coordinate and schedule his work as not to cause delays or interference with the work of others. Such coordination and scheduling shall accomplish the installation of mechanical and plumbing equipment and piping with a minimum of cutting through masonry and other adjustments.
2. Work included under this division shall consist of furnishing all materials, supplies, equipment, tools, transportation and facilities and performing all labor and services necessary for the complete installation of the mechanical systems of plumbing, heating, ventilating, air conditioning, and specialty systems.
3. The contractor under this division shall report discrepancies in the work of others which affect his work. Any changes made necessary by failure or neglect to report such discrepancies shall be made by and at the expense of the contractor of this division. Obtain written instructions for changes necessary to accommodate work of others.
4. The contractor under this division shall be responsible for proper size and location of anchors, chases, recesses, opening, etc., required for the proper installation of his work.
5. The division of responsibility under separate mechanical, and plumbing contracts for tie-in points shall be as follows:
 - a. The plumbing contractor shall provide domestic water and gas to within five feet (5'-0") of equipment connection furnished by the mechanical or electrical contractor, final connection by mechanical or electrical contractor. On the water lines, the plumbing contractor shall provide the shut-off valve, check valve, backflow preventor and pressure regulator. On the gas lines, the plumbing contractor shall provide the shut-off valve and pressure regulator.
 - b. Plumbing contractor shall run the gas, water, and sanitary to 5'-0" outside the building or to points as noted on the drawings.
 - c. Plumbing and mechanical contractor shall provide sleeves to the general contractor for placement in floors, walls, etc. and coordinate such location. The plumbing contractor shall be responsible for flashing at vent roof terminals.
 - d. The plumbing and mechanical contractor shall check with the architectural drawings concerning the test borings to determine areas of rock which should be included in his excavation work. Failure to adjust for rock conditions shall not warrant cause for additional compensation.
 - e. The plumbing contractor shall rough-in and connect all other fixtures and equipment where shown on the drawings but not previously mentioned. Provide with shut-off valves and p-traps with clean-out plug.
 - f. Unless responsibility to provide or furnish is otherwise stated on the electrical or mechanical drawings and electrical and mechanical specifications the contractor, under these divisions shall provide motors, special controls, disconnects, transformers, starters and relays as required for the proper operations of all equipment furnished under this division. All electrical equipment shall conform to requirements set forth under the electrical division and be suitable for operation on 60 cycle current available at the site.
6. Each contractor shall provide OSHA approved handrail (Guard) system for all roof mounted equipment within 10'- 0" of roof edge where the roof edge does not have a 42" high parapet or higher.

B. Codes, Permits, Standards and Regulations

1. Contractors shall install work in full accordance with rules and regulations of all applicable codes (local, city, county, state, national codes, NFPA, OSHA, etc.), government regulations, utility company requirements, and applicable standards having jurisdiction over premises. This shall include safety requirements of the state department. Do not construe this as relieving contractor from compliance with any requirements of specifications which are in excess of code requirements and not in conflict therewith.
2. Contractors shall secure and pay for all fees, permits, and certificates of inspection incidental to this work required by foregoing authorities. Arrange for all required inspections and approvals.
3. Contractor shall be responsible for payments to all public utilities for work performed by them in connection with provision of service connections required under this division of specifications.
4. Deliver all permits and certificates to architect in duplicate.

Design Drawings

- a. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, piping and ductwork unless dimensions are given. Piping and ductwork are to be installed along the general plans shown on the drawings while conforming to actual building conditions. Each contractor shall confirm all dimensions by field measurement.
- b. Before entering into a contract, the successful bidder may be required to submit satisfactory evidence to show that the manufacturer of all parts of the equipment offered have been regularly engaged in the manufacture of such equipment for three (3) years and have not less than three (3) installations of a similar type which have been in successful operation under conditions similar to those specified for not less than two (2) years.
- c. All equipment, piping and material specified herein after as shown on the drawings shall be furnished and installed by the contractor, unless specifically indicated to the contrary. Installation shall comply with all required "Building Codes" and "Reference Standards."
- d. If this contractor proposes to install equipment requiring space conditions other than those as specified and/or shown on the design drawings, or to rearrange the equipment, he shall assume full responsibility and submit drawings for the rearrangement of the space and shall obtain the full approval of the architect prior to start of any work.
- e. The exact locations for fixtures, equipment and piping which is not covered by drawings shall be obtained from the architect or his representative in the field and the work shall be laid out accordingly.
- f. Drawings and specifications are intended to supplement one another. Any materials or labor called for in one but not the other shall be furnished as if both were mentioned in the specifications and shown on the drawings.

C. Base Bid Equipment, Materials and Substitutions

1. All equipment and materials shall be new, free of defects and UL labeled.
2. Base bid manufacturers are included in the specification or listed in schedules on the drawings. All other manufacturers are considered substitution.
3. The name or make of any article, device, material, form of construction, fixture, etc., stated in this specification, whether or not the words "or approved equal" are used, shall be known as a "standard".
4. All cost shall be based on "standards" specified.
5. The equipment schedules on the drawings indicate manufacturer and their equipment model numbers that this design has been based on. Each contractor is required to bid upon the basis of design and furnish the makes specified.
6. Where more than one make or name is mentioned as being acceptable, it shall be understood that only the name or make referring to the manufacturers model numbers or sizes shall be considered the "Specified Standards." It shall be further understood that

other makes and names, even though mentioned, have not been checked for detail and that their size and arrangement are the contractor's responsibility the same as a proposed substitute item. The use of other manufacturer's equipment that is listed as acceptable alternates that entails general trades, structural, mechanical, electrical, etc., revisions is this contractor's responsibility to provide revisions. Any additional cost of such changes shall be paid by the contractor submitting the acceptable alternates which necessitates changes in installing such submitted alternate equipment, even though such costs may be part of another division of work.

7. Bids concerning the use of substitute products must be accompanied by complete specifications and performance characteristic covering these products. Contractor shall provide all available test data and experience records which may be helpful to the architect in evaluating the quality and/or suitability of alternate products.
8. Contractor is also invited to bid on any other similar products the contractor desires to propose as substitutions, stating any difference in cost (add or deduct from base bid cost) for each proposed substitution on the substitution sheet. If the architect decides to accept any of the proposed substitutions, proper notations thereof shall be made in the written contract. Where several makes are mentioned in the specifications and the contractor fails to state that he prefers a particular make in his bid, the owner shall have the right to choose any of the makes mentioned without change in price. No consideration will be given to proposals for alternative products unless submitted with the original bids.
9. Substitutions are subject to the approval of the owner. If a substitution is submitted, it is the contractor's responsibility to evaluate it and certify that the substitution is equivalent in all respects to the base specifications.
10. If substitutions are approved, notify all other contractors, subcontractors, etc., affected by the substitution and fully coordinate with them. Any costs resulting from substitution, whether by this contractor or others, shall be the responsibility of and paid for by the substituting contractor. Approved shop drawings do not absolve this contractor from this responsibility.
11. All equipment shall be installed in full accordance with the manufacturer's data and installation instructions and service clearances. It is this contractor's responsibility to check and confirm these requirements prior to starting of any work.

Warranty

- a. Fully warrant all materials, equipment and workmanship and the successful operation of all equipment and apparatus installed by this contractor for one (1) year from date of final acceptance.
- b. Extend all manufacturers' warranties to owner; including five (5) year compressor and ten (10) year heat exchanger extended warranty on HVAC equipment to include material and labor.
- c. Repair or replace without material and labor charge to the owner all items found defective during the warranty periods. In the case of replacement or repair due to failure within the warranty period, the warranty on that portion of the work shall be extended for a minimum period of one (1) year from the date of such replacement or repair.

D. Shop Drawing Submittals

1. Submit shop drawings for mechanical, plumbing, and control systems; including but not limited to sheetmetal, plumbing fixtures and equipment with adequate details and scales to clearly show construction. Indicate the operating characteristics for each required item. Clearly identify each item on the submittal as to mark, location and use, using the same identification as provided on the construction documents.
2. Sheetmetal shop drawings shall be fully dimensioned and coordinated based on field verified building dimensions and clearances and architectural ceiling layouts. Indicate structural systems, lighting, ductwork and piping at all critical locations.

3. Contractor shall review and indicate his approval of each shop drawing prior to submittal for review. Shop drawings will not be reviewed by the engineer unless the contractor's approval is noted. Do not start work or fabrication until shop drawings have been reviewed by the engineer and returned to the contractor.
4. Submittals will be reviewed only for general compliance with the contract documents and not for dimensions or quantities. The architect and engineer will make every effort to detect and correct errors, omissions, and inaccuracies in such drawings, but the failure to detect errors, omissions, and inaccuracies shall not relieve the contractor of responsibility for the proper and complete installation in accordance with the intent of the contract documents. The submittal review shall not relieve the contractor of responsibility for purchase of any item in full compliance with the contract documents or its complete and proper installation.
5. Where submittals vary from the contract requirements, the contractor shall clearly indicate on submittal or accompanying documents the nature and reason for the variations.
6. Each manufacturer or his representative must check the application of his equipment and certify at time of shop drawing submittal that the equipment specified has been properly applied and can be installed, serviced and maintained where indicated on the drawings. Advise engineer in writing with submittal drawings of any potential problems. The manufacturer shall be responsible for any changes that might be necessary because of physical characteristics of equipment that have not been called to the engineer's attention at the time of submittal.
7. Submit a minimum of one (1) print and an electronic "pdf" of shop drawings to the architect. The architect and engineer shall review and return a pdf. The contractor shall distribute copies as required to properly conduct the work, including requirements of the operating manual.

Record Drawings

- a. Each contractor or subcontractor shall keep one (1) complete set of the contract drawings and equipment submittals on the job site on which he shall regularly record any deviations or changes from such contract drawings made during construction. All recording shall be done in color ink.
- b. These drawings shall record the installed location of all concealed equipment, piping, electric service, sewers, wastes, vents, ducts, conduit, etc., by measure dimensions to each such item from column centerlines or readily identifiable and accessible walls or corners of the building. Plans also shall show invert elevation of sewers and top elevation of all other below-grade lines.
- c. Record drawings shall be kept clean and undamaged and shall not be used for any purpose other than recording deviations from working drawings and exact locations of concealed work.
- d. After the project is completed, these drawings shall be scanned to an electronic "pdf" format and pdf and hard drawings shall be delivered to the architect in good condition, as a permanent record of the installation as actually constructed.

END OF SECTION

SECTION 20 05 10 - BASIC MATERIALS AND METHODS

- A. General
1. Provide all materials, labor, equipment, and accessories required to furnish and install the mechanical items identified in this section.
 2. This section includes basic mechanical materials and methods to complement other division sections in this specification and requirements indicated on the mechanical drawings.
- B. Interferences
1. Before installing any work, contractor shall see that it does not interfere with clearance required for finish on beams, columns, pilasters, walls, or other structural or architectural members, as shown on architectural drawings. If any work is so installed and it later develops that architectural design cannot be followed, contractor shall, at his own expense, make such changes in his work as architect may direct to permit completion of architectural work in accordance with plans and specifications.
 2. Install additional offsets on piping or ductwork where required to obtain maximum headroom or to avoid conflict with other work without additional cost to owner.
 3. Report any interferences between work under this division and that of any other contractors to architect as soon as they are discovered. Architect will determine which equipment shall be relocated, regardless of which was first installed, and his decision shall be final.
- C. Protection of Work and Property
1. The contractor shall be responsible for safeguarding work, property, and facilities against damage, both his own as well as others with which he may come into contact in the performance of his work.
 2. Stored materials shall be protected against damage from weather. Pipe, and duct openings shall be closed with caps or plugs during installation. All fixtures and equipment shall be covered and protected against damage. Any materials or equipment damaged at any stage in the construction shall be replaced or repaired. Final completion, all work shall be in a clean and unblemished condition.
 3. During construction, all return air ductwork and transfer air openings serving new and existing air handling equipment and/or adjacent tenant spaces shall be protected. Openings which need to remain active shall be covered and protected with MERV 8 filtration media; openings which can remain inactive during construction shall be covered with plastic sheathing and sealed air tight. Filter media shall be replaced regularly as required during construction in order to ensure adequate airflow through all required active openings. In addition, at the end of each phase of construction and at the end of the construction project, all filtration media within each piece of equipment serving the space shall be replaced.
- D. Excavation and Backfill
1. Perform all excavation and backfill required for installation of below-grade piping and ductwork.
 2. Excavate as required to install piping at required depth and pitch. Pipe to be laid on sand bedding to give uniform bearing along length of pipe (sand inside building and interlocking aggregate outside building).
 3. Backfill with bedding material to a minimum of 12" above top of pipe and compact. Balance of backfill in outdoor grass areas shall be clean earth up to 6" above surrounding grades. Backfill below finished floors shall be sand. Backfill outdoors under paving shall be interlocking aggregate and shall be compacted in maximum 10" layers.
 4. All other excavations shall be backfilled with clean earth, excluding rubbish and boulders. Backfill shall be thoroughly tamped and puddled.
 5. Patch floor and paving to match existing adjacent surfaces.

6. Backfilling shall not be done until pipe lines are properly tested in the presence of the architect and/or inspection of the government agency having jurisdiction.
 7. Control trench soil compaction during construction for compliance with the maximum density specified for the following areas:
 - a. Building slabs, walkways, roadways, or public thorough-fares; compact top 12" of subgrade and each layer of backfill for fill material at 95 percent density for cohesionless soils, and 90 percent density for cohesive soil material. Tests to be performed by an independent testing service, with the compliance report submitted to the architect.
 8. Pipe shall not be laid in water. Furnish all pumping equipment, power, temporary connections, etc., and do all pumping necessary to remove ground or casual water.
 9. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights as night.
 10. Repave all streets or sidewalks disturbed at this contractor's expense to recommendations, procedures and satisfaction of architect and authorities having jurisdiction.
- E. Supports and Hangers
1. Hangers and supports are to be provided to properly support, secure and align piping and to meet field conditions and as manufactured by Grinnell, Michigan Hanger or Caddy.
 2. All hangers, brackets, clamps, etc., shall be of standard weight steel. Perforated strap hangers shall not be used in any work. When two or more pipes are run parallel, they may be supported on unistrut-type trapeze hangers. Other hangers for pipe 3" in size and smaller shall be clevis. For pipe transporting medium above 150 degrees F and 4" in size and above, use pipe roll. Each hanger is to be sized to include pipe insulation saddle for protection.
 3. Where building service lines enter or leave building such as water, sewer, gas, etc., and are installed on filled earth, provide continuous support on a reinforced concrete beam furnished and installed under this division. Support beam on building and with vertical support down to foundation footing and on undisturbed earth at other end. Gas main shall enter building above grade.
 4. All vertical piping passing through floors shall be supported at the floor by a riser clamp.
 5. Isolate all copper lines from ferrous hangers or supports by using foil filler or vinyl tape.
 6. Spacing to comply with ASHRAE standards and code requirements.
- F. Pipe Sleeves, Floor and Ceiling Plates
1. All pipes passing through floors or masonry walls shall be provided with machine-cut schedule 40 pipe steel sleeves. The sleeves shall be so sized to allow at least 1/4" clearance between the inside sleeve wall and the pipe or insulation surface. Sheet metal sleeves shall not be used in this work. Pipe sleeves are to extend 2" above finished floor and sealed. Pipe sleeves are to be full wall thickness and sealed.
 2. Unused sleeves shall be plugged and finished to match adjoining surface.
- G. Escutcheons
1. Fit all pipe passing through walls, floors or ceilings in finished rooms with steel or brass escutcheons. Where surface is to receive a paint finish, make escutcheons prime painted; otherwise, make escutcheons nickel or chrome plated. Where piping is insulated, fit escutcheons outside insulation.
- H. Pipe Identification and Tags
1. Identify each pipe, valve and controls in equipment rooms, above accessible ceilings and in accessible shafts.
 2. Color code identification bands or marker backgrounds to identify contents of pipe with initials and direction of flow located near each valve and fitting, on both sides of pipe passing through walls and on long runs at not over 20'-0" intervals.

3. At place where pipe is to have marking, covered pipe shall be properly primed with clear lacquer. After marking is applied, coat with lacquer. Apply marking adjacent to valves and equipment at major changes in directions, where pipes pass through walls or floors.
 4. Each piece of equipment shall be identified by a number, together with a brief description of its purpose, e.g. "Air Handling Unit – East Lobby." Identification shall be embossed or engraved plastic or stamped brass strips firmly attached to the equipment or adjacent wall at the obvious location. The lettering for such strips shall be not less than 1/2" high.
 5. All valves shall be provided with brass numbered tags attached to handle with a brass chain or ring. Wiring of tags will not be acceptable. At the completion of the work, a reproducible valve schedule shall be provided. Three (3) copies of this shall be mounted in metal, glass covered frames where requested by the architect. The schedule shall give a description of the line or equipment controlled; the normal position, emergency and/or shutdown position and location given either by description or diagram.
 6. All controls, starters, switches, etc, shall be identified by embossed stencil or engraved plate as to purpose and/or equipment controlled. Control wiring shall be identified with program number and device it services.
- I. Access Panels
1. Each contractor shall be responsible for providing all required access panels necessary for his work. This includes any access panels required for HVAC, and plumbing. Each contractor shall also provide access panels for any existing conditions as required.
 2. Refer to architectural drawings and specifications for type of access panel and coordinate locations prior to any work.
 3. Contractor shall mark lay-in ceiling tiles, in a method approved by the architect, where access is required to such mechanical, and plumbing, equipment, valves, regulators, mixing boxes, fire damper, etc.
- J. Noise and Vibration Isolation
1. Furnish and install vibration isolating mountings to isolate from the structure, by means of resilient vibration and noise isolators, all mechanical equipment over 1 HP having rotating or reciprocating parts. Isolators shall be supplied by a single source, and shall be guaranteed by the manufacturer to provide isolation efficiencies in accordance with this specification. Selection shall be based on equipment purposed, power dissipated, frequency, weight distribution and nature of the building structure. Mountings shall be designed to permit attachment to the equipment base or pad and to the structure and shall be selected for uniform deflection allowing for unequal weight distribution.
 2. Selection shall be made by the manufacturer of the mountings to provide a transmissibility not exceeding 10 percent. This contractor shall provide inertia pads for equipment where called for on drawings or recommended by the manufacturer of the mountings. These shall consist of reinforced concrete pads of suitable shape, of weight 1-1/2 times the weight of the equipment and provided with weld plates or channels at the corners to which the mountings may be secured.
 3. Vibration or noise created in any part of the building by the operation of any equipment furnished and/or installed under this contract will be prohibited, and this contractor shall take all precautions by isolating the various items of equipment, pipe and sheet metal work form the building structure. The major items of equipment shall be isolated as called for on the plans and specified herein. The minor items shall be held the responsibility of this contractor.
 4. Piping and ductwork shall be supported independently of the mechanical equipment and shall be isolated as follows:
 - a. All suspended piping in the mechanical equipment and air handling rooms shall be supported from the overhead structure by threaded rods incorporating resilient hangers. The resilient hangers shall contain steel springs and precompressed molded fiberglass inserts, designed for static deflections of between 1" and 1-3/4" under operating conditions.

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- b. All floor supported piping and pipe hangers in the mechanical equipment rooms shall be mounted on steel spring vibration isolators in combination with precompressed molded fiberglass noise isolators, designed for minimum static deflections of 1".
 - c. Floor supported piping entering or leaving mechanical equipment outside the equipment room shall be mounted on steel spring vibration isolators in combination with precompressed molded fiberglass noise isolators, designed for minimum static deflections of 1" for the first three supports.
 - d. Flexible connections shall be used between air handling equipment and ductwork.
1. Isolation efficiency shall be based on the lowest operating speed of the supported equipment. The isolator manufacturer shall provide, as a part of his submittal data, and isolating efficiencies for the isolators supporting each piece of equipment. Isolators shall be manufactured by Consolidated Kinetics Corp., 401 Dublin Avenue, Columbus, Ohio, or Mason Industries, Inc., Hollis, New York.
- K. Expansion Joints
1. Expansion joints in piping for domestic water system 2-1/2" and below shall be Flexicraft ML loop stainless steel for steel and copper pipe or Flexonics model H, stainless steel bellows, internal guides, anti-torque device for steel pipe and model HB, bronze bellows, internal guides, anti-torque device for copper pipe; end connections to match corresponding pipe construction.
 2. Pipe alignment guide to be steel spider (copper clad for copper pipe) housed in a steel sleeve with feet for attachment to structure.
 3. Expansion loops shall be provided on all pipe runs over 100 ft in length. Size loop per manufacturer's recommendations or as scheduled.
- L. Thermometers and Gauges
1. Pressure gauges shall be provided in pipe lines and at inlets and outlets to equipment as called for or specified. These shall be installed to indicate pressure changes across equipment only. This means that they must have connections installed as close as possible to equipment flanges. These shall be bourdon tube type with 3" minimum dial 1/4 male NPT connection, steel cages with pressure ranges suitable for indicating the normal operating pressure at the two-third point of the scale range. Ashcroft, 3M or Taylor. Connections shall be made with shut-off cock and surge snubber.
 2. Thermometers shall be a red mercury in glass-type with adjustable angle feature, 7" minimum scale length with range and bulb length suitable for the application and insertion well. These shall be located where they sense a true temperature and where they can be easily read and be installed with heat transfer grease.
- M. Miscellaneous Steel
1. Furnish and install all miscellaneous steel required for supports, hangers, anchors, guides, etc., required for installation of equipment and materials furnished and installed under this division.
- N. Clean-Up
1. Insofar as this contract is concerned, at all times keep premises and building in a neat and orderly condition: Follow explicitly any instructions of architect in regard to storing of materials, protective measures, cleaning-up of debris, etc.
 2. Upon completion of work, this contractor shall thoroughly clean all apparatus furnished by him, pack all valves and thoroughly clean piping, fixtures and equipment removing all dirt, grease and oil.
 3. Air systems shall not be operated without filters. Upon completion of work, replace all filters.
- O. Operating and Maintenance

1. This contractor shall furnish competent personal instruction to the owner's operating personnel for a period of two (2) days in the proper operation of the heating and air conditioning equipment. He shall also supply the owner with copies of an operation manual containing the following:
 - a. Step-by-step procedures for start-up and shut-down for each system and piece of equipment.
 - b. Performance data, curves, ratings.
 - c. Wiring diagrams.
 - d. Manufacturer's descriptive literature.
 - e. Automatic controls with diagrams and written description of operation.
 - f. Manufacturer's maintenance and service manuals.
 - g. Plumbing fixtures.
 - h. Spare parts and replacement parts list for each piece of equipment.
 - i. Name of service agency and installer.
 - j. Final approved shop drawings.

- P. Roof Curbs (as manufactured by Pate, Roof Products and Systems and Thycurb)
 1. Curb shall be 18 gauge galvanized steel with continuous welded seams, wood nailer, counterflashing, R-8 minimum and liner insulation. Top of curb shall be a minimum size as shown in detail on drawings, but not less than 14" above the high point of roof where curb attaches.
 2. Provide curb for all roof penetrations of ducts and piping.
 3. All cutting and patching of existing roof shall be by the owner's roofing contractor and paid for by the mechanical contractor.
 4. Curb shall be installed with top level. Curb base to match roof pitch.

END OF SECTION

SECTION 20 05 23 – PIPING AND VALVES

- A. General
1. Furnish all material, labor, equipment, and accessories as required to install complete, plumbing, and HVAC systems as indicated on drawings and in these specifications.
 2. Install in full accordance with local code requirements, see other specification section for additional requirements and install in accordance to manufacturer's recommendations and requirements.
- B. Connections to Equipment Furnished by Others
1. Provide valved water and/or gas connection for equipment furnished by other contractors or owner.
 2. Include accessories required by code, drawings and manufacturer's installation instructions.
 3. Fully coordinate with lab equipment, pool equipment, kitchen equipment, and laundry equipment suppliers and confirm all rough-in requirements prior to starting work.
- C. Installation
1. All piping shall be installed parallel with or perpendicular to the building walls. All vertical risers shall be installed plumb and straight. All piping above accessible ceilings shall be installed as high as possible and at height to allow sufficient space for ceiling panel removal.
 2. All piping shall be installed with pitch in the direction of flow of not less than 1" in forty feet, except as otherwise shown. It must be possible to drain every portion of the piping system.
 3. Run lines as direct as possible and avoid unnecessary offsets. However, if offsets are required in order to obtain maximum headroom or to avoid conflict with other work, they shall be made as required or as requested by the architect without addition cost to the owner. The architect reserves the right to make minor changes in the location of piping and equipment during the roughing-in, without additional cost to the owner. All changes proposed by others shall be approved by the architect.
 4. Lines shall be cut accurately to measurement at the site and worked into place without springing or forcing. Sufficient offsets, pipe loops or expansion joints between anchor points shall be provided as needed, whether or not shown, to limit stresses and control movement of lines subject to the thermal expansion.
 5. Before any piping is installed, it shall be up-ended and pounded to remove any foreign matter present, and shall be swabbed, if necessary, for thorough cleaning. After installation and before final connections made, all piping system shall be flushed with a material that is not injurious to either pipe or equipment. (See also "Tests and Adjustments.")
 6. Pipe to be threaded shall be cut square and full threaded with clean-cut tapered threads and shall be reamed after threading. Threaded connections shall be made with pipe thread compound applied to the wall threads only.
 7. The edges of pipe to be welded shall be machine beveled wherever possible. Before welding, the surfaces shall be thoroughly cleaned. The piping shall be carefully aligned. No metal shall project within the pipe. Mitered joints are prohibited. Only factory formed fittings shall be used. Elbows shall be long radius type. Flanges shall be welding neck type. Mitering of the pipe to form elbows or the notching of straight runs to form the tee connection will not be permitted.
 8. Unions or companion flanges shall be installed in all connections to equipment, automatic valves, etc., as necessary to permit removal of equipment and specialties for servicing, repairing or cleaning. It shall be possible to remove any piece of equipment by removing only one or two sections of piping.
 9. Valves shall be provided in suitable locations at each item of equipment, branch circuit, riser, or section of piping as indicated or required for proper and safe operation of the system and to facilitate maintenance and/or removal of all equipment and apparatus. On

- horizontal pipe runs, install all valve stems vertically up where possible and in no case shall the stems be turned more than 90 degrees from the vertically up position.
10. Taps (half couplings or tees) shall be provided as necessary to permit the installation of temperature control instruments, thermometers, pressure gauges, air vents, etc.
 11. Connections between copper piping and screwed ferrous equipment connections or screwed ferrous piping systems shall be made as follows:
 - a. For stationary non-rotating, non-vibrating equipment connections: dielectric unions.
 - b. For rotating or vibrating equipment connection: cast brass adapter and bronze flanges with dielectric separation of flanges and bolts.
 - c. Connections between copper piping and ferrous equipment flanges or flanged ferrous piping systems shall be made using bronze companion flange with dielectric separation of flanges and bolts.
 - d. Brass or bronze valves in ferrous piping will not require dielectric separation.
 - e. Nipples between copper piping and equipment or fixture connection fittings shall be brass, not galvanized steel.
 12. All pressure piping systems shall be installed to conform to the requirements of the local AHJ or state's pressure piping system code.
 13. All excavations for installation of pipe shall be open trench work and shall be kept open until piping has been inspected, tested, and accepted.
 14. All piping passing thru cast-in place concrete construction shall be sleeved to provide a minimum of 1/2" annular space around entire pipe to be sleeved. Space between sleeve and pipes in foundation walls shall be tightly caulked or mechanical seal to give a waterproof penetration.
 15. Any piping resting on or coming in contact with building structure shall be insulated at that point to prevent telegraphing of sound.
 16. Metal piping laid in corrosive fill shall be encased in concrete or in split tile.
 17. Threaded joints shall conform to American Taper Pipe Thread ASA-B2.1-1960. All burrs shall be removed, pipe ends shall be reamed or filed to size of bore and all chips removed. Pipe cement shall be used only on male threads.
 18. Unions shall have metal seats for drainage systems and metal to metal ground seats on water system.
 19. Furnish and install valve in branches to sill cocks, toilet rooms and other fixture groups. Plumbing fixtures shall have wheel or screwdriver stops as specified.
 20. All piping shall be rigidly supported and shall not be loose or shaky.
- D. Sanitary, Waste, and Vent Sewers
1. Install sewers, stacks, vents, drains, etc., as indicated on the drawings.
 2. All drainage and vent piping shall be constructed and run as direct as possible, protected from contact with slag or cinders and wherever practicable, shall be located so as to be accessible for inspection. The actual runs and locations of drains, soil waste, and leader piping shall be installed as to meet with the various conditions at the building and any work necessary to conceal pipes or clear pipes of other trades shall be done as directed by the architect.
 3. Sewers to be pitched a minimum of 1/4" per foot for 3" sizes and under and 1/8" per foot for 4" sizes and larger or to slope as indicated on drawings.
 4. All piping shall be correctly aligned before joins are made. All changes of direction in drainage and vent piping shall be made by means of "Y" branches and 1/6, 1/8 or 1/16 bends. No lines shall be run with unnecessary bends or offsets and where changes in direction are unavoidable; they shall be made by use of proper fittings. Single and double sanitary tees, 1/4 bends and 1/8 bends may be used in vertical sections when direction of flow is from horizontal to vertical. Changes in direction and branch connections shall be made with approved drainage fittings compatible with the piping system material in which it is installed.
 5. Install cleanouts at each change in a direction of piping greater than 45 degrees, within five feet (5'-0") of main sewer after exiting the building, or as shown on drawings.

- Cleanouts on underground lines shall extend up flush with finished floor or grade. Provide cleanouts not over 50'-0" on center along straight runs. Cleanouts shall be size of pipe to which it is installed up to 6" in diameter. Pipe over 6" in diameter shall have a 6" cleanout.
6. Vent terminals shall be terminated at least 18" above roof. Each vent terminal shall be made water tight with the roof by using sheet copper (8 ounces PSF) with base not less than 16" diameter and collar full height of pipe or rubber boot pipe flashing. Where vents are 4" or larger, flashing may be turned over into top of pipe without gap. Furnish flashing to general contractor for building into roofing material.
 7. All fixtures and sanitary drains shall be vented as indicated on drawings and in accordance with code. Vent pipes, where not vertical shall have continuous slope up to vent through roof.
 8. Openings in pipes shall be properly plugged when work is not in progress
 9. Sewers shall be laid with full length of each section resting on a solid bed. Where necessary to obtain a firm support, the pipe shall be bedded on select material and thoroughly tamped. As pipe is laid, care shall be exercised to keep interior of pipe clear of foreign matter. Where trenching for pipe is excessively wide, the contractor shall, at his own expense, embed the pipe in concrete to support the added load of backfilling.
 10. Pipe Schedule:
 - a. Below grade inside building
 - 1) Service weight - cast iron pipe ASTM A-74-82 with ASTM C-564-80 neoprene compression joints or no-hub CISPI with clamps. All kitchen sanitary shall be cast iron only.
 - 2) PVC-DWV Sch. 40 solid core pipe, ASTM D-1785 with ASTM D-2665 DWV solvent weld socket fittings.
 - b. Above grade and vent material shall be as follows:
 - 1) No-hub cast iron pipe CISPI 1-301-78.
 - 2) 1-1/4" and smaller, SCH. 40 galvanized steel pipe ASTM A-53/A53M, Type E with screwed fittings ASME B-16.4, class 125.
 - c. Site below grade sewers
 - 1) No-hub cast iron pipe CISPI 1-301-78.
 - 2) PVC-DWV SCH. 40 solid core pipe. ASTM D-1785 with ASTM D-2665 DWV solvent weld socket fittings.
 - d. Expansion Joints and deflection fittings
 - 1) Ductile-Iron, flexible expansion joints; AWWA C110 or AWWA C153 with two gasketed ball-joint sections and one or more gasketed sleeve sections rated for 250 psig minimum.
 - 2) Ductile-Iron expansion joints; three-piece assembly of telescoping sleeve with gaskets and restrained-type, ball-and-spigot end sections; AWWA C110 or AWWA C153; rated for 250 psig minimum.
 - 3) Ductile-Iron deflection fittings; compound coupling fitting with ball joint, flexing section, gaskets, and restrained joint ends; AWWA C110 or AWWA C153; rated for 250 psi minimum and up to 15 degrees of deflection.
 11. PVC piping shall not be installed unless permitted by code and shall not be installed in return air plenums.
- E. Domestic Water Piping
1. Install domestic water piping as indicated on drawings. Include all fittings, valves, hangers, and other accessories including water meter and backflow preventer. Extend domestic water piping to all fixtures and equipment required for complete installation.
 2. Include unions, or other disconnect means, stops or valves for isolation of fixtures and equipment. Valves to be fully compatible with piping for service intended as manufactured by Nibco, Crane or Milwaukee. Include hose or drain valves at low points where fixtures cannot be used for drainage.

3. Install shock absorbers at each quick closing fixture and where required to prevent water hammer as manufactured by J.R. Smith, Sioux Chief or Zurn. Absorbers shall be installed in vertical upright position.
4. Hangers on insulated pipe to be outside of insulation, sized accordingly with a sufficient saddle to protect insulation as manufactured by Grinnell or Michigan.
5. Pipe Schedule:
 - a. Below grade outside building (2-1/2" and larger)
 - 1) Ductile iron cement lined iron cement lined pipe, AWWA H3-C1.2 ductile fittings, and compression or mechanical joint.
 - 2) CPVC, Schedule 40; socket fittings and solvent cement joints.
 - b. Above grade (2" and less)
 - 1) Type "L" hard copper ASTM B 88-832 with wrought copper fittings ASTM B 16.22 1980 and non-lead or antimony solder joints.
 - 2) CPVC, Schedule 40; socket fittings and solvent cement joints.
 - 3) PEX tube and fittings with stainless steel crimp rings.
6. Flush, vent and sanitize all water piping with chlorine as required per AWWA, local building department and health department codes.
7. Domestic hot and cold water piping under concrete floor to be covered with sand so that piping will not become embedded in the floor slab.
8. All piping under concrete floor shall be type "K" soft copper, continuous. Splices or fittings will not be allowed.
9. Extreme caution must be taken so that no copper piping and insulation under concrete floors becomes crushed, cut, split or deformed during the pouring of the floor slab.
10. Allow 1-1/4" per 100 feet of length for expansion in domestic hot water lines.
11. All piping in return air ceiling plenums or walls shall be plenum rated materials.

F. Gas Piping

1. Install gas piping in accordance to the latest version of the National Fuel and Gas Code, NFPA and local gas companies' requirements and State and local codes.
2. Include meter, regulators, valves and connect to all gas using equipment.
3. Equipment connections at each unit shall include gas cock, union, dirt leg, and reducer to unit connection size. For above low pressure gas systems, provide pressure reducing valve at equipment or low pressure branches.
4. Construct concrete base to below frost line for large meter installation.
5. Pipe Schedule:
 - a. Below grade, outside building (<60 psi)
 - 1) Polyethylene plastic ASTM D-2513 with stab couplings or fusion weld joints.
 - 2) Black steel Schedule 40 pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel pipe. Install cathodic protection anode on service line.
 - b. Above grade, low pressure (≤ 2 psi)
 - 1) Schedule 40 seamless black steel pipe, beveled ends.
 - a) 2" and smaller – screwed fittings, wrought iron.
 - c. Valves shall not be located above ceiling spaces used as a return air plenum.
 - d. Exterior exposed bare steel pipe shall be painted with a primer coat and two (2) coats or rust inhibitive paint, color as selected by Architect.
 - e. All welding shall be performed by state certified welders.
 - f. All piping in non-accessible spaces shall have welded joints.

G. Refrigerant Piping

1. Mechanical refrigeration equipment including refrigerant piping, valves, and relief valves, shall be in accordance with the requirements of the current edition of the American Standards Association's "Safety Code for Mechanical Refrigeration."
2. All refrigerant pipe used in this installation shall be sealed and contain a holding charge of nitrogen. It shall remain sealed until immediately before installation: refrigerant piping

- shall be cut with a tube cutter only and shall be reamed after cutting. Hack saw cuts are prohibited.
3. After installation, the refrigerant piping shall be pressurized to 75 psig with nitrogen. All joints must then be thoroughly leak tested using an electronic leak detector, a halide torch, or soap bubbles. After the refrigerant piping has been leak checked, it should be evacuated twice by either the deep evacuation or the triple evacuation method. The unit manufacturer will recommend the method to be followed. After the evacuation, the piping shall then be charged with the system refrigerant.
 4. Isolate piping from structure with 1" insulation between all piping and support points.
 5. Install piping in as short and direct arrangement as possible to minimize pressure drop.
 6. Install isolation valves and unions to allow removal of solenoid valves, pressure-reducing valves, expansion valves, and at connections to compressors and evaporators.
 7. Install flexible connectors at inlet and discharge connection of compressors.
 8. Fill the pipe and fittings during brazing with nitrogen or carbon dioxide to prevent formation of scale.
 9. Pipe Schedule:
 - a. Piping shall be refrigerant grade type "L" copper with silver soldered joints or brazed joints. Pipe per manufacturer's piping diagrams and recommendations. Copper to copper refrigerant piping joints shall be made using a phosphorus bearing alloy such as "SIL-PHOS" without flux. Copper to brass and copper to steel joints shall be made using a 45 percent silver alloy such as "EASY-FLO" with flux.
- H. Condensate Drain Piping
1. Trap shall be installed near equipment if not integral with equipment. Install piping at a uniform slope of 1" in forty feet downward indirection to drain.
 2. Pipe Schedule:
 - a. Piping of all sizes shall be type L hard copper pipe with brass or copper fittings and soldered joint.
 - b. Piping of all size for mechanical rooms, roof and non-return air plenum rated ceiling space shall be type PVC, schedule 40 with solvent weld socket fittings.
- I. General Hydronic and Domestic Valves and Strainers
1. Ball valves 2" and smaller shall be 600# WOG, 150# SWP, two-piece, full port cast bronze or forged brass body, chrome plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, vinyl-covered steel handle and have threaded ends. Valves shall be Hammond 8901, Milwaukee BA-125, Stockham S-207, Nibco T-585, or Apollo 77-100.
 2. Gate valves 2" and smaller shall be 150# W.S.P., bronze, screwed pattern with rising stem, union bonnet, solid wedge disc. Valves shall conform to MSS SP-80. Valves shall be Crane 431-UB, Hammond IB-629, Lunkenheimer 3151, Jenkins 47-U, Stockham B-120, Milwaukee 1151, or Nibco T-135.
 3. Gate valves 2-1/2" and larger shall be 125# W.S.P., cast iron, outside screw and yoke, flanged pattern with bolted bonnet, rising stem, bronze seats, stem and disc faces. Valves shall conform to MSS SP-70. Valves shall be Crane 465-1/2, Hammond IR 1140, Lunkenheimer 1430, Jenkins 651-A, Stockham G-623, Milwaukee F2885, or Nibco F-617-0.
 4. Globe valves 2" and smaller shall be 150# W.S.P., bronze, screwed pattern with rising stem, and union bonnet, and ANSI 420-S stainless steel tapered plug and seat. Valves shall conform to MSS SP-80. Valves shall be crane 14-1/2P, Hammond B-433, Jenkins 546-P, Stockham B-29, Milwaukee 591 A, or Nibco T-235.
 5. Check valves 2" and smaller shall be 150# W.S.P. bronze, swing check, bronze seat, screwed pattern. Valves shall conform to MSS SP 80, type 4. Valves shall be Crane 141, Hammond IB-946, Milwaukee 510, Nibco T-43, Stockham B-331B, Lunkenheimer 230, or Jenkins 352.

6. Strainers 2" and smaller shall be 250#, cast iron body, screwed pattern with 20 mesh stainless steel or Monel screens, strainers to be Muessco No. 11, Armstrong, Crane, Sarco, or Hayward.
 7. Pressure reducing valves shall be as specified on drawings or an approved equal by Conbraco, Watts or Zurn.
- J. Gas Valves
1. Gas cocks 2" and smaller shall be 175# WOG, cast iron, screwed body pattern. Valves shall be UL listed for gas service. Valves shall be Dezurik series 425 with "RS-49" plug, seals and lever handle.
 2. Pressure reducing valves shall be line size and to reduce pressure from supplied side to equipment pressure requirements. Valves shall be as specified on drawings or an approved equal by American Meter Company, Fisher Control Valves or Invensys.

END OF SECTION

SECTION 20 05 93 - TESTING, ADJUSTING AND BALANCING

- A. General
1. After installation, check all equipment and perform start up in accordance with the manufacturer's instructions.
 2. All piping shall be tested and free of leaks as required by the local authority having jurisdiction.
 3. Work that is scheduled to be concealed or insulated shall remain uncovered until required tests have been completed. If the construction schedule requires, arrange for tests on sections of the system at a time.
 4. Balance all systems, calibrate controls, check for proper operation and sequence under all conditions and make all necessary adjustments.
 5. Instruct owner in operation of systems and submit operating and maintenance manual for all equipment and systems.
 6. Submit air and water balance report from independent AABC or NEBB certified subcontractor for all air and water systems per AABC or NEBB standards.
 7. When the contractor is ready to run capacity tests, he shall notify the architect. When this notice is given, the architect will assume that the contractor has made preliminary tests and is satisfied that the plant will develop specified and guaranteed capacities. It will be the contractor's responsibility to furnish any and all instruments required to obtain test data which shall include thermometers, electric meters, pressure gauges, etc.
 8. Work under this division of the specifications shall not be considered complete until the contractor has obtained required inspection, performance tests, made necessary adjustments and has submitted satisfactory evidence of the architect or his representative will make spot checks to determine the accuracy and completeness of final adjustments. Should spot checks indicate more than a reasonable deviation from design requirements, the contractor shall repeat tests and adjustments to the satisfaction of the engineer.
 9. Test results shall be submitted to the architect/engineer.
 10. The Test and Balancing contractor shall adjust all sheaves or provide new sheaves and belts as required in order to properly balance all air handling equipment.
- B. Balancing, Start Up and Instructions
1. After equipment is placed in operation, systems shall be balanced to within 10% of design flow with report submitted to owner. Balancing shall be performed by an independent AABC or NEBB certified contractor.
 2. Balance the air systems prior to balancing refrigerant systems.
 3. Test, adjust and balance cooling systems during summer season and heating systems during winter season. Balance systems when the outside air conditions are within 5 degrees F wet bulb temperature of the maximum summer design condition and within 10 degrees F dry bulb temperature of the minimum winter design condition.
 4. Start up and place all systems in operation and tag all switches and controls with permanent labels.
 5. Train and instruct owner on proper operation and preventative maintenance of system.
- C. Piping: Testing to be done by the contractor.
1. All piping shall be given the following pressure test without appreciable pressure drop: Contractor shall use recording line charts to record all pressure testing outcomes.

SERVICE	TEST MEDIUM	MIN. PRESSURE	TIME (HOURS)
Main Water Service	Water	125 psi	AWWA Procedure
Cold Water	Water	125 psi	24
Hot Water	Water	125 psi	24
*Gas, Natural	Natural Gas Co. Rules		24
Sanitary Sewer	As per State Plumbing Code or Local Authority		
Condensate	Water	125 psi	6

*A minimum notice of 48 hours shall be given the architect prior to purging of any gas lines. Purging shall be to the outside of building at a safe location.

2. During the final inspection of the building, the contractor may be asked to remove at least one water closet in the presence of the architect so that it can be checked for a proper installation. If the one toilet is found to be installed in a defective manner, the contractor shall remove and properly reinstall all toilets.
3. Care shall be exercised in installation of air piping so as not to allow contamination.
4. Minor leaks in welded joints shall be corrected by chipping out the weld and rewelding. A general sweating of a weld joint will be considered sufficient cause for rejection. Defects that may develop in screwed joints under test shall be corrected by replacing the fitting or thread or both. Caulking of defective threaded joints will not be permitted.
5. During the testing period, this contractor shall maintain on the job a competent individual thoroughly familiar with all phases of plumbing for as long as may be required to thoroughly adjust all of the systems and to demonstrate to the architect that they are functioning properly.
6. Adjust all flush valves and balancing valves for proper flow.
7. All hydrostatic and/or air tests shall be made before piping is concealed or covered. This contractor shall be responsible for completely draining the systems after hydrostatic tests are performed. Any damage from freezing prior to acceptance of the completed installation shall be repaired at the sole expense of this contractor.
8. All materials and installations under the plumbing system shall be inspected by the inspector to ensure compliance with requirements of the plumbing code.
9. This contractor shall notify the plumbing inspector whenever work is ready for test and inspection.
10. When work for the plumbing permit is issued and completed, this contractor shall request final inspection. Such request shall be made before the building is occupied or used but not more than 30 days after completion of the work.
11. Before approving the plumbing system, the plumbing inspector may require that the system in whole or part be tested to prove sufficiency. All equipment, material, power and labor necessary for inspections and test shall be supplied by the plumbing contractor.
12. All piping of plumbing system shall be tested with water or air per testing schedule.
 - a. Drainage system water test: provide fitting at property line or termination point for purpose of test plug. Water test shall be applied to entire system or by section. When tested in sections, at least the lower 20 feet of the next section above shall be retested so that every section tested shall have at least a 20-foot head test. Hold without pressure loss for 15 minutes.
 - b. Drainage system air test – attach air apparatus to suitable opening, close all other inlets and outlets, and then force air into the system until there is uniform pressure, sufficient to balance a column of mercury 10” in height or 5 pounds gauge pressure on the entire system. Hold without pressure loss for 15 minutes.
 - c. No part of system shall be covered before inspection is made and approved. If covered before test, contractor shall pay for cost of uncovering so test can be made and accepted.

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- d. Defective
 - e. Work or materials shall be replaced and inspection and tests repeated within three days.
- 13. Certificates of approval of satisfactory completion and final inspection shall be obtained by the plumbing contractor. One copy of each approval shall be given to the architect.
 - 14. Damages which result from breakage or faulty installation shall be the responsibility of the plumbing contractor.
 - 15. After the system has been in service for a two-week period and again before the system is turned over to the owner, all dirt pockets, traps, and strainers shall be cleaned, removed, and reinstalled.
- D. Water Using Equipment: All water using equipment, such as but not limited to, cooling coils and convertors, shall be balanced to obtain the required water pressure drop and flow. This contractor shall list the flow rate and required pressure drop and the observed pressure drop for each piece of equipment.
 - E. Air Handling Equipment: For each piece of air handling equipment, this contractor shall list the data of the fan, motor and drive and shall obtain by measurement and furnish to the architect/engineer the fan speed, motor voltage, operating amps, for cfm and static pressure as determined from the manufacturer's fan curves. This contractor shall also determine the fan cfm by means of a velocity traverse which shall be taken a minimum of three fan diameters from fan outlet. Before running any tests, the contractor shall have installed all the components of the system and shall ensure the cleanliness of the filters.
 - F. During the testing period, this contractor shall maintain on the job a competent individual thoroughly familiar with all phases of air conditioning, including refrigeration, temperature control and distribution, for as long a period as may be required to thoroughly adjust all of the systems and to demonstrate to the architect that they are functioning properly.
 - G. The testing and balancing engineer shall, as part of his work, perform a "Spot" re-check balancing conditions between 30 to 90 days after both summer and winter balancing operations at which time a representative of the temperature control manufacturer capable of performing adjustments to his system shall accompany the balancing engineer. This operation shall include a check of space temperature, calibration of controls, pump and fan performance and the necessary adjustments thereto.

END OF SECTION

SECTION 20 07 00 - INSULATION

- A. General
1. Furnish all material, labor and equipment as required to install complete plumbing and HVAC insulation as indicated on mechanical drawings and in these specifications.
 2. Install in full accordance with manufacturer's recommendations.
- B. Scope: This contractor shall furnish and install all insulation necessary to the project and in accordance with the following requirements. All insulation and accessories used in an air plenum space, and all duct covering and lining, regardless of physical location, shall have a composite (insulation, jacket, and adhesive) fire and smoke hazard rating as tested under procedure ASTM E-84, NFPA 255 and UL 723, not exceeding a flame spread 25 and smoke developed 50. All other areas shall have insulating materials and accessories on pipes and vessels rated at a flame spread 25 and smoke developed 150 as tested by the same procedure. All calcium silicate shall be asbestos free.
- C. Workmanship:
1. All insulation shall be installed over clean, dry surfaces. Insulation must be dry and in good condition. Wet or damaged insulation will not be acceptable. No insulation shall be applied prior to pressure test completion of the respective piping and/or duct system.
 2. All pipe insulation shall be installed with joints butted firmly together. All valves and fittings shall be insulated using mitered sections of insulation equal in density and thickness to the adjoining insulation, or with an insulation cement equal in thickness to the adjoining insulation or premolded insulated fittings. The insulation applied to the valves and fittings shall be covered with the same type of covering as used on the pipe insulation. No staples.
 3. All insulation ends shall be tapered and sealed regardless of services.
 4. All insulated, exposed piping 8'-0" and below to the finished floor shall include a 0.020" thick vinyl jacket. This jacket is in addition to the normal finish for the respective service.
 5. Rigid duct insulation shall be impaled over welded pins and secured with white insulation caps. All seams shall be firmly butted and sealed with white pressure sensitive vapor barrier tape. No staples.
 6. Wrap around duct insulation shall be applied with all joints butted firmly together. Insulation shall be cemented to the surface with fireproof adhesive applied in 6" wide strips on 12" centers. All joints in the insulation covering shall be sealed with adhesive. Where ducts are over 24" wide, the ductwrap shall be additionally secured to bottom of rectangular or oval ducts with mechanical fasteners on 16" centers to prevent sagging. Vapor barrier shall be legibly printed by the manufacturer to show nominal thickness and type of insulation. Aluminum corner angles shall be used to prevent over compressing insulation during installation.
 7. Ductliner insulation shall be applied with joints precoated with adhesive and butted firmly together. Lining shall be cemented to ductwork with a minimum of 75 percent coverage of fire resistant adhesive. Mechanical fasteners on 16" centers and adhesive shall be used when duct width exceeds 12" or when duct height exceeds 24".
 8. All ductwork in the mechanical rooms is to be considered as "exposed ductwork," i.e. supply, return, relief, and outdoor air.
 9. All round diffuser duct drops connected to lined ductwork shall be insulated the same as "ductwork" schedule non-lined.
 10. All flexible elastomeric insulation shall have all fittings, butt ends, and seams sealed with vapor barrier adhesive.
 11. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance including metal vessel covers, fasteners, flanges, chilled water pumps, frames and accessories.

12. Repair all damaged sections of the existing piping and mechanical insulation damaged during this construction period. Use insulation of same thickness as existing insulation. Install new jacket lapping and seal over existing.
 13. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- D. Plumbing Insulation (as manufactured by Owens Corning, Knauf or Schuller)
1. Insulate all above-grade hot water and cold water piping with 1" thick molded fiberglass having an all service jacket.
 2. Insulate all above-grade, horizontal air conditioning condensate floor drains and waste lines, overflow roof drains and piping, roof drains and piping and roof drain sumps with 1" thick molded fiberglass having an all service jacket.
 3. Include insulation of fittings and valves. Keep vapor barriers intact. Apply per manufacturer's recommendations.
 4. Insulate all exposed waste and water supply piping under lavatory with safety covers per ADA requirements (as manufactured by Plumberex Specialty Products, McGuire or Truebro).
- E. HVAC Insulation (as manufactured by Owens Corning, Knauf)
1. All insulation to be applied in full accordance with the manufacturer's recommendations and comply with 25/50 flame and smoke hazard ratings per ASTM E-84, NFPA 255 and UL 723.
 2. Insulate all air conditioning condensate drain piping with 1" thick molded fiberglass insulation, C = 0.22.
 3. Insulate all refrigerant suction and hot gas lines with 1" elastomeric foam insulation, C = 0.24 with joints and seams sealed vapor tight. Insulation outside shall be painted with two coats of protective coatings per manufacturer for protection to weather (as manufactured by Aeroflex, Armocell, or K-Flex).

END OF SECTION

SECTION 22 40 00 - PLUMBING FIXTURES AND EQUIPMENT

- A. General
1. Furnish all fixtures and equipment indicated and scheduled on drawings, complete with all accessories, controls, etc., as required.
 2. Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats and valves as shown by their published product information and indicated in the plumbing fixtures schedule; either as designed and constructed or as recommended by manufacturer and as required for complete installation. Where more than one type is indicated, selection is Installer's option, but all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.
 3. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
 4. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves or dispensing devices of type and size indicated and as required to operate as indicated. Include manual shut-off valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
 5. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.
 6. Water Hammer Arrestors: Provide water hammer arrestors where shown on the drawings and as required to prevent water hammer and excessive vibration in the domestic water system. Arrestors to be of size indicated or as recommended by the manufacturer.
 7. P-Traps: Include removable P-traps (with clean out plug) where drains are indicated for direct connection to drainage system.
 8. Carriers: Provide cast iron supports for fixtures of either graphitic gray iron, ductile iron or malleable iron as indicated.
 9. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
 10. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated sheet steel escutcheons with friction slips.
 11. Aerators: Provide aerators of types approved by Health Department having jurisdiction.
 12. Comply with additional fixture requirements contained in fixture schedule on drawings.
- B. Water closets
1. Manufacturer: Subject to compliance with requirements, provide one of the following:
 - a. American Standard
 - b. Kohler
 - c. Crane
- C. Lavatories
1. Manufacturer: Subject to compliance with requirements, provide one of the following :
 - a. American Standard
 - b. Kohler
 - c. Crane
- D. Mop Basin
1. Manufacturer: Subject to compliance with requirements, provide one of the following:
 - a. Fiat
 - b. Mustee
 - c. Florestone
- E. Wall Hydrants
1. Manufacturer: Subject to compliance with requirements, provide one of the following:

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- a. J.R. Smith
 - b. Josam
 - c. Zurn
- F. Floor Drains
- 1. Manufacturer: Subject to compliance with requirements, provide one of the following:
 - a. J.R. Smith
 - b. Josam
 - c. Mifab
 - d. Zurn
- G. Cleanouts
- 1. Manufacturer: Subject to compliance with requirements, provide one of the following:
 - a. J.R. Smith
 - b. Josam
 - c. MifaB
 - d. Zurn
- H. Trap Primer Valves
- 1. Manufacturer: Subject to compliance with requirements, provide one of the following :
 - a. Precision Plumbing Products
 - b. Sioux Chief
 - c. Zurn
- I. Backflow Preventer
- 1. Provide reduced pressure backflow preventer consisting of assembly including abutting shutoff valves on inlet and outlet, and discharge funnel. Backflow preventer shall include a minimum of four (4) test cocks and pressure-differential relief valve located between two (2) positive seating check valves. Backflow preventer and shutoff valves shall be the same size as the upstream pipe.
 - 2. Backflow preventers sizes 2" and smaller shall have NPT connections, be of bronze body construction with bronze ball type shut-off valves as specified in Section 200523 and test cock and bronze body relief valves with stainless steel trim.
 - 3. Complete backflow preventer assembly shall be rated to 150 psi working pressure and water temperature range from 32° F to 140° F.
 - 4. Provide each backflow preventer with a drain funnel furnished by the manufacturer. Extend drain from funnel to nearest floor drain.
 - 5. Backflow devices must meet ASSE Standards 1013, 1015 and 1020 and shall be tested at the time of installation by a person certified by the Ohio Department of Health. The plumbing contractor shall pay for all costs associated with this test.
 - 6. Manufacturer: Subject to compliance with requirements, provide backflow preventers of one of the following:
 - a. Cla-Val Company
 - b. Conbraco Industries, Inc.
 - c. Febco Sales, Inc., Sub. Of Charles M. Bailey Co., Inc.
 - d. Hersey Products, Inc.
 - e. Watts Regulator Company

END OF SECTION

SECTION 23 09 00 - INSTRUMENTATION AND CONTROLS

- A. General
1. Furnish and install complete temperature control for all HVAC systems.
 2. Provide new control devices including thermostats, damper operators, motors, temperature sensors, staging relays and other related devices for a complete operational system per the operating sequence and industry standards.
 3. Mount all controls furnished as accessories to equipment and provide all control wiring required for proper operation. All wiring shall be in conduit per N.E.C. and local code requirements.
- B. Sequence of Operation
1. Exhaust Fans
 - a. Exhaust Fan (EF-1,2)
 - 1) Interlock fan with light switch to operate when lights are turned on (interlocking wiring) by electrical contractor.
 - b. Exhaust Fan (EF-3)
 - 1) Upon a call for cooling from the space mounted thermostat. The exhaust fan shall start and the outside air damper shall open. Once the thermostat has been satisfied, the fan shall stop and the outside air damper shall close.
 2. Electric Unit Heaters
 - a. Electric Unit Heater (EUH-1-9)
 - 1) Integral thermostat shall stage heating element and fan to maintain space temperatures set point.

END OF SECTION

SECTION 23 70 00 – AIR HANDLING SYSTEMS AND EQUIPMENT

- A. General
1. Furnish all equipment, material, labor, tools, etc., for the complete HVAC system. Install complete and place in operation.
 2. Contractors bidding this project shall visit this site and familiarize themselves with all conditions affecting their work. Submission of a bid on this project shall be construed as having such knowledge.
 3. Verify exact conditions in field and coordinate with these drawings and other trades before beginning new work.
 4. Determine exact locations for all new and relocated equipment, piping, conduits and ductwork in field.
 5. Coordinate work of this contract with other trades. Conflicts shall immediately be brought to the attention of the architect. Architect's resolution to conflicts shall be final.
 6. Any discrepancies between what is shown on drawings or specified and the actual conditions in the field shall immediately be brought to the attention of the architect before proceeding.
 7. Building and surfaces damaged during installation shall be repaired, replaced, and/or restored to original condition after completion of work and before acceptance by owner.
- B. Equipment
1. Mechanical contractor to furnish all HVAC equipment indicated and/or scheduled on the drawings complete with bases, isolators, supports and other required accessories.
 2. Install complete and place in proper operation per manufacturer's recommendations, lubricate and adjust as required. Furnish and install clean set of filters prior to balancing.
 3. Equipment to be make and model as scheduled unless alternate equipment of equivalent quality and performance is submitted as a substitution prior to bidding. All substitutions are subject to acceptance without qualification by owner, engineer and architect.
 4. Contractor shall perform routine service inspection of all existing HVAC equipment to remain. Lubricate bearing, service control systems, replace fan belts and install new filters in each rooftop unit.
 5. Contractor shall field verify refrigerant charge and add refrigerant if the charge is less than manufacturer's specifications.
 6. Submit service report to any major component failures or malfunctions. Report shall include cost to service all malfunctioning or damaged items listed. Cost shall include parts and labor. Equipment shall be placed in full operation with controls calibrated upon completion of project.
- C. Cooling Coil Condensate Drains
1. Install condensate piping as indicated on drawings. Include all fittings, traps, hangers etc. Extend condensate piping from all equipment drain pans to approved locations for complete installation.
 2. Install condensate piping at a uniform minimum slope of 1/8" per foot.
 3. Condensate piping shall be as follows:
 - a. Roof or non-return air plenum ceiling space – PVC schedule 40 plastic solvent weld socket fittings.
 4. Insulation - see section 20 07 00 - Insulation.
- D. See equipment schedules on mechanical drawings.

END OF SECTION

**SECTION 26 01 00 - GENERAL PROVISIONS
(Café Building Only)**

- A. General
1. Requirements specified in Division 1, instructions to bidders, supplemental general conditions, special conditions, addenda, alternates, contract and proposal, along with Division 16 and all its sections, comprise the contract documents for the electrical contract, along with these specifications as though they were one, and anything implied by the specifications shall be interpreted as also implied by the drawings and vice versa. Provide necessary items for a complete installation of all electrically operated equipment listed in the specifications or shown on the contract drawings.
 2. The architectural, structural, mechanical, plumbing and equipment drawings and specifications are incorporated into, and become a part of this division. This contractor shall examine all such drawings and specifications and become thoroughly familiar with the provisions contained therein. The submission of his bid shall indicate such knowledge.
 3. Electrical drawings are diagrammatic. They are intended to show the approximate locations of equipment and conduit. Dimensions given on the plans, in figures, shall take precedence over scaled dimensions and shall be verified in the field. The electrical contractor shall layout all equipment rooms to make sure the equipment, as purchased, fits in the room or space shown. Exact location of all equipment shall be verified in the field and routing of conduits shall suit field conditions.
 4. Until the time of installation, the architect reserves the right to make minor changes in the location of conduit and equipment without additional cost to the contract.
 5. The electrical drawings and specifications are intended to supplement each other. Material and labor necessary to the project shall be furnished and installed even though not specifically mentioned in both. Labor and/or materials neither shown nor specified, but obviously necessary for the completion and proper functioning of the system, shall be furnished and installed by the electrical contractor.
 6. Arrange all equipment substantially as shown on the drawings. Make deviations only where necessary to avoid interference. Check all equipment sizes against available space prior to shipment to avoid interference.
 7. Examine the work of other trades insofar as their work comes in contact with or is covered by this work in no case attach to, or finish against any defective work or install work in a manner which will prevent proper installation of the work of other trades.
 8. Electrical contractor shall verify with other trades all electrical characteristics of equipment requiring electrical connections, contractor shall verify voltage, phase and horsepower and shall notify engineer of any discrepancies prior to start of work. Electrical contractor shall provide disconnecting means and overload protection for all equipment, unless furnished integral with equipment package.
 9. It is the intent of these drawings that this be a complete electrical job, any errors or omissions shall be brought to the attention of the engineer prior to bidding the job.
- B. Visit to the Site
1. This contractor shall visit the site of the work and familiarize himself with all conditions affecting his work. The submission of his proposal shall indicate such knowledge. No additional payment shall be made on claims that arise from a lack of knowledge of the existing conditions

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- C. Code and Permits
1. Installation shall be in full accordance with all codes, rules and regulations of municipal, city, county, state and public utilities and all other authorities having jurisdiction over the premises.
 2. Comply with any specification requirements that are in excess but not in conflict with code requirements.
 3. The contractor shall secure and pay for all permits, plan reviews and certificates of inspection in connection with his work, required by the foregoing authorities. Before final payment of the contract is allowed, all certificates shall be delivered to the architect in duplicate.
 4. Electrical material and equipment shall bear the UL label except where UL does not label such types of material and equipment.
- D. Shop Drawings Submittals
1. The electrical contractor shall submit five (5) sets of shop drawings, the shop drawings of the following equipment using the indicated numbering system and titles, shall be submitted through the architect to the engineer and then resubmitted for final approval if necessary. Shop drawings shall be submitted for the following items:
 - a. Wiring devices
 - b. Panelboards, transformers and safety switches including fault current study based on equipment being supplied.
 - c. Contactors, time switches and photocell
 - d. Lighting fixtures
 2. All submitted shop drawings (manufacturers' equipment descriptive sheets or vendors' prepared drawings) shall have the general contractor's or subcontractor's "stamp of approval" indicating that the item submitted is as called for on the plans and specifications, is approved by the general contractor or subcontractor, the date of approval and initialed by the person approving the submittal and the name of the company submitting said equipment for approval.
 3. Submit bound brochures complete with a table of contents. Loose or stapled together sheets are not acceptable. Any submittals not in brochure form or not as specified shall be returned at the contractor's expense for resubmittal.
 4. All descriptive literature shall be submitted in a three (3) hole brochure with a cover identifying the following:
 - a. Name of the job
 - b. Location of the job, address, city and state.
 - c. Name and address of the company submitting the brochures.
 - d. Date of the submittal.
 5. Every effort shall be made, in checking the shop drawings, to detect and correct all errors, omissions and inaccuracies. Failure to do this will not relieve the electrical contractor of the responsibility for the proper and complete installation in accordance with the contract documents.
 6. As-built Drawings
 - a. Submit to the architect one set of reproducible (mylars) electrical drawings showing the as-built conditions.
- E. Standards and Substitutions
1. Wherever the words "approved by", "approved equal", "as directed" or similar phrases are used in the following specifications, they shall be understood to refer to the owner as the approving agency. The name or make of any equipment or materials named in this specifications (whether or not the words "or approved equal" are used) shall be known as the "standard".
 2. These specifications establish quality standard of materials and equipment to be provided. Specific items are identified by manufacturer, trade name or

catalog designation. This contractor shall submit his base bid price based upon standard specified equipment described herein and as detailed on drawings and associated contract documents. These specifications are not to be considered proprietary. The contractor may submit information on materials and manufacturers (other than those listed) for review by the architect and engineer no later than ten (10) days before bids are submitted. Manufacturers of products accepted by the architect and engineer will be listed in an addendum to the specifications as an acceptable substitution equipment accepted as detailed below and shall be shown as a separate add or deduct price to be factored into the base bid price by the architect and owner if accepted.

3. Should the contractor propose to furnish materials and equipment other than those specified or approved by addendum, submit a written request for substitutions to the architect at the bid opening. The request shall be an alternate to the original bid; be accompanied with complete descriptive (manufacturer, brand name, catalog number, etc.) and technical data for all items. Failure by this contractor to submit the requisite documentation detailed above shall be understood by the architect and engineer to indicate that substitute equipment will not be presented by the contractor for consideration. Such substitutions will not be considered after the bid opening date and delay of project will not be permitted for further inspection and evaluation after this date.
4. Where such substitutions alter the design or space requirements indicated on the drawings, include all items of cost for the revised design and construction including cost of all allied trades involved.
5. Acceptance or rejection of the proposed substitutions shall be subject to approval of the architect and engineer. If requested, the contractor shall submit (at his cost) inspection samples of both the specified and proposed substitute items.
6. In all cases where substitutions are permitted, the contractor shall bear any extra cost of evaluating the quality of the material and equipment to be provided.

F. Testing and Placing in Service

1. Any material or equipment failing a test shall be repaired or replace at the contractor's expense.
2. Tests shall include the following:
 - a. Measure the load on each phase of the main service and each phase of every feeder under full load conditions.
 - b. Measure the no-load and full-load voltages (phase-to-phase, phase to neutral and phase to ground for each phase of each service, of each separately derived system, and at each panelboard or transformer).
 - c. Measure the ground resistance of the main service-grounding electrode and the ground resistance of each separately derived system's grounding electrode.
 - d. Make insulation resistance tests on all dry type transformers and motors.

G. Interferences

1. Before the installation of any item begins, the electrical contractor shall carefully ascertain that it does not interfere with clearances for the erection of finish beams, columns, pilasters, walls or other structural or architectural members as shown on the architectural drawings. If any work is installed and the architectural design cannot be followed, this contractor shall, at his own expense, make changes in his work as directed by the architect to permit the completion of the architectural work in accordance with drawings and specifications.

2. It shall be the duty of this contractor to report any interferences between his work and that of any of the other contractors as soon as they are discovered. The architect shall determine which equipment will be relocated, regardless of which was installed first. His decision will be final.
- H. Quality Assurance
1. All products shall be new and of the type and quality specified. Where materials, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation shall establish the standards of the desired quality and style. It is the intent of these specifications to establish a standard of quality of materials and equipment installed.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

- A. Nameplates
1. General: furnish and mount on each panelboard, switchboard (including branch switches), large junction box, safety switch, starter, remote control, push button station, and all similar controls, a nameplate descriptive of the equipment or equipment controlled
 2. Provide black and white nameplates constructed from laminated phenolic with a white center core. Letters shall be engraved in the phenolic to form white letters 3/8" high. Fasten the nameplates with an adhesive type fastener.
- B. Mounting Accessories
1. This contractor shall furnish and install all angle iron, channel iron, rods, supports, hangers, concrete or plywood required to install, mount and support any electrical equipment or device called for on the plans.
 2. Supporting material shall be complete with hangers, connectors, bolts, clamps and necessary accessories to make a complete installation. Supporting material shall be galvanized, painted or otherwise suitably finished. Products by Binkley, Steel City, or Racor will be acceptable.
 3. All surface-mounted equipment on block walls shall be mounted on 3/4" plywood backboard. All floor-mounted equipment shall be installed on a 4" high concrete housekeeping pad.
- C. Execution
1. The electrical work for construction proposed shall conform to all federal (OSHA), state, all specific safety requirements and the requirements of the current edition of the NEC.
 2. Check the HVAC and plumbing specifications for electrical requirements and include the same in the contract cost.
 3. Equipment connections, starters, disconnect switches, control transformers and pushbutton stations for the equipment furnished by the owner or under a separate contract shall be installed and connected under this division, as indicated on the contract drawings.
 4. All cutting, patching, excavating, backfilling and concrete work related to this contract will be the responsibility of the electrical contractor. This contractor shall assume the responsibility of providing the sleeves, chases and openings necessary for the electrical installation and for their repair in an acceptable manner, as determined by the architect. All holes shall be core-drilled. Provide fire stop in all openings created through fire-rated walls, floors or ceilings.
 5. This contractor shall be responsible for providing all required access panels necessary for his work, coordinate with architect prior to installation.
- D. Materials and Workmanship
1. All work shall be installed in a practical and workmanlike manner, by mechanics skilled in the several trades necessary.
 2. All materials shall be new and free from defects and shall be the best of their several kinds unless specified or indicated on the drawings to the contrary.
 3. During each phase and at the completion of the construction, this contractor shall remove all debris and excess materials caused by his work. He shall leave the area of operation broom clean.
 4. All electrical equipment shall bear the underwriters laboratories label or ETL label.
 5. This contractor shall guarantee his workmanship and material (lamps excepted) for a period of one year from the date of building opening and leave his work in perfect order at the completion. Should defects develop within the guarantee

period, the contractor shall, upon notice of the same, remedy the defects and have all damages to other work or furnishings caused by the repairs corrected at his expense to the condition before such damage.

E. Scope of Work

1. The electrical contractor shall provide all labor, material, storage, unpacking and placement; to include but not be limited to, the following items:
 - a. Emergency lighting and power.
 - b. Complete power and lighting distribution system including all panels, transformers and feeders.
 - c. Complete branch circuit wiring system.
 - d. Complete power wiring for all air conditioning equipment, plumbing system, heating equipment, ventilating and exhaust equipment.
 - e. Complete lighting fixture installation, including all incandescent, fluorescent and HID lamps.
 - f. Complete telephone and communication conduit and wiring system including boxes, plates, jacks, etc., as specified, shown on the drawings and required by the local telephone company and/or owner.
 - g. Temporary electrical power and lighting as required for construction.
 - h. Testing of all cables and circuit wiring after installation.
 - i. Exit light system.
 - j. Wiring devices and floor boxes.
 - k. Lighting controls.
 - l. Grounding of the electrical system.
 - m. Telephone and electric services.

F. Temporary Service

1. The electrical contractor shall furnish, install and remove as required all temporary power and temporary lighting in all areas and individual rooms when needed by the individual trades in the performance of their work. This contractor shall provide a minimum of twenty (20) foot candles of illumination for temporary lighting. Any additional lighting required by individual trades shall be provided by the individual trades including power for the lighting. The electrical work for construction purposes shall conform to all federal (OSHA), state, specific safety requirements, as well as the requirements of the national electric code and national electrical safety code. The electrical contractor shall obtain and pay for all required applications, permits and inspections pertaining to this work. This cost shall be included in the contractor's price.
2. New light fixtures shall not be used for temporary lighting.

G. Electric Service

1. Provide metering to power company specifications.
2. Pay the cost of all power company charges connected with permanent electric service to the building.
3. Coordinate all work with the power company and perform any work necessary to assure a complete, working installation. The entire service installation shall be in complete conformance with the power company's requirements.

END OF SECTION

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Refer to Division 00 and Division 01 and all addenda which are a part of this Section, and all subsequent Sections of Division 26.
- B. Refer to Alternate Proposals for possible changes affecting the extent of this Section of Work.
- C. This Contractor is instructed to review all Specifications of all parts of the Work, including Divisions 21, 22, 23, 25, 27 and 28.
- D. The Work required under Division 26 of the Specifications includes all requirements of all Sections of this Division. In general, the Work consists of furnishing and installing the equipment, service and all other materials necessary to provide the complete electrical system and all work in connection with such systems including labor, transportation, etc., complete in every respect as shown on the plans, herein specified, or reasonably implied as ready for use unless it is otherwise specifically noted or otherwise specified.
- E. The Contractor is also referred to Architectural, Structural, Mechanical and other drawings pertaining to the project. The above mentioned Construction Documents, as well as their respective Specifications, are part of the complete Contract Documents.

1.2 DESCRIPTION OF WORK

- A. This work involves the construction of a new building with new electrical services installed, wired and ready for use by the Owner.
- B. Work includes, but is not limited to, the following:
 - 1. Provide the new power service to the café building complete with all underground work including; main service disconnects, secondary service conductors, underground duct bank, conduit, cable, trenching, concrete, and backfill with restoration of all existing surfaces affected by the work.
 - 2. Provide the new communication systems services to the café building complete with all underground work including, underground duct bank, conduit, trenching, concrete, and backfill with restoration of all existing surfaces affected by the work.
 - 3. Coordinate requirements and installation with the respective Utility Companies.
 - 4. Provide the new conduits and boxes for the power and communications systems complete with mounting hardware and conduit arrangements.
 - 5. Provide the complete power distribution system for the building. Provide all feeders, panelboards, junction and pull boxes to complete the building's distribution as shown, stated, or reasonably implied. Provide all wiring to all equipment as shown or implied on the Construction Documents.
 - 6. Provide all branch circuit panelboards and all branch circuit wiring to all equipment furnished in this work or other trades in order to provide for all power supply needed to complete the building's electrical system as shown, stated, or reasonably implied.
 - 7. Provide all safety and disconnecting switches, and other control devices complete with all wiring to connect to all motors as furnished under the electrical

work or by other trades. All equipment shall be mounted, wired, and ready for use as shown, stated, or implied. Provide control and/or interlock wiring only where specifically indicated.

8. Provide all lighting fixtures indoor and outdoor of all types, with all controls, mounted, lamped and wired to provide the complete lighting system as shown, stated, or reasonably implied.
9. Provide all wiring devices and all power outlets completely wired and mounted as shown, stated, or implied.
10. Provide all communications conduits and wiring and outlet rough-in boxes for tele/communications, and other low-voltage building communications systems, complete with provisions for installation of wiring and equipment as shown, stated, or implied.
11. Provide a new grounding and bonding system for a new service.
12. Provide a telecommunications rack and equipment. Active telecommunications equipment is furnished by city.
13. Provide infrastructure for a security camera system.
14. Provide infrastructure for a data wireless access system.

1.3 MATERIALS NOT INCLUDED

- A. Materials not provided by this Contractor, but subject to his installation and or/wiring:
 1. Motors and some motor control devices will be installed by other Contractors under other Sections of the Specifications and wired under Division 26.
 2. Exhaust fans, electric cabinet heaters, motor operated dampers, pumps, appliances, air handling and heating equipment will be installed by other trades and wired by this Contractor.

1.4 WORK NOT INCLUDED

- A. Do not provide underground work beyond the points designated on the Construction Documents, but do provide for trenching and backfill for power and communications utility service cables.
- B. Do not provide motors, appliances, tables, work benches, or desks.
- C. Do not provide motor controls where they are specifically indicated or shown as furnished by others or furnished and/or installed with the equipment.
- D. Do not provide low voltage control wiring, (120 volt and below), for heating, ventilating and air conditioning systems, except as hereinbefore stated.

1.5 GENERAL

- A. It is the purpose of the Construction Documents to indicate the approximate locations of all equipment, outlets, etc. The exact location of equipment and outlets may be given from time to time as the work progresses. This Contractor shall ascertain from the Owner's Representative the exact locations and arrange his work accordingly. The Owner's Representative reserves the right to effect reasonable changes in the location of outlets up to the time of roughing-in without additional cost. Exact raceway routings, required pull-boxes and other details are left to the good judgment of the Contractor to produce the most satisfactory installation at least cost.

- B. This Contractor shall take all field measurements necessary for this work and shall assume responsibility for their accuracy. Do not scale drawings. Any interferences or field problems shall be reported to the Owner's Representative for resolution.
- C. All items of labor, materials, and equipment not specifically described herein or shown on the plans, but incidental to, or required for, the complete installation and proper operation of the work shall be furnished as if called for in detail by the Specifications or Construction Documents.
- D. It is the intent of the Contract Electrical Construction Documents and Specifications to describe as accurately as possible the work required. Should any errors, omissions or interferences with other trades be found, they shall be brought to the attention of the Owner's Representative for resolution. Minor discrepancies and interferences in locations of outlets, conduits, routings, and fixture locations shall be resolved by the Contractor under field conditions and shall not be justification for additional cost. The Contractor is responsible for the coordination required for conduits to be routed in walls, ceilings or floors as they may occur. The intent is for all conduits to be concealed and all devices flush.
- E. The design described herein is intended to comply with applicable codes and standards, and with safeguards in excess of code requirements where necessary. It is the responsibility of the Contractor to maintain these standards for achieving a complete and safe installation and to observe and report to the Owner's Representative any items which in his opinion do not conform to the codes and standards or which would improve the safety and/or serviceability of the installation.
- F. Where any conflict between Construction Documents and Specifications exists, the Specifications shall take precedence.
- G. Wherever in these Documents the word "provide" is used, it shall be interpreted to mean "furnished and installed" by the Contractor.
- H. Wherever in these Documents the word "Contractor" or "Subcontractor" is used, it shall be understood to mean the Contractor bidding the work described herein.

1.6 EQUIPMENT MANUFACTURER'S DIRECTIONS, DIAGRAMS, AND MANUALS

- A. Except where specifically permitted otherwise, all materials, equipment, and devices furnished by the Contractor shall be new and shall conform to NECA, NEMA, IEEE, ANSI, and Underwriter's Laboratories Standards where applicable and shall bear the CSA and/or UL listing or label mark.
- B. All manufactured articles and all other materials and equipment furnished by the Contractor shall be applied, connected, erected, used, cleaned, and conditioned as directed in the Manufacturer's latest printed instructions.
- C. The Contractor shall compile and deliver to the Owner before request for final payment all installation drawings, wiring diagrams, operating and maintenance manuals, etc. pertaining to all equipment furnished and installed by him.
- D. It shall be the Contractor's responsibility to consult the manufacturer's drawings, installation manuals and instructions for all equipment. All equipment shall be installed in strict accordance with these manuals and instructions.

- E. The Contractor shall arrange for complete testing of all new electrical equipment before energizing. Tests shall be performed by persons competent in test procedures and knowledgeable in their performance.
- F. Tests shall be performed in strict accordance with the manufacturer's written specifications and instructions. Any equipment which fails to pass proper testing procedures shall be repaired or replaced by the Contractor as the Owner selects. The cost of any and all repairs or replacements made necessary by faulty equipment supplied or installed by the Contractor shall be at the Contractor's expense and shall not be cause for extra compensation by the Owner.

1.7 INSPECTION

- A. The Owner and his authorized representatives shall have access to and the privilege of inspecting all work and materials as the work progresses. These representatives will have authority to approve or reject any work or materials with the Construction Documents, Specifications, Codes and good engineering practice as a basis for any action taken.
- B. Any work found not in compliance with the Construction Documents, Specifications or applicable standards as listed herein shall be repaired or replaced by the Contractor, as deemed necessary by the Owner or his representatives. Any such additional work by the Contractor as considered necessary by the Owner for the Contractor's work to comply with the Contract Documents as described herein shall not be justification for additional compensation by the Contractor.

1.8 COORDINATION OF WORK

- A. This Contractor is responsible to meet all completion dates set by the Owner, and shall be able to furnish all labor of various classes required to meet schedules and completion dates. This Contractor shall familiarize himself with the various manufacturers on delivery and arrange for delivery of equipment and materials so as not to hinder or delay any completion dates for electrical work or other trades which are affected by the electrical work.

1.9 SAFETY AND CLEANING UP

- A. It shall be the Contractor's responsibility to maintain a clean, safe work place while performing his work and upon leaving the site. Live electrical parts of fixtures, devices and equipment shall be completely protected to prevent accidental injury to others in the building. All stairways, halls and exits shall be left with free access. Tools, toolboxes, ladders, materials, etc., shall be kept in a confined area away from normally occupied areas when not in use.
- B. This Contractor shall use all possible care to avoid soiling the floors and walls. No cutting, threading or bending of conduit will be permitted in finished areas of the building. Oily waste, rags and other flammable materials must be removed from the building immediately after use. Accumulations of rubbish or stored materials of any kind will not be permitted in any public or finished area.
- C. The Contractor must include in his contract price the costs of barricades, signs, fall protection apparatus, fences and other safety devices which will be necessary to safeguard the workplace and excavations.

- D. This Contractor will be held responsible for damage to other work caused by his work or through the negligence of his workmen. All patching or repairing of damaged work shall be done by persons or Contractors normally experienced in the work to be performed; such Contractors or Subcontractors shall be subject to prior approval of the Owner's Representative. The cost of such work shall be paid by the Contractor.

1.10 INTERFERENCES, CUTTING, AND PATCHING

- A. The Contractor shall predetermine the location, size, etc., of all chases and openings necessary in new construction for the installation of his work and shall be responsible to provide all such openings. He shall set all sleeves, inserts and hangers and be responsible for their proper location.
- B. All outlets, switches, and receptacles shall be centered with regard to paneling, trim, equipment, etc., and shall line with either bottom or top of masonry courses. The Contractor shall carefully review the Architectural elevations for exact locations and mounting heights for switches, receptacles, luminaires or appliance requirements and placement. These detailed plans take precedence over electrical floor plans and specifications for actual locations or quantities.
- C. Should any structural difficulties prevent the installation of outlets, setting of cabinets, running of conduits, or other electrical construction at points shown on the Construction Documents, the minor deviations required for a satisfactory installation, as determined by the Owner's Representative, shall be performed at no additional cost.
- D. Do not provide general painting of interior raceways or boxes. However, all enclosures and equipment shall be left in like-new condition, and any finished painted surfaces shall be restored to original quality as furnished by its manufacturer.

1.11 RECEIPT OF PORTABLE OR DETACHABLE PARTS

- A. The Contractor shall retain in his possession and shall be responsible for all portable or detachable portions of the installation such as fuses, keys, locks, etc., until the completion of the work, and shall turn them over to the Owner and obtain itemized receipt. This receipt, together with a certificate of approval, shall be attached to the Contractor's request for final payment.

PART 2 PRODUCTS

2.1 SHOP DRAWINGS

- A. The Contractor shall submit electronic copies of Manufacturer's certified drawings to the Owner's Representative for approval before purchasing the equipment, in accordance with the Contract Documents. Contractor shall refer to General Conditions for exact submittal requirements. Failure to gain prior approval by the Owner's Representative shall not relieve the Contractor for supplying the equipment as specified herein. Shop Drawings are required on the following items:
1. Switchboards, distribution panels, CT cabinets
 2. Branch circuit panelboards
 3. Disconnect switches
 4. Power utility service installation drawings
 5. Lighting equipment, lighting controls
 6. Lighting control panelboards

7. Tele/communications Equipment
 8. Wiring devices, lighting control devices
- B. The Contractor shall review each set of Shop Drawings before submission to the Owner's Representative. The Contractor shall verify the Shop Drawings accurately and correctly identify the equipment as specified and sufficient information is included for the complete evaluation by the Owner's Representative.
 - C. All Shop Drawings shall be stamped by the Contractor indicating the date and status of his review. No Shop Drawing shall be submitted to the Owner's Representative unless it has been reviewed and approved by the Contractor.
 - D. The Contractor shall submit Shop Drawings of all equipment as stated even if no deviation of the specification is made and such equipment is exactly as specified herein.
 - E. Specific submittal requirements and content may be listed in other sections. In general, provide submittals only as listed in these specifications, and only for pertinent equipment components; not general, unedited "marketing" type material.

2.2 STANDARDS AND SUBSTITUTIONS

- A. It is the intent of these Specifications to describe and require materials and equipment of a particular quality and standard. Wherever in these Documents a manufactured specific item is designated, the Contractor's proposal shall be based on furnishing the specific item as specified. Refer to Division 00 and 01 for additional requirements.
- B. The Contractor shall also include a cost breakdown indicating any savings or additional cost to be awarded to or incurred by the Owner should he accept any or all such substitutions.
- C. Failure by the Contractor to gain acceptance of any or all such substitutions by the Owner's Representative shall in no manner be justification for additional cost or relieve the Contractor from providing the specified items herein described.
- D. The Owner's Representative reserves the right to accept or reject proposed substitutions and to limit or extend the time period allowed for their submittal.
- E. Wherever in these Specifications more than one manufacturer is listed for a specific item of equipment, the Contractor's proposal shall be based on furnishing equipment manufactured by one of those listed.
- F. Should the Contractor elect or choose other than the first item as specified, he shall be responsible to provide complete and proper fit, installation, operation, and adjustment for the equipment he intends to use. In addition, the Contractor shall provide any and all adjustments of other related or connected equipment which may be affected by the choice of the associated equipment.

PART 3 EXECUTION

3.1 CODES, PERMITS, AND INSPECTIONS

- A. All work shall be executed in accordance with the latest National Electrical Code and the Ohio Building Code, and any Local, City, or County Codes in effect at the time of construction.
- B. At all times during which the Contractor or any Subcontractor are engaged in work covered by these Documents, all requirements of the Occupational Safety and Health Act shall be observed.
- C. The Contractor shall secure and pay for all permits from all agencies and obtain all inspections required for the completion of the electrical work. All permits and certificates of inspection and approval signed by the controlling building department shall be furnished in duplicate to the Owner's Representative and shall become the property of the Owner.

3.2 WORKMANSHIP

- A. All electrical work shall be installed under the direct supervision of a skilled journeyman electrical foreman. All work shall be tested, inspected, and certified approved as to materials and workmanship by proper authority prior to acceptance.
- B. The installation shall be installed and arranged so that its component parts will function as a workable system complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order. The work shall be so executed in conformity with the best accepted standard practice so as to contribute to efficiency of operation and maintenance, maximum accessibility, and appearance and minimum cost in construction of future alterations and additions. It shall also be executed that the installation will conform with and adjust itself to the building structure its equipment and its usage.
- C. Electrical work shall be installed by journeyman electricians under the direct supervision of a competent foreman at all times. At no time shall electrical work be installed by apprentice electricians without the immediate on-the-job supervision of a journeyman electrician.
- D. The workmanship of all installed electrical equipment shall be subject to final approval of the Owner's Representative. Any work which does not meet recognized standards of proper installation shall be repaired or replaced by the Contractor at the Owner's Representative discretion. The cost of any repairs and/or replacements necessary due to faulty workmanship shall not be justification for additional compensation by the Contractor.

3.3 VISITING THE SITE

- A. The Contractor shall visit the site before submitting his proposal, compare the Construction Documents with the existing work and inform himself of all pertinent local conditions including location accessibility and general character of the site, the character and extent of existing work within or adjacent to the site, and any other work being performed thereon at the time of the submission of his bid. Failure to visit the site will in no way relieve the Contractor from the necessity of furnishing any materials or performing any work that may be required to complete the work in accordance with these

Documents. Lack of knowledge will not be acceptable as a valid excuse for granting any extra compensation or for failure or neglect to perform any or all work in this Contract.

3.4 GUARANTEE OF CONTRACT WORK

- A. The Contractor shall guarantee the materials used in the installation herein specified are the best of their respective kinds and that they shall be put together in a thorough and workmanlike manner under the immediate supervision of the Contractor. He shall guarantee that he will correct any defects in workmanship, materials, or effectiveness of any portion of the equipment and/or systems within one (1) year after completion and acceptance of the installation. This is to be done without cost to the Owner, provided that such defects are due to faulty material and/or workmanship which were provided by the Contractor.
- B. Certain items of equipment may carry a requirement for longer guarantee periods, as specified elsewhere in the Contract Documents.

3.5 TEMPORARY LIGHT AND POWER

- A. This Contractor shall include installation and/or maintenance and removal of temporary wiring for lighting and small tools for this project. The cost of all conduit and wire connections and all associated equipment needed for this temporary power for this Contractor's work shall be included in the Contractor's proposal. The cost of energy needed for a reasonable amount of power for the duration of the construction shall be paid by the General Trades Contractor, or by the Owner.

3.6 INTERFERENCES

- A. It is the intent of the Electrical Construction Documents and Specifications to describe as accurately as possible the work required. Should any inconsistencies, or interferences with other trades be found, they shall be brought to the attention of the Owner's Representative for resolution. Minor discrepancies and interferences in locations of outlets, conduit routing and fixture locations, shall be resolved by the Contractor under field conditions and shall not be justification for additional cost.

3.7 CHANGES IN WORK

- A. The Owner, without invalidating the Contract, may order extra work or make changes by altering, adding to or deducting from the work, with the contract "Lump Sum Price" being adjusted accordingly as described in Division 00 or 01.

3.8 STORAGE OF MATERIALS

- A. Materials furnished and delivered by this Contractor for the work may be placed or stored on the property of the Owner only in a location as will be designated by the Owner or his representative. However, the Contractor shall assume full responsibility for all materials so stored.

3.9 PAINTING

- A. The Contractor shall provide painting of boxes, hangers, and supports used in all outdoor installations with rust inhibiting paints unless galvanized. In addition, all manufacturers' enclosures and equipment shall be left in like-new condition, and any furnished surfaces shall be restored to original quality.

- B. In general, exposed boxes, conduit and fittings in indoor locations will not require painting but shall have all surfaces as furnished by the manufacturer left in clean, like-new condition.
- C. All equipment, boxes, etc., installed outdoors exposed to weather shall be corrosion resistant with a protection of galvanizing or not less than two (2) coats of rust inhibiting paints.

3.10 RECORD DRAWINGS

- A. Whenever field changes, modifications or revisions to the Contract Construction Documents are permitted or required, it shall be the Contractor's responsibility to record such changes on a set of the contract construction prints. These prints shall not be utilized for any other purpose. Field changes shall be recorded to indicate as neatly and accurately as possible all changes in locations, routing and other incidental information as necessary to convey to the Owner the exact as-installed status of the electrical system.
- B. The Contractor shall record final locations of all underground lines within or outside the building by depth from finished floor or grade and by offset measurement from building components or surface improvements such as building columns, building walls, curbs, edges of walks, etc.

3.11 IDENTIFICATION

- A. The Contractor shall provide fully engraved micarta nameplates with minimum 1/4-inch high lettering for all equipment provided by him including; panelboards, motor controllers, safety switches, transformers and one for each circuit designated from main distribution panels. Nameplates shall be black with white lettering. Each plate shall identify the equipment, voltage class, phase, power supply source, ampere rating and purpose of the specific circuit or equipment involved. Nameplates shall be fixed to equipment enclosures with rivet pins or epoxy adhesive.
- B. Provide a permanent nameplate or plaque to identify the maximum fault current amperes available at the main service disconnecting means, in accordance with National Electrical Code Article 110.

END OF SECTION 26 05 00

SECTION 26 05 05 - ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Contractor shall visit and examine the site prior to bidding to ascertain the existing conditions and limits of demolition and construction. Adjoining areas shall be maintained in operation.
- B. Remove all items of existing construction not to remain as a part of the final project. Unless otherwise noted:
 - 1. Remove all existing electrical equipment, wiring, and conduit in the areas to be renovated, in this project.
 - 2. Existing equipment serving other areas, but interfering with the construction, shall be relocated as necessary.
 - 3. Certain items of electrical equipment are noted to be relocated and reinstalled as part of this project.
- C. Any demolition indicated on the Construction Documents is shown in general to indicate the extent of demolition and is not to be considered as a record drawing of existing conditions. Accordingly, the Contractor shall be responsible for complete demolition of the electrical work indicated including any buried items or any existing items not shown on the Construction Documents. Before demolition and before submission of proposed methods and operations, the Contractor shall be responsible to obtain, for reference, any existing record Construction Documents and to conduct any appropriate field testing to determine the nature of the existing electrical work to be demolished.
- D. Protect existing work remaining in place, and protect the public.
- E. Repair and restore to original sound condition all items or portions of electrical work which are not noted to be demolished, but are damaged by work under this contract.
- F. It shall be the Contractor's responsibility to protect and retain power to all existing active equipment which shall remain.
- G. Contractor shall reconnect any equipment being disturbed by this renovation yet required for continued service to same or nearest available panel.
- H. Where work by the General Contractor (wall removal, new or relocated wall opening, etc.), results in the removal, relocation, or refeeding of electrical devices or lighting fixtures, the Contractor shall disconnect or reconnect as required all active devices remaining on that circuit or system.
- I. Contractor shall "ring out" all circuits in existing panel affected by this alteration. Where additional circuits are needed, reuse circuits available for reuse, or provide new circuits. Tag all unused circuits as spare, replace all inoperative or defective circuit breakers. Tighten all connections.

PART 2 PRODUCTS AND PROCEDURES

2.1 COORDINATION

- A. Coordinate and sequence demolition so as not to cause shut-down of operation of surrounding areas.
- B. Do not proceed with demolition without written authority to proceed.
- C. Proceed with demolition in a systematic manner and coordinate all trades involved.
- D. Carefully remove equipment, materials, or fixtures which are to be reused.
- E. Disconnect or shut off service to areas where electrical work is to be removed. Remove all electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not a part of the final project in all areas where work of this contract is to be performed.
- F. Refer to the mechanical Construction Documents for mechanical equipment which must be disconnected by this Contractor for removal or abandonment by the Mechanical Contractor.
- G. Remove all conduit wire, boxes, and fastening devices, as required to avoid any interference with new installation. Abandoned underground conduit to be capped at both ends.

2.2 SHUT-DOWN PERIODS

- A. Arrange timing of shut-down periods of all in-service panels with Owner or his representative. Do not shut down any utility without prior written approval.
- B. Keep shut-down period to a minimum or use intermittent period as directed by the General Contractor.

PART 3 EXECUTION

3.1 SALVAGEABLE ITEMS

- A. Items of salvageable value to the Owner shall be removed and protected by the Contractor and turned over to the Owner as directed.
- B. All removed equipment shall be disposed of by this Contractor unless directed to do otherwise by the Owner's Representative. Disposal responsibilities include:
 - 1. Mercury Abatement
 - a. Remove and recycle mercury containing fluorescent and HID lamps as universal waste, in accordance with the EPA universal waste rule.
 - b. All Mercury-related operations shall be performed in accordance with the EPA universal waste rule. Regulation 40 CFR Parts 260, 261, 264, 265, 268, 270 and 273 for mercury containing fluorescent and HID lamps.
 - 2. PCB Abatement
 - a. Remove and incinerate ballasts which contain polychlorinated biphenyl (PCB), in accordance with current environmental regulations.

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- b. All PCB-related operations shall be performed in accordance with EPA Regulation 40 CFR 761, Polychlorinated Biphenyls, Manufacturing, Process, Distribution in Commercial Use Prohibition.
 - 3. Properly dispose of all ionization type smoke detectors during demolition work as required by local, state, and regional codes.
 - 4. Properly dispose of all batteries during demolition work as required by local, state, and regional codes; this also includes any other electrical equipment containing lead.
- C. Items of salvageable value to the Contractor may be removed as the work progresses. Salvaged items must be transported from the site as they are removed. Storage or sale of removed items on the site will not be permitted.

3.2 REUSABLE ELECTRICAL EQUIPMENT

- A. Disconnect, remove, or relocate all existing electrical material and equipment that interferes with new installation. This includes, but is not limited to; panels, lighting fixtures, wiring devices, signal equipment, exhaust fans, baseboard heaters, unit heaters, etc.
- B. Relocate existing lighting fixtures as indicated on plans. Fixtures shall be cleaned and re-lamped, also tested to confirm if fixture is in good working condition before installation at new location.

END OF SECTION 26 05 05

SECTION 26 05 13 - WIRING AND CABLE

- A. Color code conductors (except control and instrumentation conductors) as follows:

208/120
System

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

1. #12 and #10 conductors shall have continuous insulation color, as listed above.
 2. Color code conductors larger than above, which do not have continuous insulation color by application of at least two laps of colored tape on each conductor at all points of access including junction boxes. Color tape shall be the equal of 3M products Scotch #35.
 3. Conductors shall be soft annealed copper insulated for 600 volts unless specifically indicated otherwise.
- B. Insulation type shall be type THWN for wire sizes #8 AWG and larger and THHN or THWN for #10 AWG and smaller. THHN shall not be used in wet or damp locations.
- C. Flexible cord shall be heavy-duty type so with an equipment ground conductor in addition to the current carrying conductors.
- D. Provide #12 conductors, unless otherwise indicated.
1. Control conductors shall be #14 minimum for NEC class I and #16 for NEC class II.
- E. Conductors #8 AWG and larger shall be stranded.
- F. Conductors #10 AWG and smaller shall be solid.
- G. Install wiring in conduit.
- H. Connect #10 and smaller wires with constant pressure expandable spring type connectors, "Scotchlok" by 3M or B-Cap by Buchanan.
- I. Connect #8 and larger wires with compression connectors or splices as manufactured by Burndy or T&B.
- J. Insulate splicing connectors to at least 200% of the wire insulation. Use pre-stretched tubing connector insulators, 3M PST for #2 and larger conductors.
- K. Pull conductors using recognized methods and equipment leaving at least 6" wire at all junction boxes for connections.
1. Clean out each conduit system before pulling wire.
- L. Form and tie all wiring in panelboards.
- M. There shall be no wirenut joints or splices made inside switchboards/panelboards.

- N. Branch circuit wire sizes (and conduits) shall be increased from those indicated on the plans to prevent excessive voltage drop. Branch circuits shall be installed with wires of sufficient size so that voltage drop between the panel and the loads does not exceed limit of 3%. Regardless of the temperature rating of the conductor insulation, all conductor ampacity rating for this project shall be determined from the 75°C conductor temperature ratings indicated in the NEC tables. Where equipment or devices are provided with terminals/lugs rated for 60°C, the ampacity rating of the 75°C conductor shall be limited to its associated 60°C rating as indicated in the NEC tables. The electrical contractor shall be responsible to increase the conductors and conduit size as required.

- O. Circuits may be multi-plexed in conduit provided wire is properly derated and conduit sized per code. Under no circumstances shall more than six (6) current carrying conductors be run in a single conduit.

END OF SECTION

SECTION 26 05 19 - CONDUCTORS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for, and incidental to, the proper installation of the complete electrical wire and cable systems herein specified, and as shown on the Construction Documents.

1.2 QUALITY ASSURANCE

- A. All conductors shall be copper and shall conform to the requirements of the National Electrical Code (NEC), IACS, ASTM, and IPCEA, and shall be Underwriters Laboratories Listed.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material should not be stored directly on the ground or floor and shall be kept as clean and dry as possible and free from damage or deteriorating elements.
- B. In general, do not deliver items of electrical equipment to the project substantially before the time of installation. Limit each shipment of bulk and multiple-use materials to the quantities needed for installations within three (3) weeks of receipt.
- C. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.

PART 2 PRODUCTS

2.1 FABRICATION AND MANUFACTURE

- A. All feeder, branch circuit and control conductors shall be 600 volt, 90 degree centigrade, single conductor copper cables, Type 'THWN', 'THHN' or XHHW.
- B. Wiring in fluorescent fixture channels shall be Type 'THHN' insulation rated at 90 degrees centigrade.
- C. Cords for makeup connections to equipment shall be rated 600-volts, heat resistant, rubber insulated, portable cable with neoprene jacket Type 'SO' and 'W' of extra flexible stranded copper.
- D. All other special power cable and signal wires shall be as noted on Construction Documents and/or hereinafter specified.

PART 3 EXECUTION

3.1 INSTALLATION

- A. For new distribution systems, color code branch circuit and feeder conductors as follows:
 - 1. 208Y/120 volt, 3 phase, 4 wire system
 - a. Phase A – black
 - b. Phase B – red
 - c. Phase C – blue
 - d. Neutral – white
 - e. Grounding - green
 - 2. In addition to these requirements, also provide color coding of conductors at junction or pullboxes.
- B. All rough-in work in the building shall be completed before wires are installed into conduits. The conduits shall be cleaned out by pulling a swab through the tubing with a fish tape, and wires shall be pulled through conduit in such a manner as to avoid kinking or injuring the insulation. Thermoplastic wire shall not be pulled where ambient temperatures are lower than 15 degrees F.
- C. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.
- D. All joints and splices in wire #10 AWG and smaller shall be twisted and made mechanically strong with electrical spring pressure type connectors similar to "Scotch-lok" of proper size, rated 600 Volts and shall be wrapped with half lapped layers of plastic tape.
- E. Solderless type connectors of approved and accepted types shall be used on splices and taps in wires #8 AWG and larger. All splices shall be insulated with a minimum of two (2) half-lapped layers of "Scotch" #88 and #22 plastic tape. All connectors having irregular surfaces shall be properly padded with "Scotch-fill" to eliminate sharp corners and voids before applying plastic tape.
- F. Branch circuit wires in panels shall be neatly arranged with all surplus wire cut off and all wires tied with nonmetallic ties. Metallic ties will not be permitted. Only one conductor shall be attached to a terminal screw or lug unless terminal is UL Listed for more than one (1) terminal.
- G. All mechanical wire and cable termination shall be torque tightened with torque wrench or torque screwdriver to manufacturers recommended torque values.
- H. For feeders and equipment circuits 40 ampere rated and above, the intent of the design is to install a maximum of three (3) current-carrying conductors in a single conduit (raceway), utilizing the full conductor ampacities allowed and defined in the National Electrical Code Article 310. Combining of four (4) or more current-carrying conductors in a single raceway must be reviewed and approved by the Owner's Representative.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING

- A. Ground all equipment per N.E.C.
- B. All conduits shall contain a code-sized ground wire size per N.E.C. in addition to the conductors shown on the plans. Where circuit conductors are increased in size for any reason (i.e. voltage drop, derating, etc.), the ground wire size shall be increased proportionately (according to circular mil area).
- C. Where an isolated, insulated ground is required a separate isolated green ground shall be run from the panel isolated ground bus to the isolated ground connection of the device served. In no case shall the system ground (green wire and associated outlet boxes, conduit and building steel) be allowed to contact the isolate ground (green wire with white stripe).

END OF SECTION

SECTION 26 05 26 – GROUNDING (STAGE / SITE)

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for, and incidental to, the proper installation of the complete electrical grounding systems herein specified, and as shown on the Construction Documents.

1.2 QUALITY ASSURANCE

- A. All grounding materials and equipment shall be copper and/or copper clad and shall conform to the requirements of the National Electrical Code (NEC), IEEE, NEMA, JIC, ANSI, and shall be labeled with the Underwriters' Laboratories Seal of Inspection.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material should not be stored directly on the ground or floor and shall be kept as clean and dry as possible and free from damage or deteriorating elements.
- B. In general, do not deliver items of electrical equipment to the project substantially before the time of installation. Limit each shipment of bulk and multiple-use materials to the quantities needed for installations within three (3) weeks of receipt.
- C. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.

1.4 PERFORMANCE, SEQUENCING, AND SCHEDULING

- A. The Contractor is responsible to test the entire grounding system, including all conductors and connections before the power distribution system is energized. Improper grounding conditions shall be corrected before occupancy of the building.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Provide a copper equipment grounding busbar in all branch circuit panelboards and distribution panels.
- B. Provide ground "rods" and equipment grounding as indicated on the Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The entire light and power system shall be permanently and effectively grounded in accordance with the latest issue of the National Electrical Code, including service equipment, panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of the electrical equipment.
- B. All cord connected appliance frames shall be grounded to the conduit system through a grounding conductor in the cord. Flexible connections to motors shall be jumped with a braid equipment grounding conductor.
- C. Flexible metallic conduit equipment connections utilized in conjunction with single phase branch circuits shall be provided with suitable green insulated grounding conductors connected to approved grounding terminals at each end of the flexible conduit.
- D. Neutral conductors shall be grounded at the source, but they shall not be used for equipment grounding.
- E. Identify equipment grounding conductors by a green color code, and neutral conductors with a white color code.
- F. Grounding of the electrical system shall be by means of insulated grounding conductor installed with all feeders and branch circuit conductors in all conduits. Grounding conductors shall be sized in accordance with NEC 250 and shall run from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground all conduits by means of grounding bushings on terminations at panelboards with an installed #12 conductor to grounding bus.
- G. Grounding conductors shall be stranded.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAYS AND BOXES

A. Raceways

1. All wire shall be run in accordance with code in corrosion resistant, rigid, threaded, metal conduit or electrical metallic tubing (E.M.T.) unless otherwise specifically stated herein.
 - a. Conduit in exterior walls, below floor slab, or underground shall be rigid, threaded, galvanized, heavy wall type.
 - b. Carlon PVC type 40 heavy wall conduit with ground wire may be used below floor slab or underground in lieu of rigid, threaded, galvanized conduit. PVC 40 conduit shall not be run in or above floor slab. PVC conduit shall terminate below floor slab with rigid, threaded metal conduit adapter. Conduit above slab shall be metal.
 - c. Conduit run exposed to the weather shall be heavy wall, metal threaded type.
2. Conduit size shall be 3/4" minimum.
3. Conduit shall be securely fastened in place.
4. All conduit shall be concealed in walls, floor and ceilings wherever possible. Exposed conduit in finished areas will not be permitted. Exposed conduit will be permitted in the unfinished areas with the specific approval of the architect.
5. Use flexible conduit for the connection to recessed or semi-recessed lighting fixtures (6' length maximum). Use liquid tight metal conduit for all connections to motors and other equipment subject to vibration and in areas subject to moisture.
6. Use watertight joints with buried and concrete encased conduit. All buried conduits outside of buildings shall have a minimum of 24" of cover. Metal conduits buried in earth shall be painted (two coats) with heavy asphaltum paint.
7. Support runs of conduit as detailed in the appropriate table of the national electrical code (NEC).
8. Installed exposed runs of conduit and conduit above lay-in ceilings parallel or perpendicular to the walls, structural members of intersections of vertical planes and ceilings. Provide right angle turns using fittings or symmetrical bends. Support conduits within 1" of all changes in direction.
9. If a conduit is suspended, it shall be supported on trapeze hangers which use "all-thread" rods from the structural steel. The use of ceiling support wire or similar material will not be accepted.
10. Install empty conduit for future use as indicated on the drawings. Conduit shall be complete with jetline or pull rope, junction/outlet boxes, tile rings and appropriate cover plates.
11. Provide pitchpockets where conduits penetrate the roof.
12. Thread lubrication/sealant is required on outdoor and underground threaded metal joints.
13. Install fire seal fittings where conduits penetrate concrete floor slabs or masonry walls required to be fire rated.
14. Horizontal portion of conduit exposed on the roof and feeding equipment shall not be more than 5'-0" unless the written approval from architect or engineer is obtained.

B. Pull and Junction Boxes

- a. Install pull and junction boxes where shown on the drawings, and where required for changes in direction, at junction points, and to facilitate wire pulling. Furnish box sizes in accordance with NEC unless larger boxes are indicated.

- b. Provide steel boxes and removable covers of code gauge, hot rolled sheet steel, hot dipped galvanized inside and outside, for above ground work. Furnish weatherproof boxes when installed above ground outside.
 - c. Provide cast iron boxes, hot dipped galvanized inside and outside where shown on the drawings. Furnish removable covers with gaskets and stainless steel, brass or bronze screws.
 - d. Provide concrete boxes for underground work unless otherwise indicated on the drawings. Furnish steel frames and covers with the cover attached to the frame with hexagon head, brass or bronze cap screws, 3/8" in diameter. Provide a rubber gasket for sealing between the cover and the frame. Paint the cover with two coats of heavy asphaltum.
- C. Outlet Boxes
1. Use sheet steel boxes, zinc coated or cadmium plated, for concealed interior work.
 2. Use cast boxes, zinc-cadmium finish malleable iron, for exposed interior work, and for exposed or concealed work in wet, damp or exterior locations. Cast boxes shall be series FD by Crouse Hinds or Appleton.
 3. Wall box sizes (minimum) shall be 4" square X 2-1/2" deep where wall construction permits. Where wall construction dictates, the depth may be reduced to 2-1/8" or 1-1/2" under special conditions.
 4. Fixture outlets in ceilings (minimum) shall be 4" octagonal X 1-1/2" deep (4-11/16" octagonal X 2-1/2" deep where required to accommodate larger conduit or larger number of wires).
 5. Ganged boxes shall be one piece (minimum), 2-1/8" deep.
 6. Provide cast iron, concrete-tile floor boxes with adjustable covers set flush and level with the finished floor, with outlets as indicated on the drawings. Provide Hubbell #B-2400, 4200, or 4300 series boxes with leveling screws. Flush type covers and openings to serve outlets used. Furnish flush caps for closing off box when not in use.
 7. Flush mount boxes in all finished walls, install the plaster rings in drywalled plastered walls and raised covers as required in walls with other finishes so that the cover plates fit tightly against boxes or rings, 3/16" maximum gaps are allowed for noncombustible walls.
 8. Adjust location of outlets in masonry or tile construction to occur in the nearest joint to the height specified. Heights shall meet AD.A. requirements.
 9. Support all boxes to maintain proper alignment and rigidity.
 10. Clean boxes of all foreign matter prior to the installation or wiring of devices.
 11. Mounting heights on the drawings are to the centerline of the box unless otherwise noted.

END OF SECTION

SECTION 26 09 61 - DMX LIGHTING CONTROL SYSTEM

PART 1 -GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for, and incidental to, the proper installation of the control system herein specified and as shown on the Construction Documents.

- B.

References

 - 1. Underwriters Laboratories (UL):
 - a. UL 508 - Industrial Control Equipment American National Standards Institute (ANSI)
 - b. UL 924 - Emergency Lighting and Power Equipment
 - 2. National Fire Protection Association (NFPA):
 - a. NFPA 70 - National Electric Code
 - 3. American National Standards Institute (ANSI):
 - a. ANSI E1.11-2008 USITT DMX512-A - Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories
 - b. ANSI E1.20-2006 - Remote Device Management over USITT DMX512
 - 4. IEC 61000-4-2 Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques-Electrostatic Discharge Immunity Test; 2008

1.2 QUALITY ASSURANCE

- A. Integrated equipment rating tests shall be factory performed and adjusted for rated continuous current, rated light output, enclosure stability, and dielectric strength.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material shall not be stored directly on the ground or floor and shall be kept as clean and dry and free from damage or deteriorating elements.

- B. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.

- C. The finished surfaces of all luminaires shall not be defaced in any way and shall be cleaned to original finish at time of completion of the work.

1.4 SUBMITTALS

- A. Submittal Schedule
 - 1. Within thirty (30) days of contract award, the Contractor shall submit a complete list of control products he intends on furnishing with manufacturer and catalog designations, along with currently quoted lead times for delivery of same. Should the Contractor anticipate that the delivery schedule of any specified product may adversely impact the construction schedule, he shall bring it to the attention of the Architect or Owner's Representative at this time.

- B. Shop Drawings should include:
 - 1. Manufacturer cut sheets for each component
 - 2. Bill of materials listing each component
 - 3. Cad renderings of the device with the precise dimensions
 - 4. Network diagrams
 - 5. System schematic/riser diagram

- C. Quality Assurance
 - 1. Manufacturer: Minimum 10 years of experience designing and assembling architectural lighting controls
 - 2. All devices are 100% factory function tested prior to delivery
 - 3. All power components UL listed for required loads

- D. Substitutions
 - 1. Voluntary product substitutions from the Contractor will not be considered.

1.5 CLOSEOUT SUBMITTALS

- A. Submit closeout manual and documentation
 - 1. Warranty
 - 2. Technical Support Contact
 - 3. Manual

PART 2 -PRODUCTS

2.1 Manufacturer

- A. Provide basis of design system by Electronic Theatre Controls (ETC).
 - 1. Controls to be procured by Integrator. Controls are available to be procured through multiple distribution channels meeting the requirements of a public bid.
 - 2. System pricing has been obtained by the Design team prior to the bid and shared with the Owner.

2.2 Integrator

- A. It is the intent that all DMX controls equipment herein be furnished by an Authorized Dealer of the entertainment Lighting Systems manufacturer. The installation of this equipment, including supply of standard electrical supplies (i.e. conduit, wire, standard boxes, breaker panels), shall be by the Electrical Contractor. The Theatrical Lighting Systems manufacturer or their Authorized Dealer shall be responsible for commissioning, configuring and training of the system. The Electrical Contractor bears the responsibility for the complete system unless otherwise contracted.

- B. Subject to compliance with requirements, the equipment indicated herein shall be provided by a qualified theatrical integrator meeting the following qualifications:
 - 1. Approved Dealer or authorized reseller of an approved manufacturer.
 - 2. The Integrator shall have been in business and providing theatre lighting systems for a period of ten years or more, and shall have completed at least ten projects of this type and scope.
 - 3. integrator shall be responsible for project management including submission of shop drawings, samples, equipment delivery, coordinating the integration and performance or all elements of the system described in this section.

4. The Integrator shall be an entertainment technician certification program (ETCP) recognized employer during the duration of the project.
5. Pre-qualified Integrators:
 - a. Vincent Lighting Systems, Columbus, Ohio
 - b. Live Technologies, Columbus, Ohio
 - c. Indianapolis Stage Sales, Indianapolis, IN

2.3 Products

- A. Unison Mosaic Show Controller (MSCX)
 1. General
 - a. The Controller shall be a microprocessor-based system specifically designed for control of lighting and related systems in an architectural or entertainment application. A personal computer running emulation software shall not be acceptable.
 - b. The Controller shall store operating software and show data in non-volatile solid-state memory. This memory shall be removable for purposes of backup or disaster-recovery.
 - c. Show data may be downloaded from a remote personal computer over an Ethernet or USB connection.
 - d. It shall be possible to update the Operating Software by download from a remote personal computer over an Ethernet connection.
 - e. The Controller shall commence show playback automatically on receiving power without additional external inputs.
 - f. The Controller shall have an internal real-time clock that continues to operate when external power is absent. It shall be capable of adjusting for Daylight Savings Time automatically and can be updated over the Internet using the Network Time Protocol (NTP).
 - g. The Controller shall be able to calculate sunrise and sunset times based on longitude and latitude information, and use these as triggers for events.
 - h. The capacity of the controller shall be defined in terms of number of control channels being used, and the maximum capacity of each unit shall be factory-configured to user requirements.
 - i. There shall be visual indicators on the Controller showing status of the controller and its interfaces.
 - j. The Controller shall operate a web server on its Ethernet interface. This shall allow status information, control and configuration options to be accessed remotely.
 - k. The Controller shall have an internal watchdog feature that will restart the unit in the event of program failure.
 - l. Multiple Controllers shall automatically synchronize and share triggers when programmed as part of a single show and linked via Ethernet during playback.
 - m. The Controller shall support conditional logic and execute user-defined Lua scripts to support advanced show control operations.
 - n. The Controller shall be provided with a 5 year manufacturer warranty.
 - o. The Controller shall output control data as ETCNet2, Philips KiNet, Pathport and Art-Net II protocols simultaneously via Ethernet.
 2. Mechanical
 - a. Enclosure and mounting shall comply with IEC 60297
 - b. The controller shall be a 2U 19" rack mount enclosure (19" x 3.5" x 15")
 - c. The controller shall be entirely solid-state with no moving parts, fans or hard disc drives
 3. Electrical

- a. The Controller shall be designed to support the following standard connectors:
 - 1) RJ45 socket for 10/100/1000 Base-TX Ethernet for control data
 - 2) RJ45 socket for 10/100/1000 Base-TX Ethernet for system management
 - 3) USB-A Socket for USB 2.0
 - 4) (2) IEEE 1394 socket for DV input and/or output
 - 5) (2) 9-pin D plug for RS232 serial input/output
 - 6) 5-pin XLR for USITT DMX512 input \DVI-I socket for DVI output
 - 7) Fused IEC socket for 115-250VAC/47-63Hz/2-1A mains input and power cables for North America, Europe and UK shall be provided.
4. Thermal
 - a. The controller shall operate in a temperature range from 0°C to 50°C (32°F to 122°F)
5. Software
 - 1) The Controller shall be supported by programming software running on either a PC or Mac platform. Programming features shall include:
 - b. Comprehensive architectural and automated fixture library
 - c. Drag and drop placement of fixtures on plan
 - d. Drag and drop patching of fixtures to output addresses
 - e. Import of any media for mapping to fixture arrays
 - f. Timeline-based programming and playback
 - g. Extensive range of editable effect presets
 - h. Drag and drop placement of effect presets and media on timeline
 - i. Variety of triggering options for firing system-wide events
 - 1) Each trigger event may be configured to initiate one or more lighting or show control action
 - j. Each trigger event may be configured to test one or more conditions before executing its actions
 - k. Simulation of individual timelines, and entire project with triggers
 - l. Live output from software for programming verification purposes
 - m. Controller and network management tools
 - n. Export TSV reports for all aspects of programming
- B. Power Control System
 1. The installation rack shall be the Sensor3 120V as manufactured by Electronic Theatre Controls, Inc., or equal. The Power Control System enclosure shall consist of up to 48 module spaces.
 2. Electrical
 - a. Sensor3 racks shall operate at 120V, three phase, four wire + ground, 47-53 or to 57-63 Hz at 800 amps max. Other voltage and phase options are available upon request. Sensor racks shall automatically compensate for frequency variations during operation. Provisions shall be made for optional amp trap devices for fault current protection. Standard SCCR fault current protection shall be 100,000A.
 - b. All load and neutral terminals shall accept up to #4 AWG (25mm²) wire. Systems providing smaller terminals do not allow contractor wire sizing flexibility and shall be deemed unacceptable.
 - c. Load terminals shall be located at the front of the wiring cavity. Front access racks having terminals located at the back of the rack or on the side near the back of the rack such that adjacent load cabling may block terminal access shall not be acceptable.
 3. Electronics

- a. Power control electronics (CEM3) shall be contained in a single module that can be plug-in capable without use of tools. Power control and dimming systems that require tools for removal of control electronics shall not be acceptable.
 - b. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary conductor terminations. Systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the control module or pluggable backplane shall not be permitted.
 - c. The power controller shall directly support the following network protocols:
 - 1) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)
 - 2) ANSI E1.7 Architecture for Control Networks (ACN)
 - 3) Systems that do not support the above listed industry standard ACN protocols for Ethernet setup, control and feedback integrated directly between the power system and control system shall not be deemed acceptable.
 - d. The power controller shall directly support 2 ports of control input using ANSI E1.11 USITT DMX512-A.
 - e. Control signals shall be sent between control module and dimmer/power modules using flat ribbon cables. Systems using cat5 cable and rj45 connections or discrete hand wired conductors as sole physical communication media between control module and dimmer/power modules shall be considered long term unreliable and shall be not be acceptable.
 - f. System shall provide an optional low voltage connection to maintain power of control electronics through brown out, instantaneous, and sustained power outages. Systems that do not provide optional low voltage backup power connection to the power controller shall not be acceptable.
 - g. Control electronics shall be housed in a formed steel body with cast-aluminum face panel.
4. Physical
- a. The Sensor3 rack shall be a free-standing, dead-front switchboard, substantially framed and enclosed with 16 gauge, formed steel panels. All rack components shall be properly treated, primed and finished. Exterior surfaces shall be finished in fine-texture, scratch-resistant, epoxy paint. Removable top and bottom panels shall facilitate conduit termination on the 48 module rack. Knockouts shall serve the same purpose on 12 and 24 module racks.
 - b. Sensor3 racks shall be available in three sizes: SR-3-12; SR3-24; and SR3-48
 - c. Racks shall be designed for front access to allow back-to-back or side-by-side installation.
 - d. Racks shall be designed to allow easy insertion and removal of all modules without the use of tools. Supports shall be provided for precise alignment of modules into power and signal connector blocks. With modules removed, racks shall provide clear front access to all load, neutral and control terminations. Racks that

- require removable panels to access load, neutral or control terminations shall not be acceptable
- e. An optional bus bar kit shall be available from the factory to allow adjacent racks to be powered by a single line feed. No soft buss rack-to-rack wiring shall be required. Racks that require discrete cabling to connect adjacent racks shall not be acceptable.
 - f. Module spaces shall be mechanically keyed to accept only the 20A or below 50A, or 100A module specified for that space. Racks that allow modules of varying wattages to plug into the same space shall not be acceptable. The rack shall be configurable to accept mixed dimmer types and sizes throughout the rack.
 - g. Each rack shall provide a lockable full-height door containing an integral electrostatic air filter that shall be removable for easy cleaning. A single low-noise fan shall be located at the top of each rack. Design of the rack and modules shall draw all cool air intake air through the integral electrostatic air filter at the front of the rack, discretely through each module housing and directly out the top of the rack such that exhausted hot air from adjacent modules does not heat the module(s) above, below, or to the side of each other. System designs that draw the same heated air through multiple modules shall not be acceptable
 - h. The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the dimmer room does not exceed 40°C/104°F. Racks that do not employ both locking doors and electrostatic air filters shall not be acceptable.
 - i. The fan shall turn on whenever any circuit in the system is activated. In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down and a message shall appear on the control module LCD. The fan shall remain on during thermal shutdown of individual dimmer modules. Systems that do not include over-temperature sensing and preventative thermal shutdown shall not be acceptable.
 - j. A fan sensor shall be provided. In the event of momentary fan failure, error message will be displayed and sent remotely over Ethernet to optional logging systems. Systems that do not provide optional system event logging shall not be deemed acceptable.
 - k. A fan sensor shall be provided. In the event of momentary fan failure, error message will be displayed and sent remotely over Ethernet to optional logging systems. Systems that do not provide optional system event logging shall not be deemed acceptable.
 - l. A 3 x .5-inch LED status indicator (beacon) shall be mounted in the rack door. The beacon shall be visible throughout a wide viewing angle. In normal operating conditions, this LED is illuminated. If the rack's control module senses an error condition, the beacon shall flash until the error is corrected. An optional indicator shall be available for remote locations. Racks have no external means of visually showing that an error is present shall not be acceptable.

- C. Control Processor Modules
 - 1. The

PART 3

3.1 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.2 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.3 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.
- B. Install products in accordance with manufacturer's instructions.
- C. Define each dimmer/relay load type, assign each load to a zone, and set control functions.

3.3 FIELD QUALITY CONTROL

- A. Startup Services
 - 1. Manufacturer's authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.
 - 2. Conduct Pre-Installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".
 - 3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:
 - a. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM – GENERAL REQUIREMENTS", authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 - b. Verify connection of power wiring and load circuits.
 - c. Verify connection and location of controls.
 - d. Address devices.
 - e. Verify system operation control by control.
 - f. Verify proper operation of manufacturer's interfacing equipment.

- g. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.
 - h. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".
 - i. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
 - j. Obtain sign-off on system functions.
- B. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.3 ADJUSTING

- A. On-Site Scene and Level Tuning

3.3 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.3 CLOSEOUT ACTIVITIES

- A. Training:
 - 1. Include services of manufacturer's authorized Service Representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.

END OF SECTION

SECTION 26 21 16 - ELECTRICAL SERVICES

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for, and incidental to, the proper installation of the incoming electrical service herein specified, and as shown on the Construction Documents.
- B. The building shall be supplied by American Electric Power (AEP) by means of underground primary conductors, and a pad mounted transformer from the existing utility company manhole, with secondary voltage provided at 208Y/120 volts, 3 phase, 4 wire.

PART 2 PRODUCTS

2.1 FABRICATION AND MANUFACTURE

- A. American Electric Power (AEP) will provide for the complete electrical service requirements of this project. Underground 208Y/120V service shall be supplied to the building from the utility manhole on 4th Street. The Contractor shall supply conduits with pullwire from the utility manhole to the building, as indicated on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The Power Company will furnish and install the primary underground cable, but this Contractor shall provide all trenching, pipe sleeves, underground PVC conduit and backfill from the service pole to the pad-mount transformer location with approximate routing as indicated on the Construction Documents, and in complete conformance with Power Company's requirements. All work in connection with the pad mounted transformer will be provided by the Power Company, but this Contractor shall provide the concrete "vault" style transformer base, secondary underground service conduits, [concrete duct bank], and secondary service conductors. This Contractor shall terminate all ducts and cables as directed by the Power Company, and provide termination lug hardware, if necessary.
- B. This Contractor shall arrange conduits and conductors to accommodate the Power Company requirements in accordance with the Utility's accepted standards. Meters will be furnished and installed by the Power Company at the transformer location. Secondary wiring from the current transformers to meters will be by the Power Company; conduit is provided by the Contractor.
- C. Outdoor or indoor metering current transformer (CT) cabinets shall be provided by the Contractor, and shall meet the standards of the power utility.
- D. New electric services shall be provided with a complete grounding system to meet the latest edition of the National Electrical Code, Article 250 Requirements, and all requirements detailed on the Drawings.

- E. This Contractor shall include in his bid proposal an allowance item of Ten Thousand Dollars \$10,000.00 for the charges or costs made by the Power Company for provision of service to the building. This allowance item shall be used to compensate the Contractor for the actual charges made by the Power Company, with the balance of the item, if any, credited back to the Owner.

END OF SECTION 26 21 16

SECTION 26 24 16 – PANELBOARDS (STAGE / SITE)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
 - 3. Field quality-control test reports.
 - 4. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Square D; Schneider Electric. Subject to compliance with requirements, provide the specified product or a comparable product manufactured by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Contactors, and Accessories:

- a. Eaton Corporation; Cutler-Hammer Products.
- b. General Electric Co.; Electrical Distribution & Protection Div.
- c. Siemens Energy & Automation, Inc.

2.2 MANUFACTURED UNITS

- A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1.
 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Note: "Door-in-Door" front covers are also acceptable.
- B. Phase and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- C. Conductor Connectors: Suitable for use with conductor material.
 1. Ground Lugs and Bus Configured Terminators: Compression type.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- F. Panelboard Short-Circuit Rating:
 1. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
 2. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.3 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch Overcurrent Protective Devices:
 1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.
 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
 - 3. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - a. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.
- C. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements published by the manufacturer.
- C. Mount top of trim 72 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub three 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub three 1-inch empty conduits into raised floor space or below slab not on grade.

-
- H. Panelboard Nameplates and Circuit Identification: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Provide a typewritten panel circuit directory to identify the load on each active circuit.
 - I. Ground equipment according to Division 26 Section "Grounding".
 - J. Connect wiring according to Division 26 Section "Conductors".
 - K. Provide multi-pole circuit breakers or approved "handle ties" for multiple single-pole circuit breakers when multi-wire branch circuits are installed, in accordance with NEC Article 210.
 - L. Circuit breakers provided as "spares" shall be identified as such, and shall be left in the "off" position at the conclusion of the work.

3.2 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

END OF SECTION 26 24 16

SECTION 26 24 16 - PANELBOARDS

- A. Panelboards
1. Panelboards shall be enclosed dead front safety type with features and ratings as scheduled on the drawings.
 2. Panels known as "load centers" are unacceptable.
 3. Molded case circuit breakers shall be as scheduled on the drawings and specified in this division.
 4. All bus bar shall be rectangular solid copper.
 5. Space, where shown in panel schedules, designates space for future protective devices and shall include bus and support.
 6. Install cabinets so that center of the top breaker does not exceed 6'-6" above the finished floor.
 7. Entries on directory cards shall be typed, complete and accurate.
 8. All bolted connections shall be torqued in accordance with manufacturer's standards.
 9. Electrical contractor shall arrange circuits as near as possible to circuit numbers on the drawings.
 10. At completion of job, electrical contractor shall take current reading checks of respective phases. A minimum of circuit connections shall be rearranged to balance, as closely as possible, the load in the panel.
 11. All breakers shall be bolt-on type.
 12. Provide (3) spare 1" conduits into accessible ceiling space where panels are flush-mounted.
 13. Manufacturer shall be Square D. Siemens. G.E. or Cutler-Hammer.

END OF SECTION

**SECTION 26 27 26 - WIRING DEVICES
(Café Building Only)**

- A. Wiring device color shall be selected by architect, unless otherwise indicated.
- B. Provide totally enclosed, 20 ampere, 120/277 volt, quiet *NC* general use snap switches.
- C. Switches shall be specification grade as manufactured by Hubbel, P&S, or Leviton.
- D. Provide NEMA configuration 5-20R Duplex 125 volt grounding type receptacles rated for 20 amperes unless otherwise indicated on the drawings.
- E. Receptacles shall be specification grade as manufactured by Hubbell, P&S or Leviton.
- F. Receptacles requiring amperages, voltages or configurations different from the duplex convenience receptacles above shall be as indicated on the drawings.
- G. Provide other receptacles of a quality, material and workmanship equal to that specified for duplex convenience receptacles.
- H. Provide cover or device plates for outlet boxes as follows unless otherwise noted:
 - 1. Finished areas: thermoplastic - color to match device.
 - 2. Unfinished areas: zinc coated sheet metal, aluminum, or cast metal as appropriate for the type of box.
 - 3. Exterior areas: copper free aluminum with gray, powder epoxy finish, gasket, weatherproof, Crouse-Hinds "WLRD" for duplex receptacles and WLRS for single receptacles or equal.
 - 4. Telephone, communication, and signal outlet plates, shall match those used for receptacles and switches. All outlet and/or junction boxes shall be complete with a cover plate by this contractor.
 - 5. Where devices are ganged, they shall be installed under a common coverplate.
- I. Locate the switches approximately 4'-0" above the finished floor elevation or nearest block course (within ADA requirements), unless otherwise indicated. The long dimension of the switches shall be vertical.
- J. Locate receptacles approximately 1'-6" above the finished floor elevation or nearest block course (within ADA requirements), unless noted otherwise. The long dimension of receptacles shall be vertical.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES (STAGE / SITE)

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, materials, equipment, tools, and services necessary for, and incidental to, the proper installation of all wiring devices, such as switches, receptacles, plates, etc., herein specified, and as shown on the Construction Documents.

1.2 QUALITY ASSURANCE

- A. All wiring devices shall conform to the requirements of the National Electrical Code (NEC), NEMA, ANSI, and shall be labeled with the Underwriters Laboratories Seal of **Inspection**.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material should not be stored directly on the ground or floor and shall be kept as clean and dry as possible, and free from damage or deteriorating elements.
- B. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage, and handling.

1.4 SUBMITTALS

- A. Shop Drawings, if listed in 260010, shall be submitted for all equipment under this Section.

PART 2 PRODUCTS

2.1 FABRICATION AND MANUFACTURE

- A. Hubbell devices shall be used as a standard of bidding. Equivalent "specification grade" devices as manufactured by Pass & Seymour or Leviton are acceptable. All receptacle and snap switch type devices shall be of one manufacturer.
- B. All receptacles shall be in complete compliance with the latest published NEMA configurations for the intended applications, even though not specifically indicated on the Construction Documents.
- C. General Purpose Receptacles: 125 volt, 20 ampere, 2-pole, 3-wire, duplex type, NEMA 5-20R, Hubbell #5362.
- D. GFCI Receptacles: 125 volt, 20 ampere, 2-pole, 3-wire duplex type, NEMA 5-20R, with self-test feature - Hubbell #GFR-5362, feed-thru type capable of protecting downstream circuit devices.

- H. Tamper Resistant Receptacles: 125 volt, 20 ampere, 2-pole, 3-wire duplex type, NEMA 5-20R, Hubbell #BR20-TR series.
- I. Exterior Receptacles: Provide a GFCI receptacle with a Taymac #MX4380S, metal extra duty "in-use" cover and horizontal mounted box.
- J. Other special purpose devices may be specified on the plans.
- K. Ivory has been selected as the standard for bidding; however, colors shall be as selected by Owner's Representative from the Manufacturer's specification grade standards for both wiring devices and cover plates.
- L. All switch and convenience outlet plates shall be high impact smooth thermoplastic (Noryl or equal) to suit the various outlets or switches installed in finished areas or for flush mounted devices. Color to match device. In unfinished areas, utilize cadmium plate round corner steel covers, with cadmium plated screws. Cover plates for emergency outlets shall be red.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The approximate locations of devices are given on the Construction Documents. The exact location shall be determined at the building as the work progresses. Coordinate with architectural features; also remain clear of all mechanical equipment.
- B. Unless otherwise indicated or otherwise decided at the site, outlet boxes in walls shall be located with center line at elevation above the finished floor as indicated in the symbol legend on the drawings. Also review the architectural elevations and outlet location plans; if dimensions are given, outlets shall be provided with box supports and bracing to allow the installation to the dimensioned locations.
- C. The Owner's Representative shall reserve the right to reasonably change the location of any outlet before it has been installed, without additional charge.
- D. Install special purpose receptacles, switches, and fixed equipment connections in accordance with Shop Drawings and rough-in drawings furnished by the trades providing such equipment. Verify locations prior to rough-in.
- E. Provide green grounding conductor from each receptacle grounding contact bonded to the outlet box with an approved grounding clip or ground screw connection.
- F. All plates shall suit the device installed. Sectional plates will not be permitted. All flush outlets shall be fitted with device plates that completely conceal the openings.
- G. Install receptacles and switches only in electrical boxes which are clean and free from excess building materials, debris, etc.
- H. At time of substantial completion, replace those wall plates and receptacles which have been damaged during construction.
- I. Wiring devices covered in this section shall be provided with a grounded wire connected to the device and/or the associated outlet box. Test wiring devices to ensure electrical

continuity of grounding connections after energizing circuitry to demonstrate compliance with all grounding requirements.

- J. All receptacles shall be installed with the grounding pin opening in the "up" position. All single pole light switches shall be installed with the "OFF" position down. Outlet boxes shall not be mounted "back-to-back" in stud wall construction.
- K. On the inside cover of each receptacle cover plate provide a permanent label to indicate the panel and circuit number that feeds the receptacle.
- L. All GFCI receptacles shall be installed in a readily accessible location, visible for testing and inspection.

END OF SECTION 26 27 26

**SECTION 26 28 13 – FUSES
(Café Building Only)**

- A. The contractor shall furnish a complete set of fuses for all switches, plus fusible equipment furnished by other trades. Unless indicated otherwise on plans, the fuses shall be of the following types:
 - 1. Fuses 601 to 6000 amps shall be UL class. Trade type shall be KRP-C as manufactured by Bussmann Company.
 - 2. Fuses 1/10 to 600 amps shall be UL class RK1. Trade type shall be low peak LPS-RK (600V) and LPN-RK (250V) as manufactured by Bussmann Company.
 - 3. All other fuses shall be dual-element current-limiting type with 200,000 amperes symmetrical interrupting capacity.
- B. Fuses shall be manufactured by Bussman, Gould-Shawmut or Reliance.
- C. Spare fuses amounting to a duplicate set of each size installed shall be turned over to the owner upon completion of the project. Provide and place in a spare fuse cabinet similar to Bussman # SFC.
- D. This contractor shall replace all fuses blown during construction.

END OF SECTION

SECTION 26 28 13 – FUSES (STAGE / SITE)

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for and incidental to, the proper installation of the fuses and similar overcurrent protective devices for all switches and fusible equipment, including fusible equipment furnished by other trades, herein specified, and as shown on the Construction Documents.

1.2 QUALITY ASSURANCE

- A. All fuses shall conform to the requirements of the National Electrical Code (NEC), NEMA, IEEE, ANSI, and shall be labeled with the Underwriters Laboratories Seal of Inspection: UL 248-10 (Class L), UL 248-12 (Class R) or UL 248-8 (Class J).
- B. Mersen-Ferraz Shawmut Inc. is the basis of design and specification. Equivalent products by Cooper Bussmann or Littelfuse may be provided.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Materials should not be stored directly on the ground or floor and shall be kept as clean and as dry as possible and free from damage or deteriorating elements.
- B. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.

1.4 SUBMITTALS

- A. Contractor may be required to submit fuse coordination curves plotting the time-current characteristic of each type fuse along with fuses in the main service switches all on the graph so that it may be readily determined that proper coordination between the various components of the service and distribution equipment will be attained.
- B. If Contractor substitutes for fuses specified, Contractor shall submit coordination curves as required in Paragraph '1.4.A' above.
- C. All fuses shall be of the same manufacturer to insure retention of selective coordination as designed.

PART 2 PRODUCTS

2.1 600 VOLT HIGH-INTERRUPTING CAPACITY FUSES, CURRENT-LIMITING TYPES.

- A. Unless otherwise specified or indicated on the Drawings, all fuses rated 601 through 6000 amperes shall be UL listed Class L. Such fuses shall have a current-limiting

threshold of 10 times their current rating or less, and shall have a time-delay of 4 seconds at 5 times their rating: Type A4BQ.

- B. Unless otherwise specified or indicated on the Drawings, all fuses rated 600 amperes or less shall be UL listed, time-delay Class J.
- C. Unless otherwise specified or indicated on the Drawings, all single motor branch circuits shall utilize Type AJT (Class J) fuses sized at 150% (or next standard size) of the National Electrical Code tables, in Article 430.
- D. Transformer primary circuits shall utilize Type TRS-R (Class R 600V) or Type TR-R (Class RK5 250V) fuses sized at 150% of the primary full load current, or next standard size.
- E. Unless otherwise indicated on the Drawings, fuses for branch circuits and feeder circuits shall be:
 - 1. Circuits from 1 ampere through 200 amperes shall be Type AJT (Class J) fuses sized at a minimum 125% of the circuit full load amps and no greater than the conductor rating.
 - 2. Circuits from 225 amperes through 600 amperes shall be Type A4J (Class J) fuses sized at a minimum 125% of the circuit full load amps and no greater than the conductor rating.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fuses shall not be installed until equipment is to be energized. Fuses shall be installed with label oriented such that manufacturer's type, catalog number, voltage and current rating can be easily read.

3.2 EXTRA PRODUCT

- A. Spare fuses amounting to 20% (minimum three) of each type and rating shall be supplied by the electrical Contractor. These shall be turned over to the Owner upon project completion.

3.3 FUSIBLE EQUIPMENT

- A. All fusible equipment rated 600 volts or less and 600 amperes or less shall be equipped to accept only Class J fuses unless specified otherwise.
- B. When fuses protect an individual item of equipment, the equipment nameplate data supercedes fuse sizing suggested in this Section or sizing indicated on the Drawings.

END OF SECTION 26 28 13

SECTION 26 28 16 - SAFETY AND DISCONNECT SWITCHES (STAGE / SITE)

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, materials, equipment, tools, and services necessary for, and incidental to, the proper installation of the safety and disconnect switches herein specified, and as shown on the Construction Documents.

1.2 QUALITY ASSURANCE

- A. All safety and disconnect switches shall conform to the requirements of the National Electrical Code (NEC), ANSI, and shall be labeled with the Underwriters Laboratories Seal of Inspection.
- B. Safety and disconnect switches shall comply with all requirements of the Regulatory Agencies and shall conform to State Code, Local Codes, and Ordinances.
- C. Integrated equipment rating tests shall be factory performed for rated continuous current, short circuit current, enclosure stability, and dielectric strength.
- D. Reference Section 262813 "Fuses" for proper fuse clip hardware.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material should not be stored directly on the ground or floor and shall be kept as clean and dry as possible and free from damage or deteriorating elements.
- B. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.
- C. The finished surfaces of switches shall be cleaned to original finish at time of completion of the work.

1.4 SUBMITTALS

- A. Shop Drawings shall be submitted for all equipment provided under this Section. Drawings shall include physical layout showing conduit entrances, lug sizes, lug locations, electrical ratings, and nameplate nomenclature. Manufacturer's written recommendations for storage and protection, installation instructions, and field test requirements shall be provided. Manufacturer's instructions for tightening connections, performing cleaning, and operating and maintenance shall also be included.

PART 2 PRODUCTS

2.1 FABRICATION AND MANUFACTURE

- A. Safety switches shall be heavy duty, sheet steel enclosed, fused or unfused, of the type, size and electrical characteristics indicated on the Construction Documents.
- B. All switches shall have blades which are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressors, where necessary to permit easy access to line-side lugs. Lugs shall be front removable and UL listed for copper cable. All current-carrying parts shall be plated.
- C. Switches shall have quick-make and quick-break operating handles and mechanism which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for padlocking in the "OFF" position only, with at least three padlocks. The locking provisions shall be such that the padlock directly interferes with the operating handle and is fully visible. Switches shall have a dual cover interlock to prevent unauthorized opening switch door in the "ON" position or closing of the switch mechanism with the door open. Handle position shall indicate if switch is "ON" or "OFF".
- D. Horsepower rated switches shall be provided for motor disconnect application.
- E. Switch enclosure, unless otherwise noted, shall be NEMA Type 1 general purpose enclosures.
- F. Provide raintight type NEMA Type 3R, with conduit hubs for exterior installation or when exposed to the weather.
- G. Switches shall be as manufactured by Square D, Eaton/Cutler-Hammer, Siemens, or General Electric.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's written instructions.
- B. Provide all angle iron, channels, supports and hardware required to install equipment. Wall mounted devices shall be mounted with metal "strut" type hardware.
- C. Ground and bond in accordance with the National Electrical Code.
- D. Equipment shall be so installed that the center of the handle will not be more than 72" above the floor or platform.
- E. Provide engraved laminated phenolic plastic nameplate fastened on each switch with self-tapping sheet metal screws.

3.2 ADJUSTMENTS AND CLEANING

- A. At completion of the electrical work, clean out interior of each unit. Clean exterior of units to original finish.

- B. Check all bolted connections to insure that connections are properly installed, contact surfaces are properly mated and bolted connections are properly torqued in accordance with manufacturer's instructions.
- C. Adjust operating mechanisms for free mechanical movement.

END OF SECTION 26 28 16

**SECTION 26 28 16 - SAFETY SWITCHES
(Café Building Only)**

- A. Safety switches shall be the enclosed heavy-duty type (type HD) with quick-make, quick-break mechanism and external pad lockable operating handle.
- B. Safety switches shall be rated for 240 or 600 volts as applicable. They shall be horsepower rated when used in motor circuits.
- C. Safety switches shall be fusible or non-fusible 2, 3, or 4 pole as indicated on the drawings.
- D. Safety switches shall be single throw unless otherwise indicated on the drawings.
- E. Enclosures shall be NEMA 1 indoors and NEMA 3R outdoors unless otherwise indicated on the drawings.
- F. Manufacturer shall be Square D, Siemens, G.E., or Cutler-Hammer. All safety switches shall be by one manufacturer.
- G. Mount the safety switches securely between 3' X 6' levels above the floor unless otherwise indicated on the drawings.
- H. Switches on block walls shall be mounted on a 3/4" plywood backboard, where located indoors.

END OF SECTION

SECTION 26 29 13 - MOTOR STARTERS

- A. Provide motor starters (magnetic or fused combination) and control equipment where shown. Starters shall be provided with 120 volt coils, 3 overloads, control transformer with fused 120 volt secondary control circuit, (2) N.O. and (2) N.C. auxiliary contacts, hand-off-auto selector switch and running pilot light, unless otherwise noted. Wire thru control devices furnished by other trades. Since motor driven equipment is furnished by other trades, the control indicated on the drawings shall be considered as for bidding purposes only. Wire to conform to the actual equipment supplied and installed by the other trades. All fuses shall be dual element type. Provide "blownfuse" indicator lamps in cover.
- B. Starters shall be Square D, G.E., Cutler-Hammer, or Siemens.
- C. The exact number of normally open and normally close auxiliary contacts in each starter shall be determined by the temperature control contractor.
- D. Coordinate all equipment indicated on the electrical drawings with mechanical equipment schedules and specifications and provide motor starters for all equipment indicated as being interlocked or started from a remote location.
- E. Starters supplied as an integral part of equipment shall be furnished under the division providing the equipment. Wiring and disconnect shall be by this contractor. All other starters and auxiliary control equipment shall be supplied and wired by this contractor unless otherwise noted.

END OF SECTION

SECTION 26 50 00 - LIGHTING SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for, and incidental to, the proper installation of all interior and exterior luminaires herein specified and as shown on the Construction Documents. Provide all lamps for all fixtures of size and type as recommended by the fixture manufacturer and as scheduled.
- B. Types of fixtures, reflectors, refractors, lenses, louvers, ballasts, and lamps shall be as shown on the Construction Documents in the Luminaire Schedule, and shall be furnished complete with plaster frames, bar hangers, mounting stems, and other accessories necessary for proper installation.

1.2 QUALITY ASSURANCE

- A. All luminaires shall conform to the requirements of the National Electrical Code (NEC), NEMA, ANSI, IEEE, IES, CBM, NFPA, and shall be labeled with the Underwriters Laboratories Seal of Inspection.
- B. Luminaires shall comply with all requirements of the Regulatory Agencies and shall conform to State Code, Local Codes, and Ordinances.
- C. Integrated equipment rating tests shall be factory performed and adjusted for rated continuous current, rated light output, enclosure stability, and dielectric strength.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material shall not be stored directly on the ground or floor and shall be kept as clean and dry and free from damage or deteriorating elements.
- B. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.
- C. The finished surfaces of all luminaires shall not be defaced in any way and shall be cleaned to original finish at time of completion of the work.

1.4 SUBMITTALS

- A. Submittal Schedule
 1. Within thirty (30) days of contract award, the Contractor shall submit a complete list of lighting products he intends on furnishing with manufacturer and catalog designations, along with currently quoted lead times for delivery of same. Should the Contractor anticipate that the delivery schedule of any specified product may adversely impact the construction schedule, he shall bring it to the attention of the Architect or Owner's Representative at this time.
 2. Within thirty (30) days of bid award, contractor shall provide a complete list of all field replaceable lamps which will be furnished on the project. This list shall be

organized alphabetically by the luminaire type indicated on the luminaire schedule, and include the manufacturer and exact model number of each lamp.

- B. Shop Drawings: Indicate dimensions and components for each luminaire, not standard product of manufacturer. Provide shop drawings for each type of lamp specified. Submit cover sheet with a matrix of all luminaire types and catalog numbers submitted.
- C. Product Data:
 - 1. Submit physical characteristics of each luminaire showing conduit entrances, physical dimensions, component locations, electrical ratings, mounting hardware, and nameplate nomenclature.
 - 2. Submit manufacturer's written recommendations for storage and protection, installation and instructions, and field test requirements.
 - 3. Submit certified reports of fixture performance in accordance with IESNA accepted standards in IES photometric format covering candlepower distribution curves, luminaire efficiency, coefficients of utilization, and isolux chart (both horizontal and vertical footcandles) for each luminaire.
 - 4. Submit manufacturer's instructions for testing, troubleshooting, performing cleaning, and operating and maintenance.
- D. Substitutions
 - 1. The lighting equipment specified herein has been carefully specified for its ability to meet the luminous environment requirements of this project. Calculations have been performed to determine horizontal and vertical illuminances. Equipment and manufacturers which have been shown to comply with established criteria are specified. Substitutions in all likelihood will be unable to meet all of the same criteria as the specified equipment.
 - 2. Voluntary product substitutions from the Contractor will not be considered without prior approval to submit from the Lighting Designer.
 - 3. Should the Contractor wish to have products considered other than those specified, they must submit those items ten (10) days in advance of the bid. Non-returnable working samples of the unsolicited substitutions should be included. Failure to submit within that deadline will require that the specified products will be supplied. Submittal of a bid for this project shall include a written acknowledgment of these terms from the Contractor.
 - 4. Bid value shall not be based on substitutions in expectation of approval.
 - 5. The Lighting Designer will invoice the Contractor, at Senior Designer hourly rates, to review any product not listed in the specification.

1.5 CLOSEOUT SUBMITTALS

- A. Submit an itemized list, including Manufacturer's order numbers, of each type of lamp to be able to obtain identical replacement lamps.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Provide all sources of a particular type or classification by the same manufacturer to maintain color consistency throughout the project.

- C. All LED luminaire manufacturers shall provide electrical and photometric data performed in accordance with IESNA LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
- D. LED luminaires shall be designed with heat sinking adequate such that the junction temperature of the LEDs is maintained to meet the rated life as published by the LED manufacturer. Luminaire manufacturer shall provide validation documentation.
- E. Manufacturer shall provide photometric performance data on luminaires in accordance with ANSI/IES LM-63-02: ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information.
- F. LED luminaires shall have a minimum complete five year warranty from the date of installation unless a ten year warranty is required per the luminaire schedule.
- G. The following types shall be procured from a procured by Integrator who is an authorized dealer of the product: K,K1.
 - 1. Installation of luminaires to be by licensed electrical contractor. Integrator to coordinate delivery of luminaires and addressing with Electrical Contractor.
 - 2. Integrator can serve as a subconsultant to the Electrical Contractor.
 - 3. The Integrator shall be a qualified with the following:
 - a. Approved Dealer or authorized reseller of the approved manufacturer.
 - b. The Integrator shall have been in business and providing entertainment lighting systems for a period of ten years or more, and shall have completed at least ten projects of this type and scope.
 - c. The Integrator shall be responsible for project management including: submission of shop drawings; samples, equipment deliver; system startup; final scene setting; and coordinating the integration and performance of all elements of the DMX system described in this section.
 - d. The Integrator shall be an entertainment technician certification program (ETCP) recognized employer during the duration of the project.
 - 4. Pre-qualified Integrators:
 - a. Vincent Lighting Systems, Cleveland, Ohio
 - b. Live Technologies, Columbus, Ohio
 - c. Indianapolis Stage Sales, Indianapolis, IN
 - 5. Integrator to include system setup, commissioning and addressing, scene setting and night-time programming sessions within their scope.
- H. Delivery of all fixture types noting DMX control protocol must be coordinated with Integrator to coordinate system startup and addressing of luminaires.
- I. Provide a total of five (5) spare type "P" and "P1" luminaires as attic stock for the Owner.

2.2 LUMINAIRE MANUFACTURERS

- A. Manufacturers
 - 1. The Base Bid lighting fixtures shall be from the Manufacturers listed in the Luminaire Schedule on the Drawings. Contractor shall only submit on the products that are specified, or those listed as alternates. Submission of unsolicited substitutions will be treated as Non-Listed Manufacturers.
 - 2. Manufacturers not listed must be pre-qualified to bid as follows:
 - a. Manufacturer shall have not less than five years experience in design and manufacture of lighting fixtures of the type and quality shown. Pre-

- qualification submissions must include a list of completed projects and dated catalog pages indicating length of experience.
- b. Manufacturer shall also submit a working 120Volt non-returnable sample with cord and plug for review by the Owner's Representative and Lighting Designer.
3. Single source luminaires are listed based solely on specific performance criteria to that luminaire or decorative aesthetic design choices.
- B. Construction
1. Recessed downlight reflectors required to have "haze" Alzak finish and be constructed of one-piece of spun aluminum unless otherwise specified in the Luminaire Schedule. All ceiling trims must fit tight to the luminaire with no light leaks.
 2. No labels or stickers are to be visible through the luminaire.
 3. Adjustable accent luminaires must have locking tilt and locking rotation to ensure focus is not disturbed during re-lamping and maintenance.

2.3 LED POWER SUPPLIES

- A. Performance Requirements
1. LED power supplies shall operate LEDs within the current limit specifications of the manufacturer.
 2. LED power supplies shall operate from 60Hz or 50Hz input source and have input power factor above 90% and a minimum efficiency of 70% at full rated load of the driver.
 3. LED power supplies shall have short circuit and overload protection.
 4. LED power supplies shall have a minimum starting temperature of -20F.
 5. LED power supplies shall have a maximum case temperature rating of at least 70°C.
 6. Power supply output shall be regulated to +/-5% across published load range.
 7. LED power supply shall have a class A sound rating.
- B. Regulatory Requirements
1. LED power supplies shall be UL 1310/8750 Recognized when used in conjunction with a UL Listed luminaire (UL Listed when application is direct install) and Canadian Standards Association (CSA) Certified where applicable.
 2. Power supplies intended for commercial applications shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, non-consumer (class A) for EMI/RFI (conducted and radiated).
 3. Power supplies designated by the manufacturer for residential applications must meet FCC requirements for consumer use (FCC 47 CFR Part 15/18 Consumer Emission Limits).
 4. Power supply shall comply with IEEE C.62.41-1991, Class A operation. The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.
 5. LED power supply shall contain no PCBs (polychlorinated biphenyl).
- C. Other
1. LED power supply shall carry a five (5) year warranty from date of manufacturer against defects in material or workmanship, including a replacement, for operation at or below the maximum case temperature specification.

2. Manufacturer shall have a 15 year history of producing power supplies for the North American market.
3. Dimmable power supplies shall be controlled by a 0-10v control device; and shall be capable of operating from 100-1% dimming range.
4. Dimmable power supplies shall allow the light output to be maintained at the lowest control setting (prior to off) without dropping out.

2.4 LED REPLACEMENT LAMPS

- A. All LED retrofit lamps shall be UL listed.
- B. All LED retrofit lamps intended for indoor application shall have a correlated color temperature of 4000K (per schedule). The variation of chromaticity in different directions (i.e., with a change in viewing angle) shall be within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram.
- C. Shatterproof lamps to be used over food service areas per schedule and specs.
- D. Color Maintenance - The change of chromaticity over the lifetime of the product shall be within 0.007 on the CIE 1976 (u',v') diagram.
- E. CRI \geq 80.
- F. Published LED life ratings shall be based on the point at which LED sources reach L70 lumen maintenance and tested in accordance with IESNA LM80-08 Approved Method: Testing Lumen Maintenance of LED light sources.
- G. LED retrofit product shall not draw power in the "off" state.
- H. Manufacturer of LED replacement lamps shall provide 3 sample of product for evaluation and specification sheets indicating photometric performance, color characteristics, life, and warranty.
- I. LED retrofit lamps shall have a minimum 3 year warranty from date of installation.
- I. Supply 10% additional lamps for attic stock.

2.4 LED LIGHT SOURCES

- A. All LED light sources intended shall have a correlated color temperature of 4000K (unless specifically noted in the schedule).
- B. Published LED life ratings shall be based on the point at which LED sources reach L70 lumen maintenance and tested in accordance with IES LM80-08 Approved Method: Testing Lumen Maintenance of LED light sources.
- C. In instances where the LED sources are to be mounted directly into the architecture, the LED manufacturer shall provide a recommended heat sink volume adequate to achieve rated life at L70.
- D. All LEDs light sources shall have a CRI \geq 80.
- E. All LED sources shall have \leq 3 step binning for color consistency and uniformity.

- F. Where specified, RGB and RGBW sources shall be provided.
- G. Where specified, RGBW chip shall be mounted on a quad-chromatic board where aiming angle does not allow for consistent mixing distance. Substitutions of product with Discreet RGBW chips is not allowed.

2.5 LED DRIVERS

A. General Requirements:

1. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment.
2. Operate for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
3. Provide thermal fold-back protection by automatically reducing power output (dimming) to protect LED driver and LED light engine/fixture from damage due to over-temperature conditions that approach or exceed the LED driver's maximum operating temperature at calibration point.
4. Provide integral recording of operating hours and maximum operating temperature to aid in troubleshooting and warranty claims.
5. Designed and tested to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
6. Manufactured in a facility that employs ESD reduction practices in compliance with ANSI/ESD S20.20.
7. UL 8750 recognized or listed as applicable.
8. UL Type TL rated or UL Class P listed where possible to allow for easier fixture evaluation and listing of different driver series.
9. Suitable for field replacement as applicable; listed in accordance with UL 1598C or UL 8750, Class P as indicated.
10. Designed and tested to withstand Category A surges of 4,000 V according to IEEE C62.41.2 without impairment of performance.
11. Class A sound rating; Inaudible in a 27 dBA ambient.
12. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.
13. LED drivers of the same family/series to track evenly across multiple fixtures at all light levels.
14. Offer programmable output currents in 10 mA increments within designed driver operating ranges for custom fixture length and lumen output configurations, while

meeting a low-end dimming range of 100 to 1 percent or 100 to 5 percent as applicable.

15. Meet NEMA 410 inrush requirements for mitigating inrush currents with solid state lighting sources.
16. Employ integral fault protection up to 277 V to prevent LED driver damage or failure in the event of incorrect application of line-voltage to communication link inputs.
17. LED driver may be remote located up to 100 feet (30 m) from LED light engine depending on power outputs required and wire gauge utilized by installer.
18. Control Input
 - a. 4-Wire (0-10v DC Voltage Controlled Dimming Drivers)
 - 1) Must meet IEC 60929 Annex E for General White Lighting LED drivers
 - 2) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
 - 3) Must meet ESTA E1.3 for RGBW LED drivers
 - b. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers
 - 1) Must meet DMX / RDM: USITT DMX512A and ANSI E1.20 (Explore & Address)
 - 2) Capable of signal interpolation and smoothing of color and intensity transitions

PART 3

3.1 PREPARATION

- A. Provide fluorescent, compact fluorescent, and metal halide luminaires with 100-hour continuous operation burn-in period.

3.2 INSTALLATION

- A. Install fixtures, lamps, lenses, etc., after building is enclosed, weathertight, and environmental conditions are nominally the same as expected for the complete spaces. All lamps, glassware, reflectors and refractors shall be clean and free of chips, cracks and scratches. Glassware and lamps shall not be installed until approved by the Owner's Representative.
- B. Furnish and install all necessary hangers, supports, framing, fittings, etc., to support fixtures and fixture outlets. All fixture supports shall be securely anchored to the ceiling and/or building construction and shall be capable of supporting the fixture in question plus 100% additional weight. This Contractor shall coordinate with other Contractors onsite to insure that supports are installed.
- C. For recessed (flush) mounted fixtures, the Contractor shall coordinate the installation and construction details with ceiling system in which they are installed, i.e. support system dimensions, flanges (where required), acoustical tile, or pan pattern, etc. The Contractor shall verify the specific ceiling construction is appropriate for the fixture specified before ordering the luminaires. This Contractor shall coordinate his work with that of structural,

masonry, patching, plastering and acoustical tile Contractors to assure proper locations of openings for all fixtures. Ceiling outlets in acoustical tile ceilings shall be spaced and installed so as to replace the ceiling tile in accordance with the acoustical ceiling layouts.

- D. Flush type fixtures shall be securely fastened to the ceiling framework, and supplied with finished metal trim for plastered or acoustical ceiling. In general, the Manufacturer and catalog number of the fixture type is given in the Luminaire Schedule; however, this Contractor shall verify the ceiling suspension system to be installed and shall provide the proper type fixture suspension straps, retaining clips, supporting hooks, etc., as required to properly support the fixture. Flange type, snap-in or lay-in fixture trims shall be furnished, as required, for the ceiling system installed.
- E. All suspended fixtures shall be constructed with swivel device such that canopies will neatly fit slope of ceilings and fixtures hang plumb. Flexible conduit or cord connections will not be approved for feeding suspended fixtures, unless specifically indicated in the Luminaire Schedule.
- F. Flush fixtures shall have the branch circuit system terminated in a junction box above the ceiling, but accessible through ceiling opening. Four feet (4') of 1/2" flexible metal conduit shall be provided between the junction box and the fixture housing.
- G. All exposed fixture housings shall be so installed that the housing surface, trim frame, door frame, and lens frame shall be free of light leaks. The lens door shall close in a light-tight manner.
- H. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.
- I. Recessed luminaires for installation in ceiling construction, where fixtures will be in direct contact with thermal insulation, shall be equipped with internal thermal protection and shall be so identified. Recessed luminaires installed flush in suspended grid ceilings, where fixtures will not be in direct contact with thermal insulation, shall be standard fixture so identified for this particular type of installation.
- J. Exterior wall mounted fixtures shall have the joint between the fixture and wall on top and both sides sealed with a silicon sealer. Do not seal the joint at the bottom to allow for drainage.
- K. Upon completion of installation of interior luminaires, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- L. Fixture type "P" and "P1" note a mockup is required prior to complete installation to confirm mounting detail within the Pavilion structure.

3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTABLE LUMINAIRES

- A. Aim and adjust luminaires as directed by the Lighting Designer, Owner's Representative, or Electrical Engineer. Exterior adjustable luminaires shall be aimed at night. Include two nighttime aiming sessions with Integrator present.

3.5 CLEANING

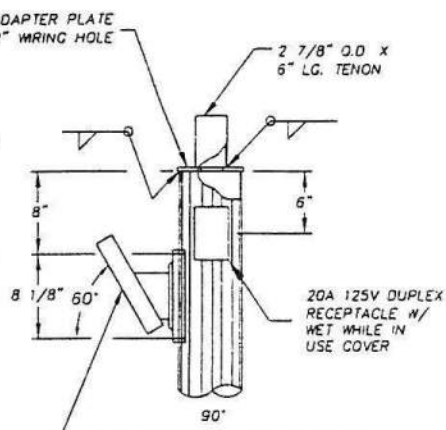
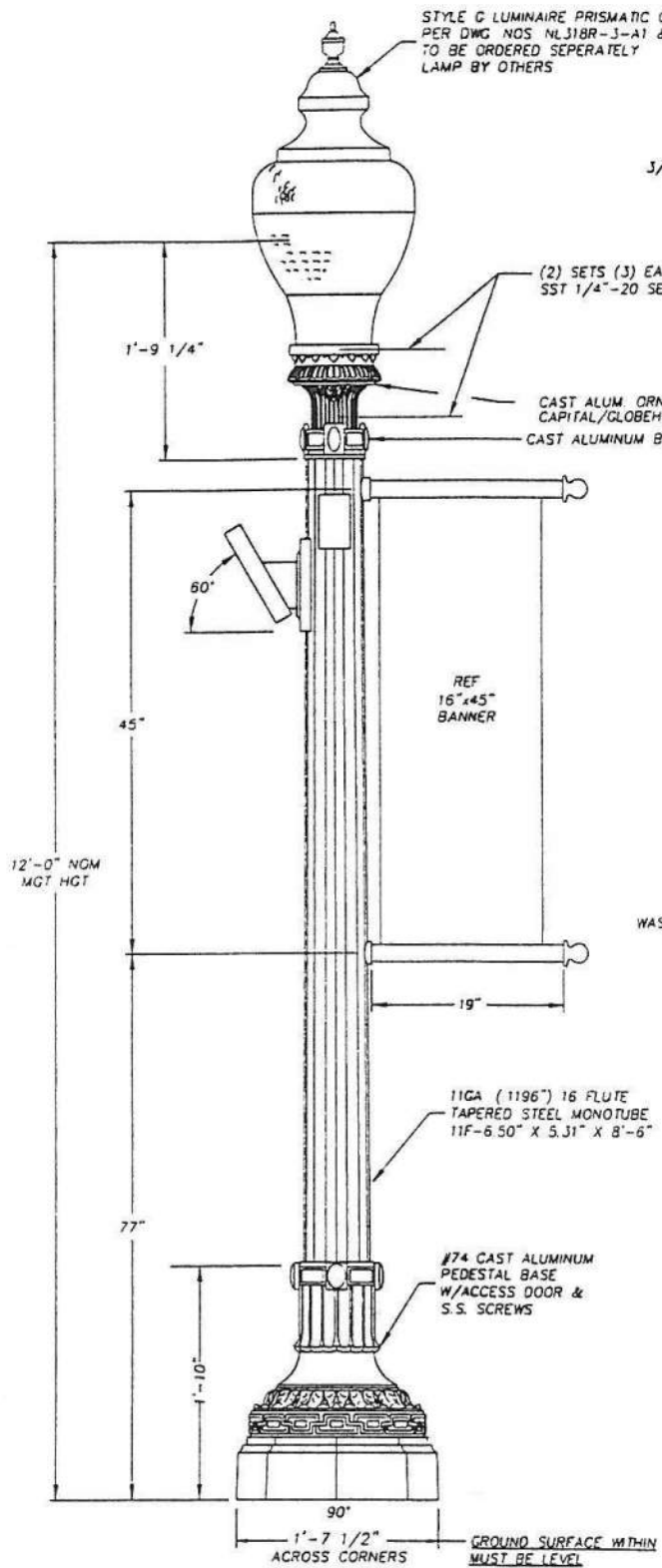
- A. Fixtures shall be mounted straight, level and true to the building lines. Warped or damaged fixtures shall be replaced or repaired to the satisfaction of the Owner's Representative and Owner.
- B. Immediately preceding the final inspection, this Contractor shall thoroughly clean all fixtures of dust, dirt, grease, fingermarks, etc. All lamps shall be operating at the time of Owner's acceptance.

END OF SECTION

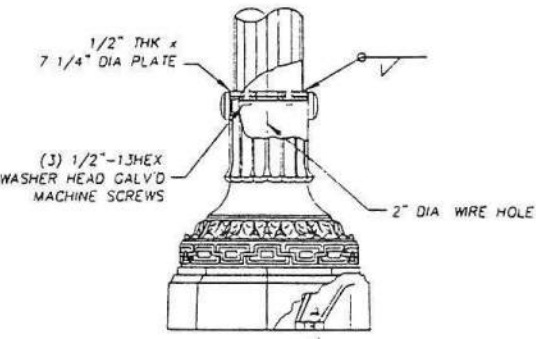
CONSTRUCTION DOCUMENTS LUMINAIRE SCHEDULE										
TYPE	LUMINAIRE		LAMP TYPE	DESCRIPTION	MOUNTING	MANUFACTURER	CATALOG NUMBER	CONTROL PROTOCOL	ALTERNATE	REMARKS
	WATTS	VOLTS								
A	TBD	TBD BY EE	INTEGRAL 4000K LED	PEDESTRIAN CITY STANDARD LUMINAIRE WITH 16' TALL FLUTED POLE, OCTAGONAL PEDESTAL BASE, STYLE "G" PRISMATIC GLOBE AND LED LIGHT SOURCE.	POLE	UNION METAL	P2000-74-88-Y2	TBD	N/A	
A1	TBD	TBD BY EE	INTEGRAL 4000K	PEDESTRIAN CITY STANDARD LUMINAIRE WITH 16' TALL FLUTED POLE, OCTAGONAL PEDESTAL BASE, BANNER ARMS, TWO (2) STYLE "G" PRISMATIC GLOBES AND LED LIGHT SOURCES.	POLE	UNION METAL	NL318R-3-A4-1	TBD	N/A	
B	50	120	INTEGRAL RGBW LED, 2000+ LUMENS	POLE MOUNTED RGBW SPOTLIGHT LUMINAIRE WITH 8 X 60 DEGREE BEAM SPREAD, DIE-CAST ALUMINUM HOUSING WITH TEMEPRED GLASS LENS, INTEGRAL POWER SUPPLY/, IP67 RATED. 12 LBS. SEE POLE DETAIL FOR QUANTITY .PROVIDE 20' TALL 6" SQUARE SMART POLE AND UNIVERSAL YOKES FOR FIXTURES: LUMENPULSE PL-T-6-S-20-COLOR-SB, PLTU	POLE	LUMENPULSE	LBL-100-RGBW-VN-LSLV-BK-DMX/RDM-UL, SNW	DMX	COLOR KINETICS, INSIGHT	COLOR TO BE CONFIRMED
B1	28	120	INTEGRAL 4000K LED, 1400 LUMENS	POLE MOUNTED WHITE SPOTLIGHT LUMINIARE WITH 40 DEGREE FLOOD OPTIC, DIE-CAST ALUMINUM HOUSING, TEMPERED GLASS LENS, INTEGRAL POWER SUPPLY/DMX MODULE, IP67 RATED. 6 LBS. PROVIDE 20' TALL 6" SQUARE SMART POLE AND UNIVERSAL YOKES FOR FIXTURES: LUMENPULSE PL-T-6-S-20-COLOR-SB, PLTU	POLE	LUMENPULSE	LBM-X-40K-FL-WHTX-7-LBMVS-WH	DMX	INSIGHT, COLOR KINETCS	COLOR TO BE CONFIRMED.
B2	28	120	INTEGRAL 4000K LED, 1400 LUMENS	SAME AS TYPE "B1" EXCEPT WITH VISOR AND ADJUSTABLE SPREAD LENS	POLE	LUMENPULSE	LBM-X-40K-NFL-WHTX-7, LBMVSSLA-WH	DMX	INSIGHT, COLOR KINETCS	COLOR TO BE CONFIRMED
F	8	120	INTEGRAL 4000K LED, 400+ LUMENS	SUSPENDED LOW VOLTAGE CATANARY SYSTEM WITH 12' TALL ROUND TAPERED STEEL POLE AND LOW VOLTAGE LUMINAIRES WITH 4.25" DIAMETER APERTURE, 4" TALL ALUMINUM HOUSING AND DROP FROSTED ACRYLIC DECORATIVE LENS. PROVIDE REMOTE POWER SUPPLY.	CATENARY	LUMIERE	CAMBRIA PDR53209-213-10LEDXXXX-12-XX-ACRYLIC HOOD	0-10V	SUBMIT FOR CONSIDERATION	POLE BY UNION METAL, SEE CUT SHEETS FOR DETAILS
H	4.6 W/FT	120	INTEGRAL 4000K LED, 200+ LUMENS/ FT	INTEGRATED ILLUMINATED STAINLESS STEEL HANDRAIL WITH EMBEDDED LINEAR LED WITH LENS, ASYMETRIC DISTRIBUTION AND LUTRON A-SERIES POWER SUPPLY IN POST. COORDINATE HEIGHT WITH ARCHITECT.	HANDRAIL	INTENSE LIGHTING	IVR15-SPI-ST-PXX-HO-40-30AS	FORWARD PHASE	COLE LIGHTNG, WAGNER ARCHITECT-URAL	
J	19	120	INTEGRAL 4000K LED, 92 CRI	SURFACE MOUNTED LED CYLINDER WITH 6" DIAMETER APERTURE, 9" TALL HOUSING INTEGRAL DIMMABLE DRIVER, WIDE DISTRIBUTION AND IP 65 RATING. (PAVILION)	SURFACE	ERCO	84528-WH-92CRI	REVERSE PHASE	WE-EF	

K	100	120	INTEGRAL LED	PIPE MOUNTED LED STAGE WASH LUMINAIRE WITH NARROW AND MEDIUM LENS. WET LOCATION LISTED. PROVIDE SAFETY CABLE. (STAGE LIGHTING)	PIPE	ETC	SELD40LO-1	DMX	N/A	PROCURED BY INTEGRATOR
L	17 W/ FT	120	INTEGRAL RGBW LED, 400+ LUMENS/ FT	RECESSED INGRADE LED LINEAR LUMINAIRE WITH 10X60 OPTIC, RGBW COLOR MIXING, INTEGRAL DRIVER AND SLIP RESISTANT LENS AND IP68 RATING.	INGRADE	LUMENPULSE	LOI-120/277-48-RGBW-10X60-TS2.5-DMX/RDM-ASL	DMX	INSIGHT, COLOR KINETCS,	
L1	8.5 W/FT	120	INTEGRAL 4000K LED	SAME AS TYPE "L" EXCEPT WHITE LIGHT, ASYMETRIC WALLWASH OPTIC AND ANTI-SLIP LENS REQUIREMENT	INGRADE	LUMENPULSE	LOI-RO-120-48-40K-WW-DMX/RDM-ASL	DMX	INSIGHT, COLOR KINETICS	
L2	17 W/FT	120	INTEGRAL RGBW	SAME AS TYPE "L" EXCEPT WITH 10X10 OPTIC WITH A PRESET 5 DEGREE TILT.	INGRADE	LUMENPULSE	LOI-120/277-48-RGBW-10X60-TS5-DMX/RDM-	DMX	INSIGHT, COLOR KINETICS	
M	6	120	INTEGRAL LED	FLAGPOLE MOUNTED LED BEACON WITH INTEGRAL POWER SUPPLY.	POLE	AMERICAN BEACON	95866-006X	N/A	TBD	
P	17 W/FT	TBD BY EE	INTEGRAL LED, RGBW	SURFACE MOUNTED LINEAR LED LUMINIARE WITH 30 DEGREE OPTIC, INTEGRAL DRIVER AND POWER SUPPLIES, AND QUAD-CHROMATIC CHIP. PROVIDE DMX MODULES AS REQUIRED (32 PER MODULE)	SURFACE	INSIGHT LIGHTING	MVWII-17-RGBWq-30-SMSS-48"-120-DMXFX-TW, CDS-A	DMX	TRAXON, HYDREL	MUST MATCH "P1"
P1	17 W/FT	TBD BY EE	INTEGRAL LED RGBW	SAME AS TYPE "P" EXCEPT WITH 15 DEGREE GRAZING OPTIC.	SURFACE	INSIGHT LIGHTING	MVWII-17-RGBWq-30-SMSS-48"-120-DMXFX-TW, CDS-A	DMX	TRAXON, HYDREL	MUST MATCH "P"
R	6	24/120	INTEGRAL 4300 K LED	SPIKE MOUNTED LED LANDSCAPE SPOTLIGHT LUMINAIRE WITH 25 DEGREE OPTIC, IP65 RATING AND REMOTE DIRECT BURIAL POWER SUPPLY.	SPIKE	LUMASCAPE	LS782LED-6W4-NM-13DIM-CB, LSTDB1-300	0-10V	SUBMIT FOR CONSIDERATION	

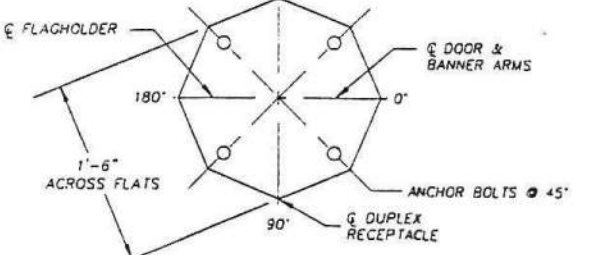
DESIGN NO	BANNER ARMS
P2000-74-B8-11	YES
P2000-74-B8-12	NO



REMOVABLE FIELD INSTALLED CAST & FABRICATED ALUMINUM FLAGHOLDER SECURED BY (2) S/S 3/8" DIA CAP SCREWS W/ FLAT & LOCKWASHERS INTO SO NUTS WELDED TO POLE CENTERED OVER 1/2" DIA HOLES



(4) 3/4" X 30" LG GALVD ANCHOR BOLTS (2 1/2" PROJ) W/ (1) GALVD HEX NUT, (1) 1" GALVD FLAT WASHER & (1) 3/4" GALVD FLAT WASHER ON 12" BC (8 1/2" CTRS) (2) #16 GA GALVD SHIMS PER POLE INCLUDED 1/2-13 GROUND SCREW PROVIDED IN ANCHOR LUG



FINISH PER SALES ORDER

ORNAMENTAL LIGHTING POLE
DESIGNED FOR CANTON, OHIO

LOF _____ ENG REF # _____
REQ.# - 0301-19-98 SO # _____ CAD# 0301998

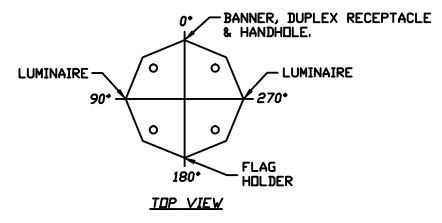
Union Metal
CORPORATION

DRAWN _____ DATE 4/28/98
CHECKED _____

DRAWING NO
N2000-74-B8

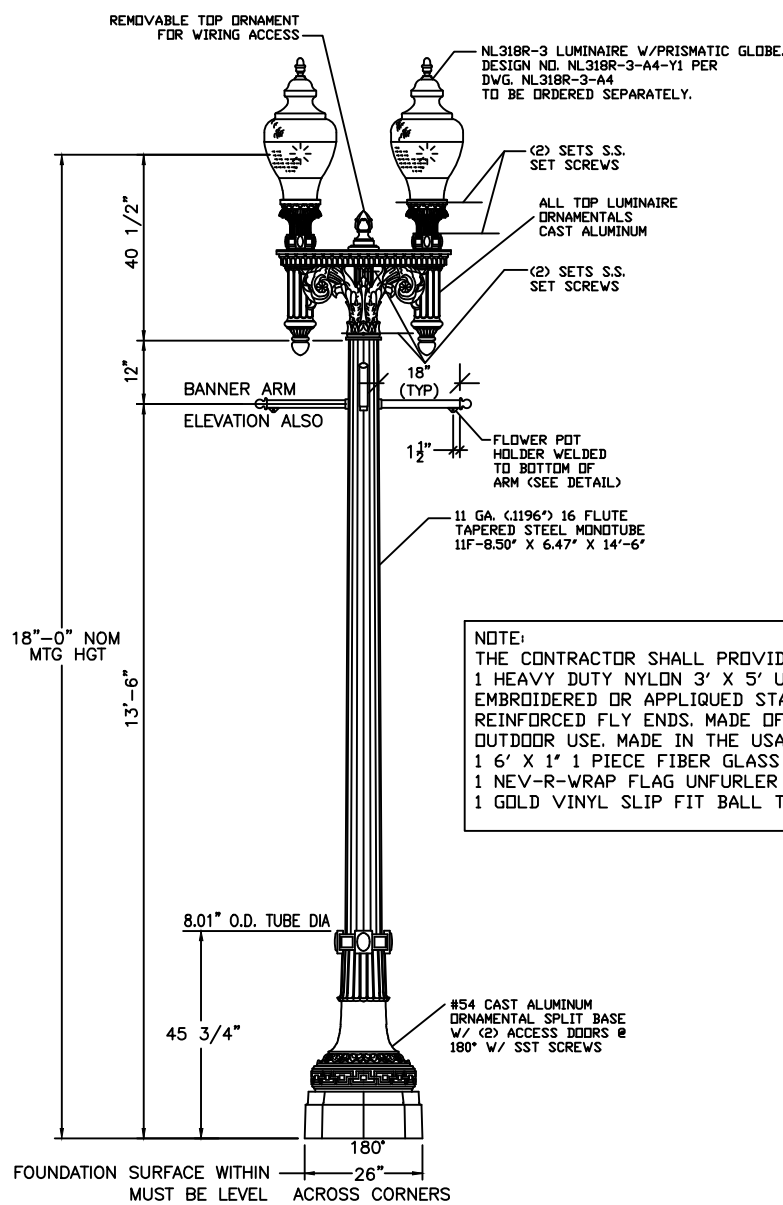
REVISIONS	CHANGED POLE HGT TO 12'-0" NOM	2/12/99
R1	REV ORIENTATION OF BANNER ARMS. 1999 FLAGHOLDER & RECEPTACLE ADDED BANNER ARM OPTION	WJC/ML

SCALE 1" = 1'-0"

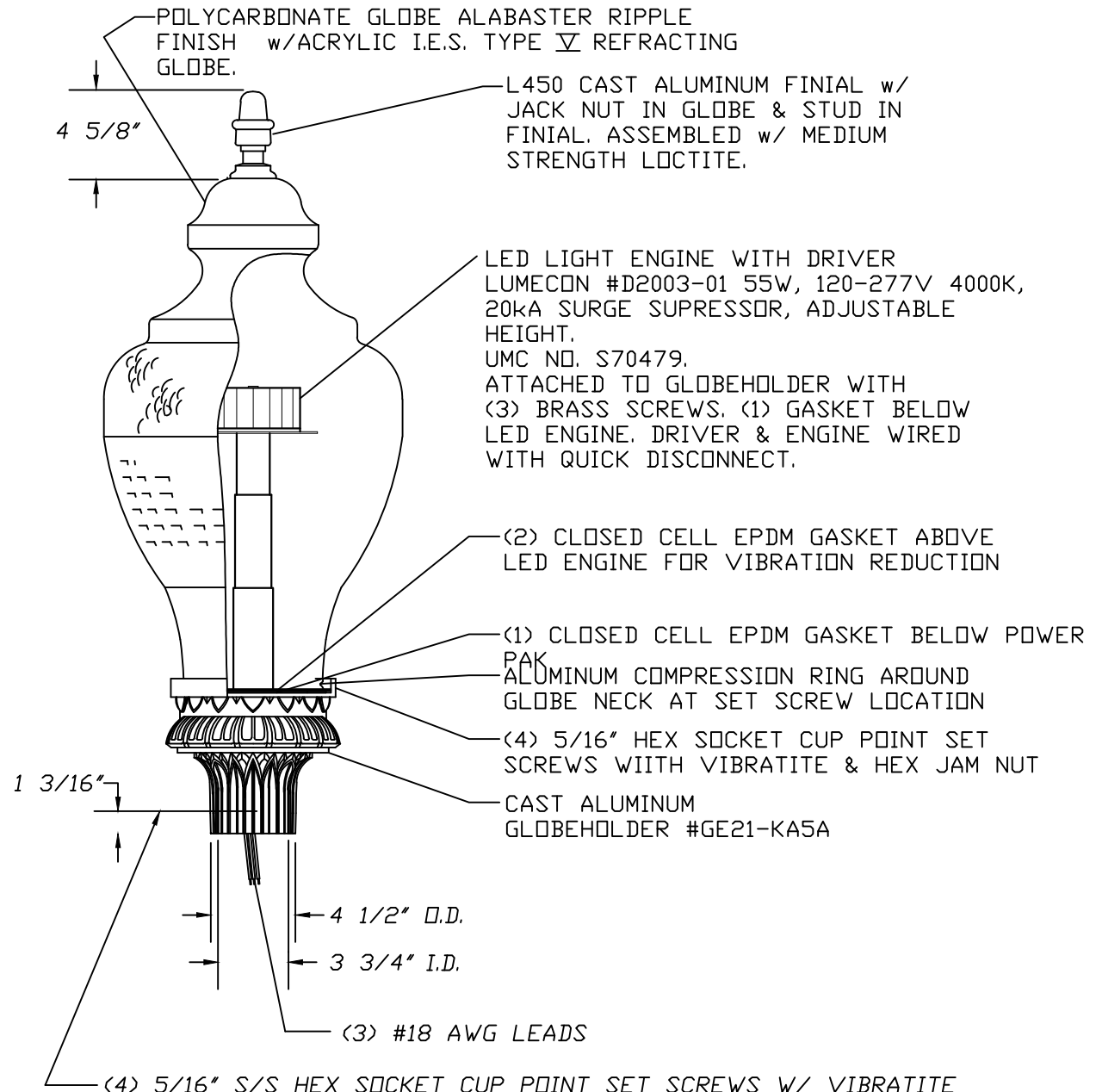
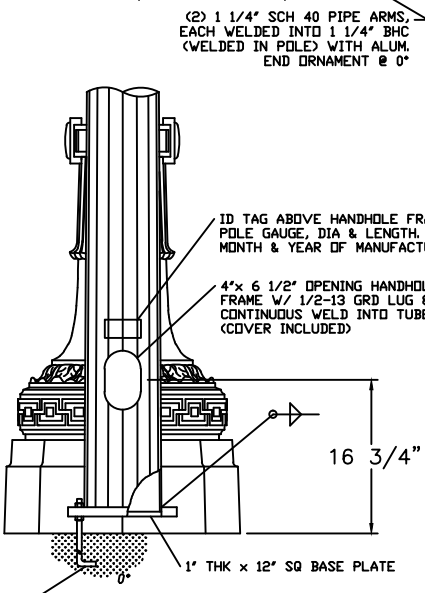
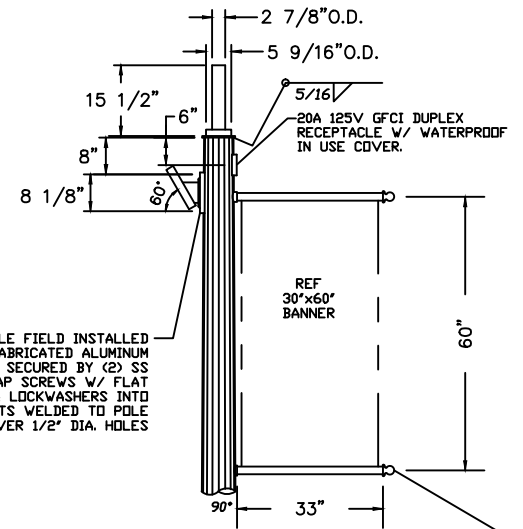


MATERIAL SPECIFICATIONS	
MONOTUBE	EQUAL TO ASTM-A595 GR A
PLATES	ASTM-A36
TUBING	ASTM-A513
PIPE	ASTM-A53 GRB, A501
ALUM CASTINGS	ASTM B26 356.0
HANDLE FRAME	ASTM-A502 GR50/A709 GR50
HANDLE COVER	C1010 STEEL
ALUM PLATE, PIPE	ASTM B209, 210, 221, 241 6061, 6063
ANCHOR BOLTS	ASTM-F1554 GR55
ANCHOR BOLT NUTS	ASTM-A563 GRA
FLAT WASHERS	ASTM-F436
SST HARDWARE	A193-300 SERIES (18-8)
HARDWARE FINISH	GALVANIZED ASTM-A153
STRUCTURE FINISH	GALVANIZED ASTM-A123
FINISH	POWDER OVER GALV. CANTON CBD GREEN

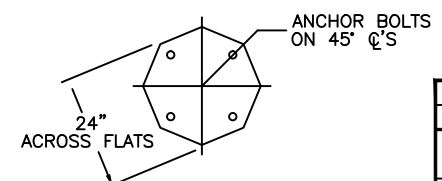
STRUCTURE DESIGNED IN ACCORDANCE WITH 1994 AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY TRAFFIC SIGNS, LUMINAIRES & TRAFFIC SIGNALS FOR 90 MPH WIND ZONE.



NOTE:
THE CONTRACTOR SHALL PROVIDE PER LIGHT POLE:
1 HEAVY DUTY NYLON 3' X 5' US FLAG CONSTRUCTED WITH EMBROIDERED OR APPLIED STARS, SEWN STRIPS AND REINFORCED FLY ENDS. MADE OF NYLON, MANUFACTURED FOR OUTDOOR USE. MADE IN THE USA.
1 6' X 1' 1 PIECE FIBER GLASS POLE.
1 NEV-R-WRAP FLAG UNFURLER THAT FITS 1' POLE DIAMETER.
1 GOLD VINYL SLIP FIT BALL THAT FITS 1' POLE DIAMETER.



NOTES:
1. GLOBEHOLDER & FINIAL POWDER COATED CITY OF CANTON CBD GREEN.
2. GLOBE STREET SIDE POSITIONED BETWEEN TWO LED BARS. STREET SIDE OF LUMINAIRE MARKED ON OUTSIDE OF GLOBEHOLDER.



NOTES:
1. HD GALV & POWDER COATED FINISH, CITY OF CANTON CBD GREEN.

STATE: OHIO	REQ# / SO#: NOH54053	REV	DESCRIPTION	DATE	REV BY/CHK BY
PROJECT NAME: NOSTALGIA_LUMINAIRE_NL318R_WITH_LED_&_GE21_KA5A_GLOBEHOLDER					
DESIGN NUMBER B2473-54-B37-Y1					
		DESIGNED BY	CHECKED BY	DATE	SCALE
		DGMR	EJL		NONE
		N2473-54-B37		REVISION	ENG REF
				REV	N2473-54-B35
				SHEET	
				SHT OF SHTS	

STATE: OHIO	REQ# / SO#: NOH54508	REV	DESCRIPTION	DATE	REV BY/CHK BY
PROJECT NAME: NOSTALGIA_LUMINAIRE_NL318R_WITH_LED_&_GE21_KA5A_GLOBEHOLDER					
DESIGN NUMBER NL318R-3-A4-Y1					
		DESIGNED BY	CHECKED BY	DATE	SCALE
					NONE
		N2473-54-B37		REVISION	ENG REF
				REV	NL318R-3-A3
				SHEET	
				SHT OF SHTS	

OFFICE OF THE CITY ENGINEER
CANTON, OHIO
DANIEL J. MOEGLIN, P.E., CITY ENGINEER
2436 30th St. NE 44705 : 330-489-3381 : www.cantonohio.gov/engineering

APPROVED DATE: MARCH 2014
APPROVED BY: EEM
DRAWING FILE NAME: ce_61-65_LIGHTPOLES.dwg

REVISIONS		
DESCRIPTION	DATE	BY
INSERTED UM DRAWINGS	4/17/15	EGM
N2473-54-B37 & NL318R-3-A4		
FLOWER POT HOLDERS ADDED	8/23/16	EGM
LED ENGINE UPDATE	7/6/2018	RMB

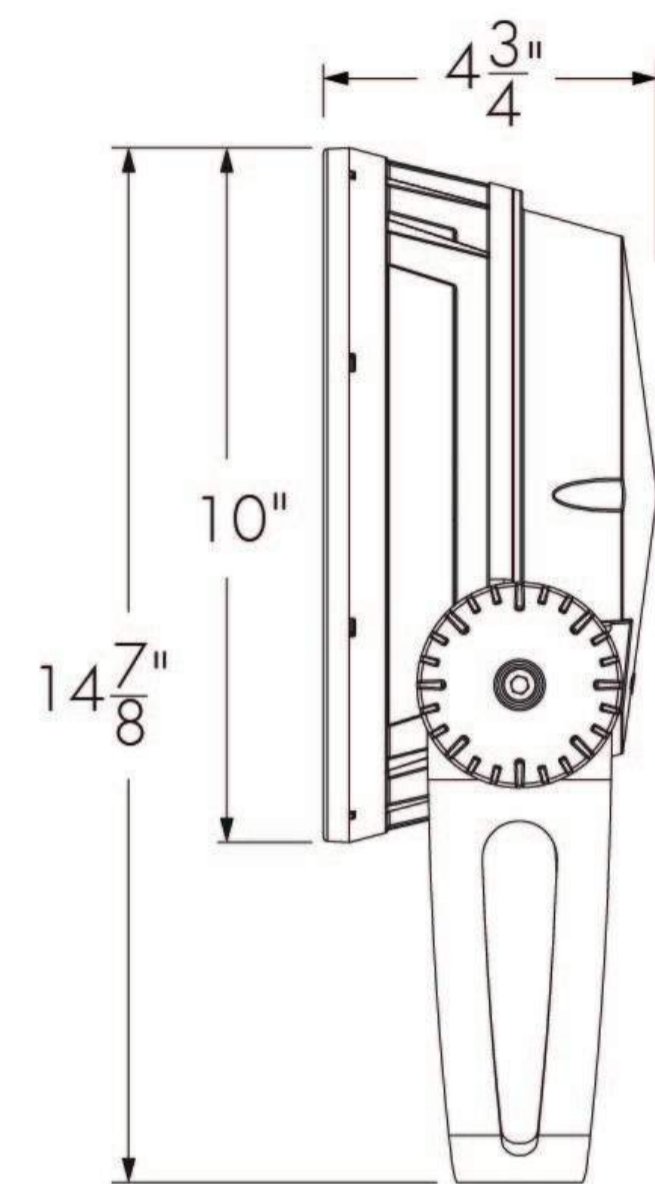
STANDARD DRAWING NO. 63
NOSTALGIA LIGHT POLE & LUMINAIRE
SHEET 3 OF 5

Project Name _____ Qty _____

Type _____ Catalog / Part Number _____



Front view



Side view

Photometric Summary

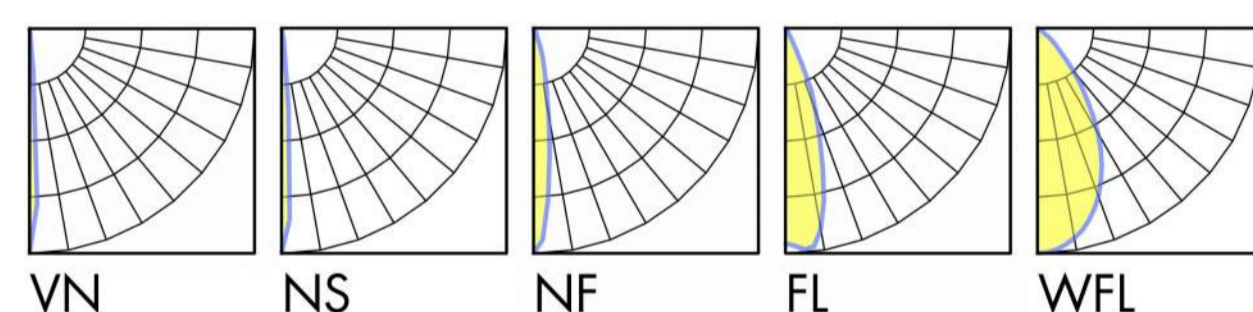
Based on RGBW color mix, full output

	Delivered output (lm)	Intensity (peak cd)
VN	2,233	93,100
NS	1,767*	60,125*
NF	1,631*	11,977*
FL	1,642*	4,543*
WFL	1,600*	1,513*

Photometric performance is measured in compliance with IESNA LM-79-08.

*Estimated. Consult website for the latest IES and LDT files.

Optics



Control

lumen talk™ DMXrdm

Rating



Description

The Lumenbeam Large Color Changing is a high-performance, 50W luminaire for applying dynamic color to multi-story facades and structures. It offers a wide array of options including a choice of optics for floodlighting or accent lighting; RGB, RGBW or RGBA color mixing; various mounting options, accessories, spread lenses and controls.

Features

Color and Color Temperature	Additive RGB, Additive RGB + white 4000K, Additive RGB + amber
Optics (nominal distribution)	6°, 10°, 20°, 40°, 60°
Optical Option	Linear spread lens horizontal distribution, Linear spread lens vertical distribution
Options	Short Yoke, 3G ANSI C136.31 Vibration Rating for bridge applications, Corrosion-resistant coating for hostile environments
Power Consumption	50 W
Warranty	5-year limited warranty
Performance	
Delivered Output	1,795 lm (RGB full output, VN optic), 2,233 lm (RGBW full output, VN optic), 1,690 lm (RGBA full output, Vn optic)
Delivered Intensity	72,904 cd at nadir (RGB full output, VN optic), 93,100 cd at nadir (RGBW full output, VN optic), 66,141 cd at nadir (RGBA full output, optic VN)
Color Consistency	2 SDCM
Lumen Maintenance	L70 120,000 hrs (Ta 25 °C)

Physical

Housing Material	Low copper content high pressure die-cast aluminum
Yoke Material	Heavy aluminum (standard yoke included)
Lens Material	Clear tempered glass
Hardware Material	Stainless steel
Gasket Material	Silicone
Surface Finish	Electrostatically applied polyester powder coat
Weight	12 lbs
EPA	Front = 0.94 sq ft, Side = 0.56 sq ft

Electrical and control

Voltage	100 to 277 volts
Fixture Cable	Power and data in 1 cable, 3 ft cord standard (#16-5), other lengths available
Resolution (DMX/RDM)	Per fixture, 8-bit or 16-bit, 3 channels (RGB) or 4 channels (RGBW, RGBA)
Control	Lumentalk, DMX/RDM enabled

Environmental

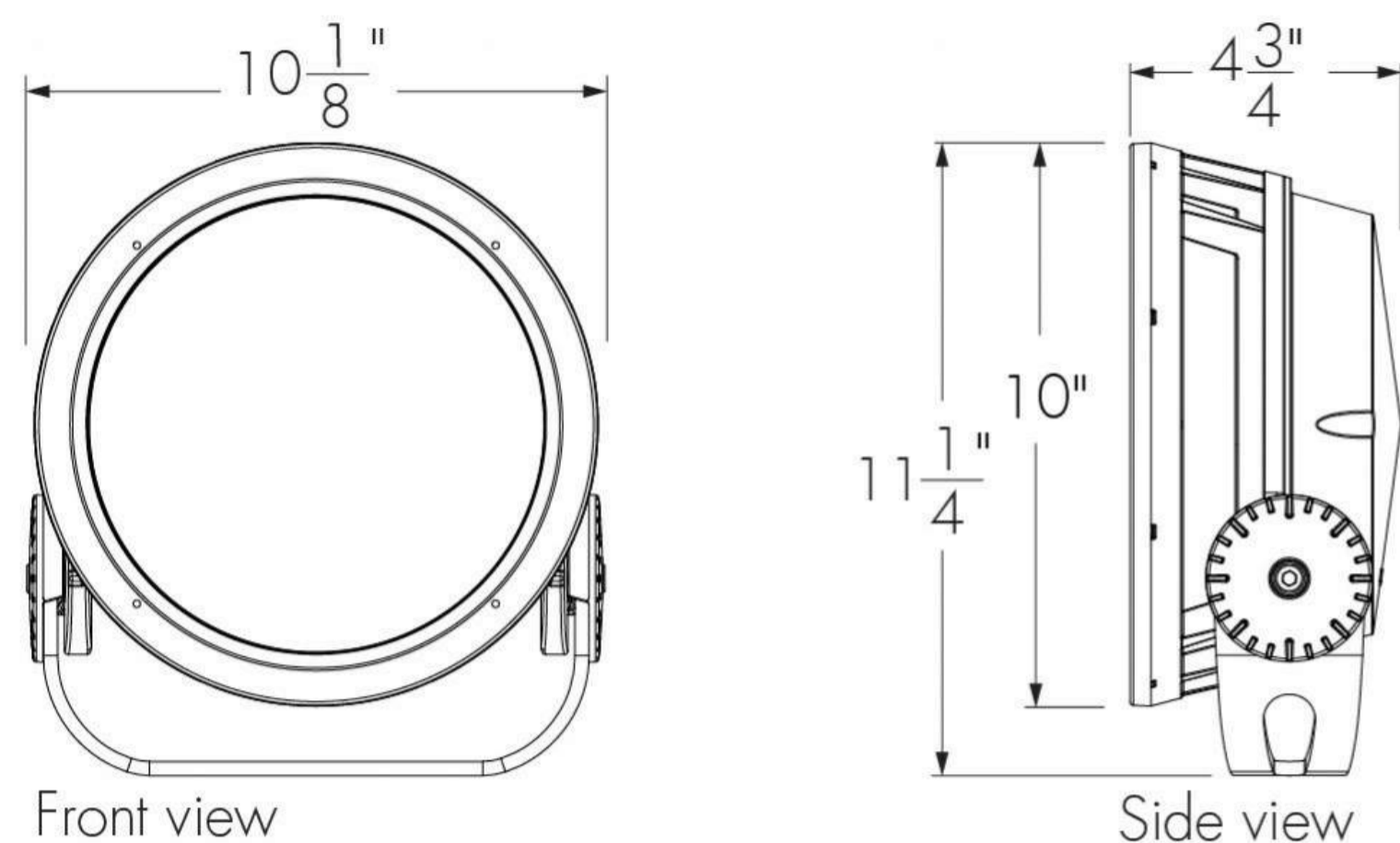
Operating Temperature	-13 °F to 122 °F
IP Rating	IP66
IK Rating	IK10

Accessories (order separately)

Control Boxes	Power and control box - daisy chain configuration, Power and control box - star configuration
Control Systems	Lumentouch 2.0™, Lumencue, Lumentone
Diagnostic and Addressing Tools	LumenID, LumentalkID

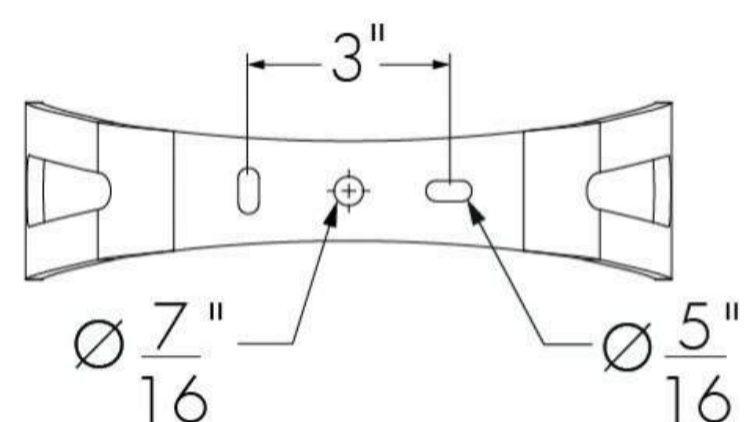
Mounting options

SY - Short yoke

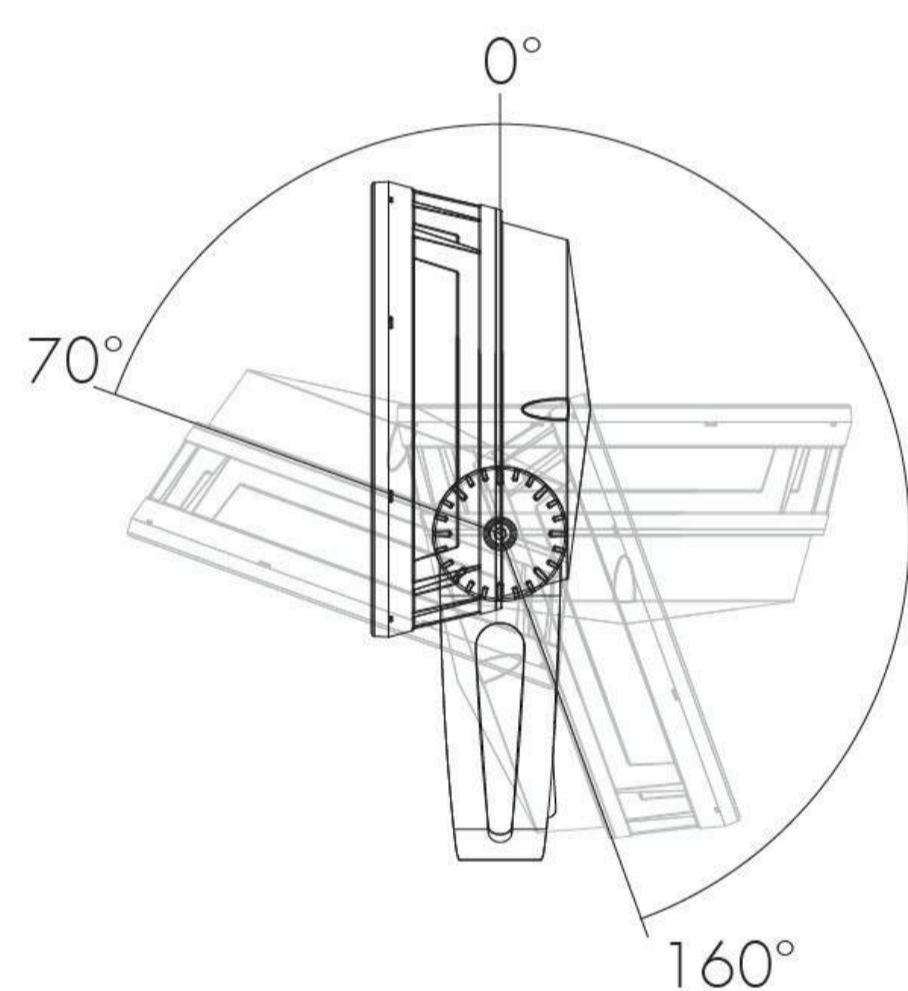


Mounting details

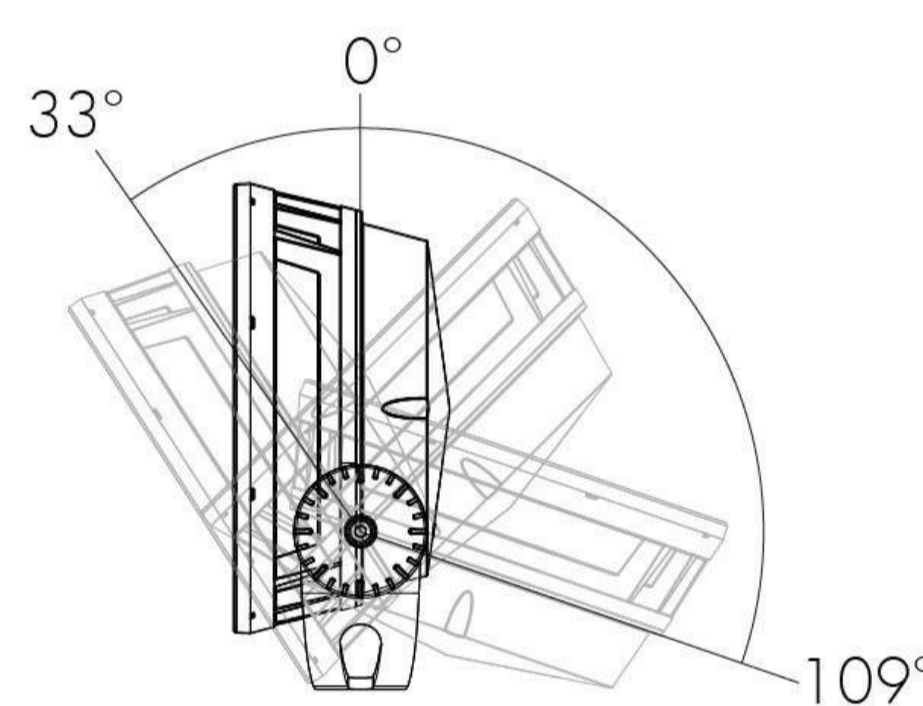
Mounting hole pattern - standard and short yoke



Adjustable pivot limits



Standard yoke

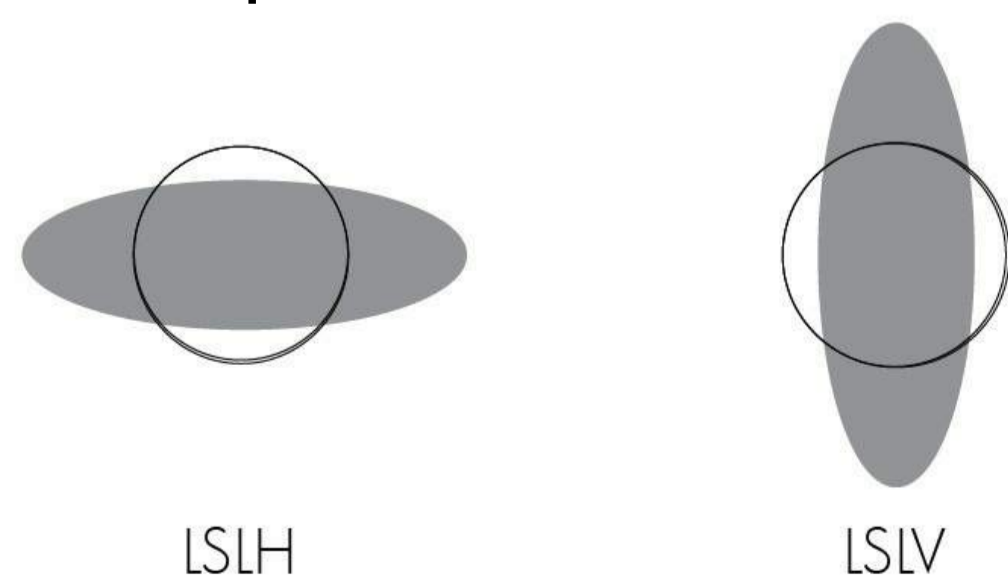


Short yoke

Optical options

LSLH - Linear spread lens horizontal distribution

LSLV - Linear spread lens vertical distribution

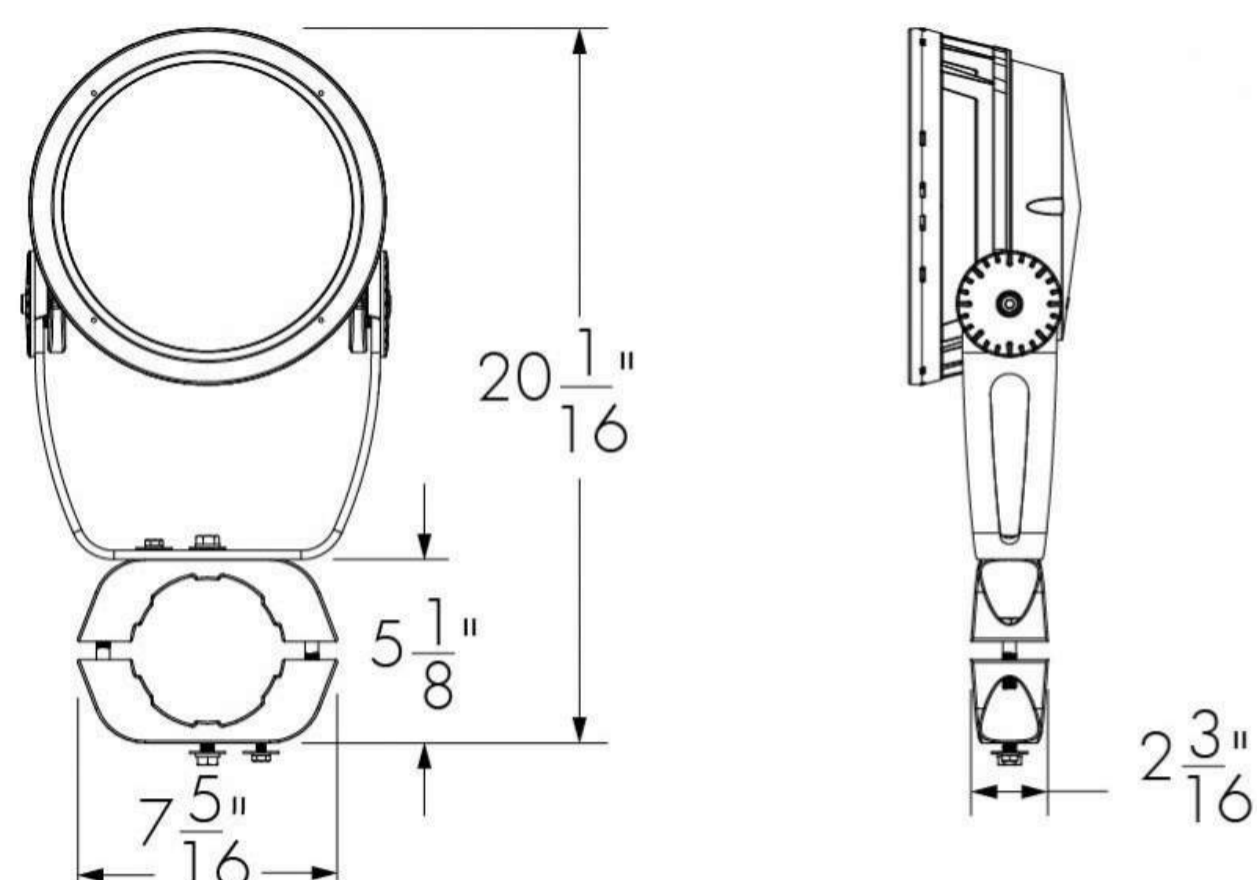


	Beam angle with LSLH/LSLV
VN	8° x 60°
NS	9° x 60°
NF	18° x 65°
FL	32° x 72°

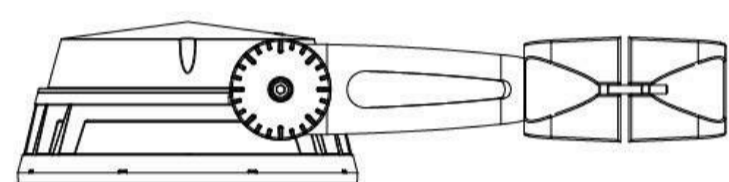
Factory installed, not adjustable on site. Not available for WFL optic.
See 'Optical Accessories' section for field adjustable spread lens (LSLA).

Mounting accessories (order separately)

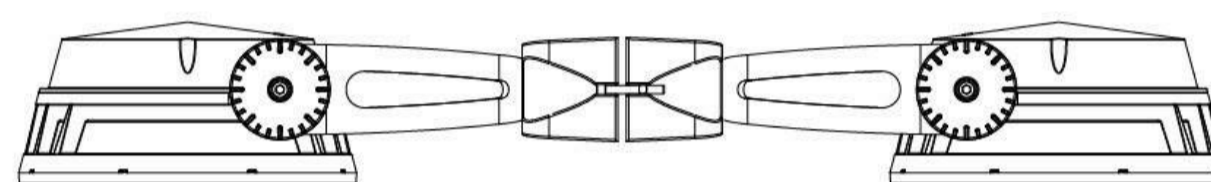
Round pole mounting accessory



PM4 model shown.
Consult factory for square pole section.



PM4-1, PM4.5-1, PM5-1 - Round pole mounting accessory - single fixture

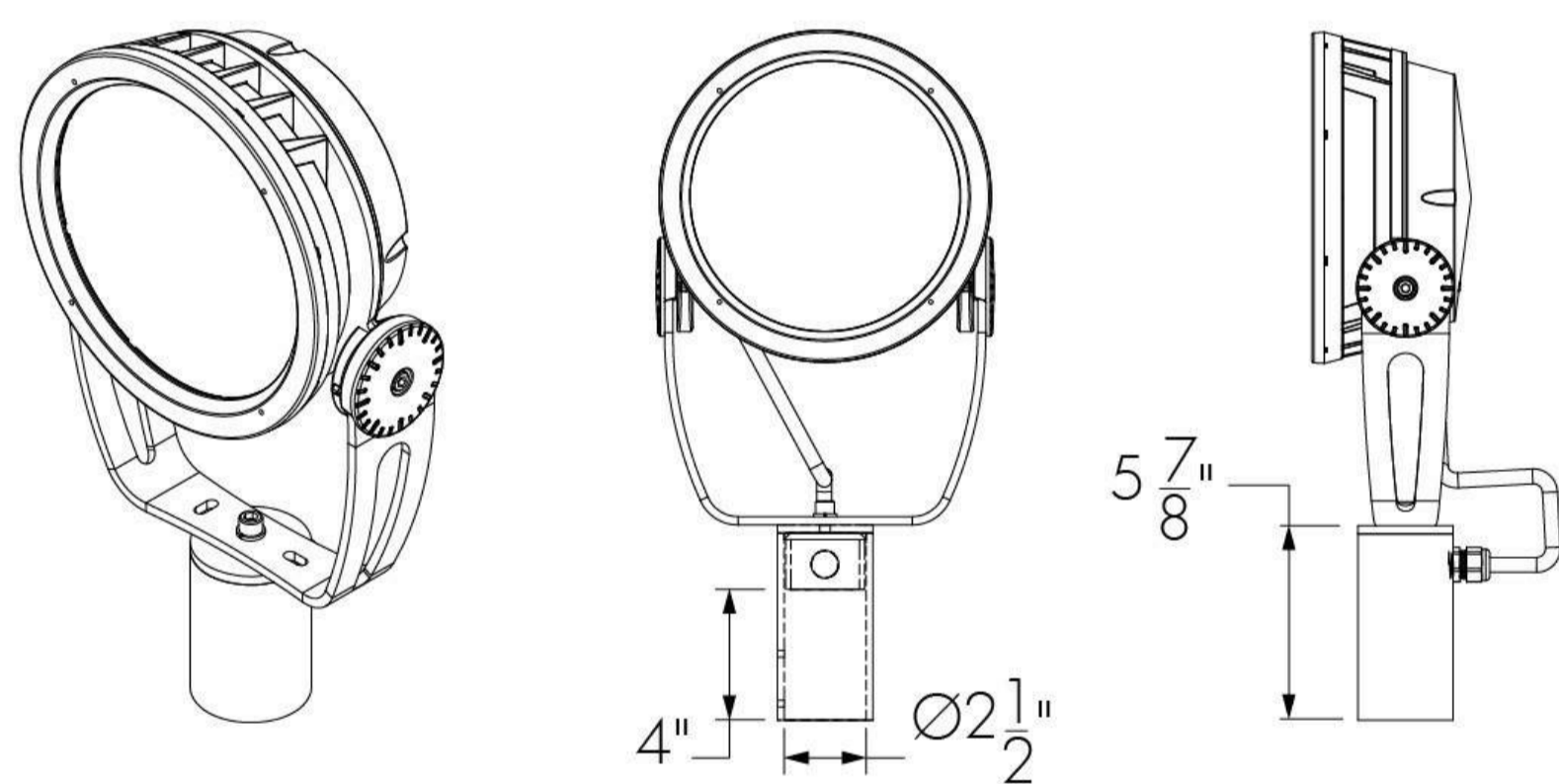


PM4-2, PM4.5-2, PM5-2 - Round pole mounting accessory - twin fixtures
*One bracket assembly is supplied per 2 fixtures unless otherwise specified.

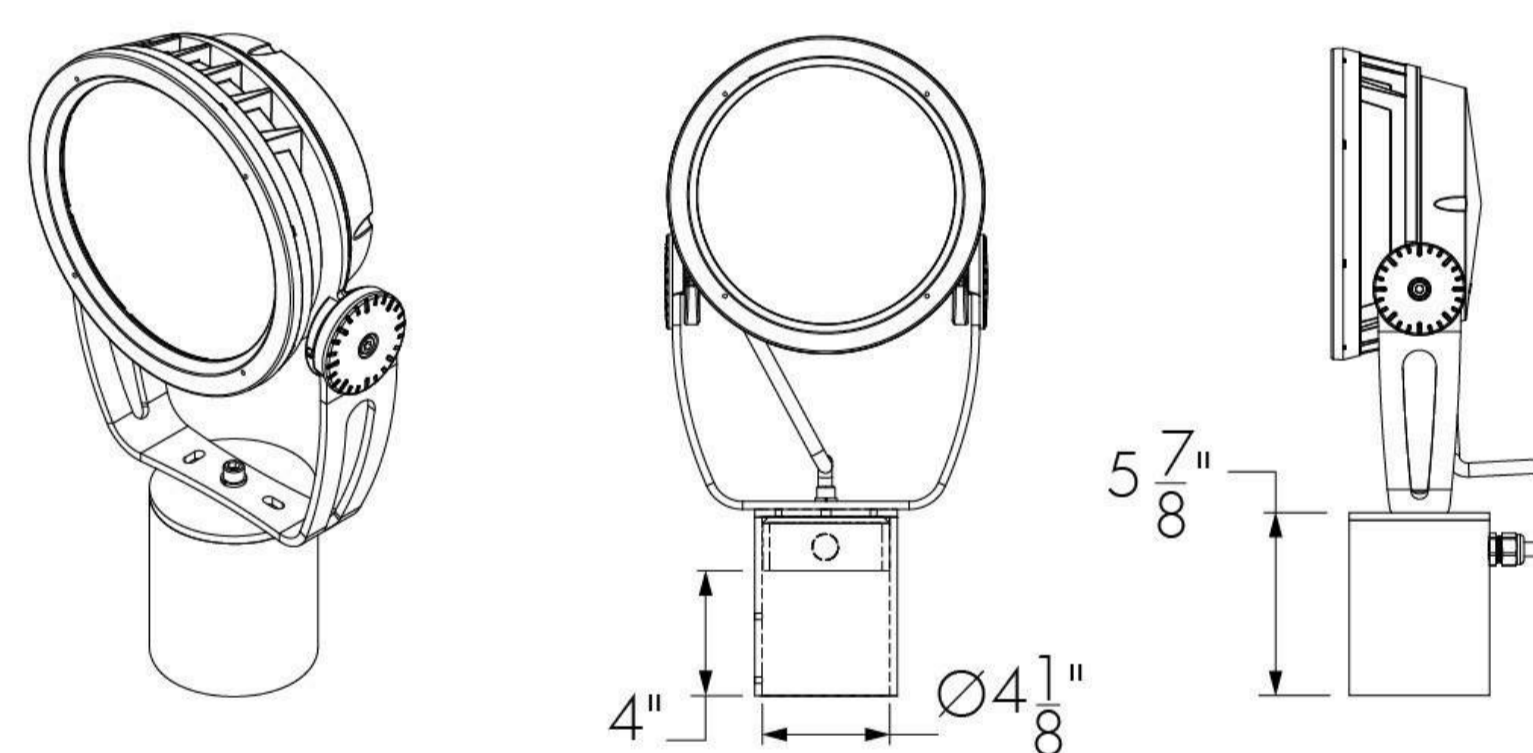
	PM4	PM4.5	PM5
For pole Ø	4" ± 1/16"	4.5" ± 1/16"	5" ± 1/16"

Consult factory for other pole diameters.

Tenon adapter



TN2 - Tenon adapter to fit on 2 3/8 in O.D. tenon

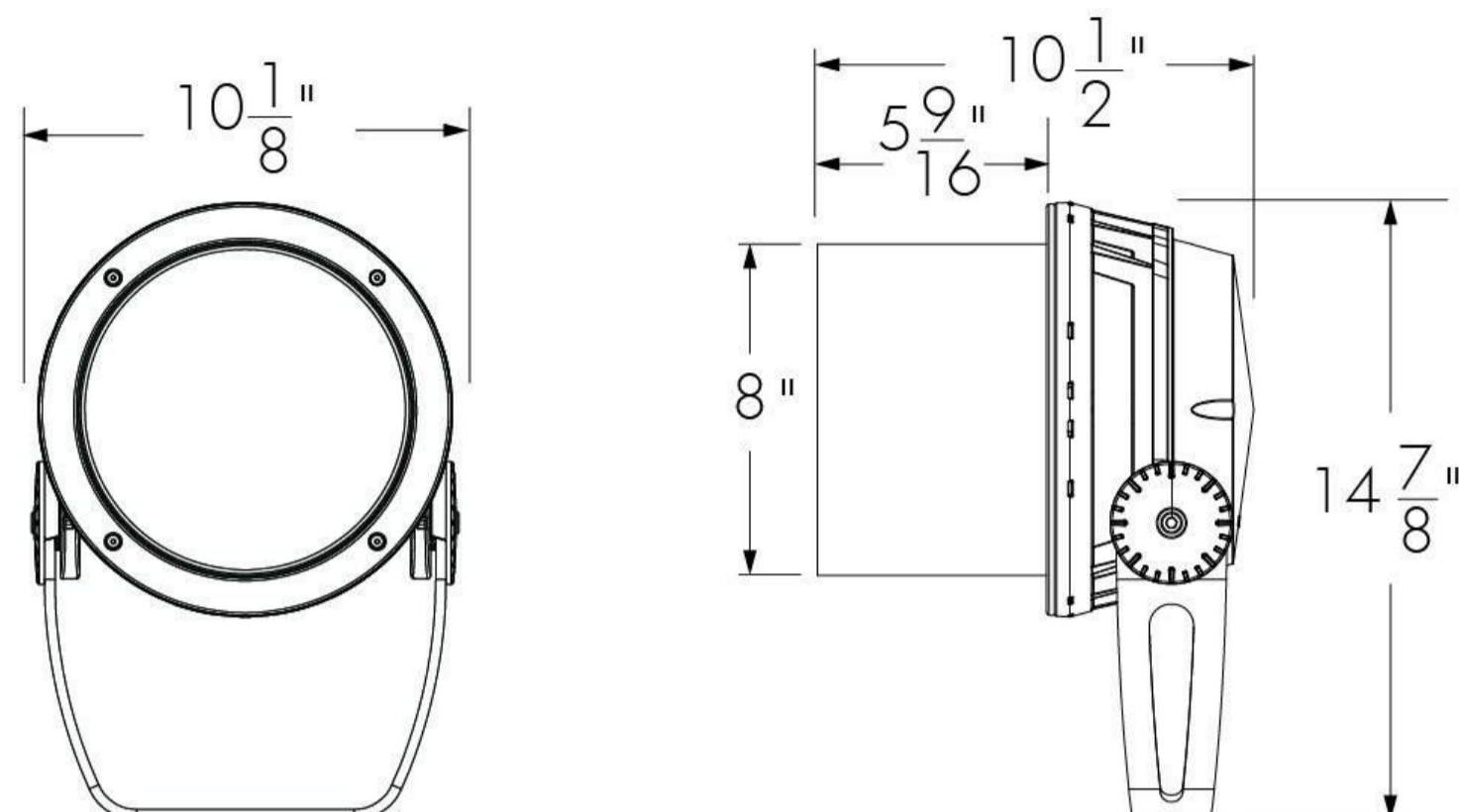


TN4 - Tenon adapter to fit on 4 in O.D. tenon

Optical accessories (order separately)

Installed optical accessories will affect the maximum pivot limits for each mounting option, consult factory for details.

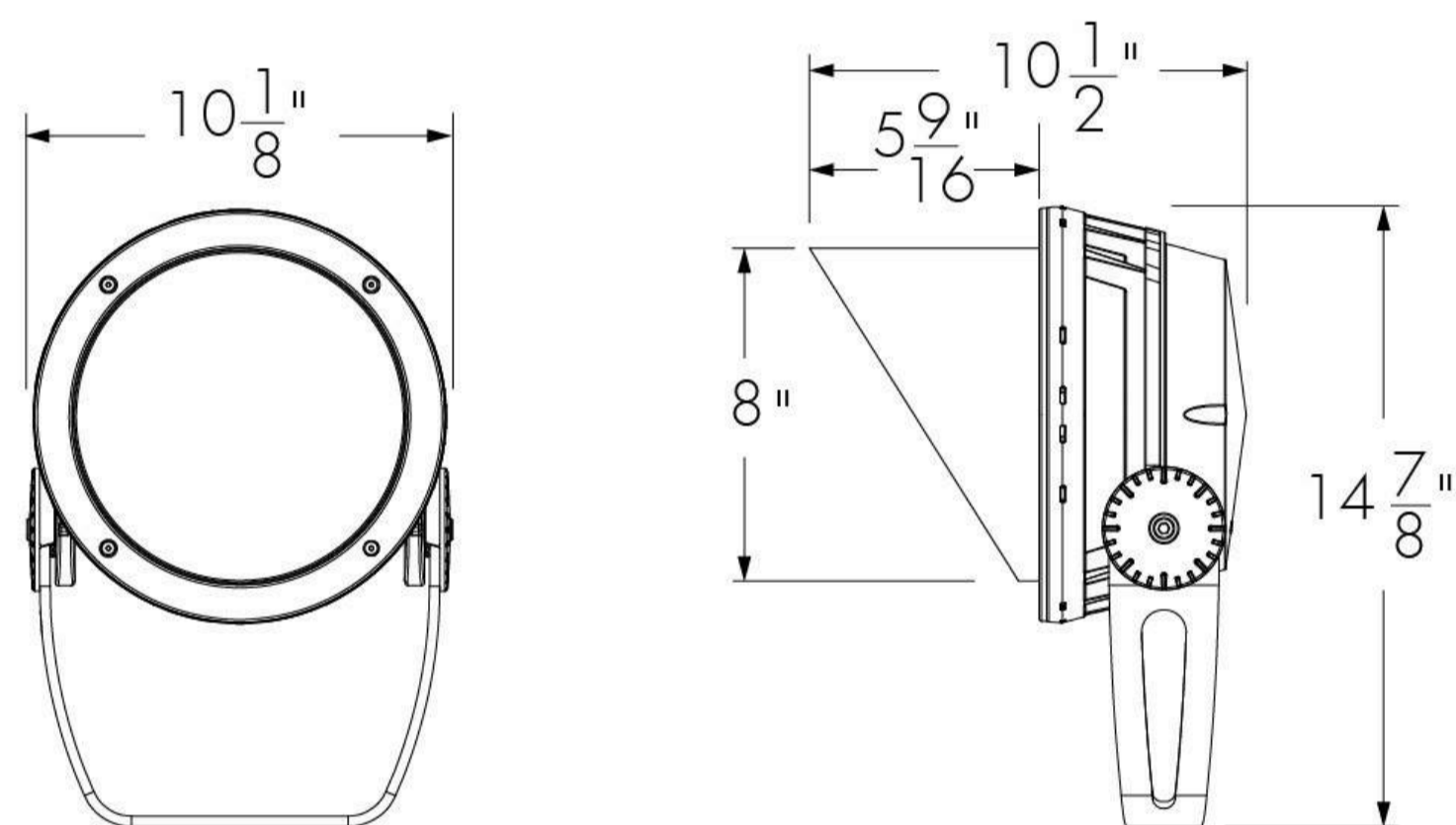
SN - Snoot



LBLSN-FINISH-BK

Interior surface painted black. Please specify desired exterior FINISH from list of available finishes.

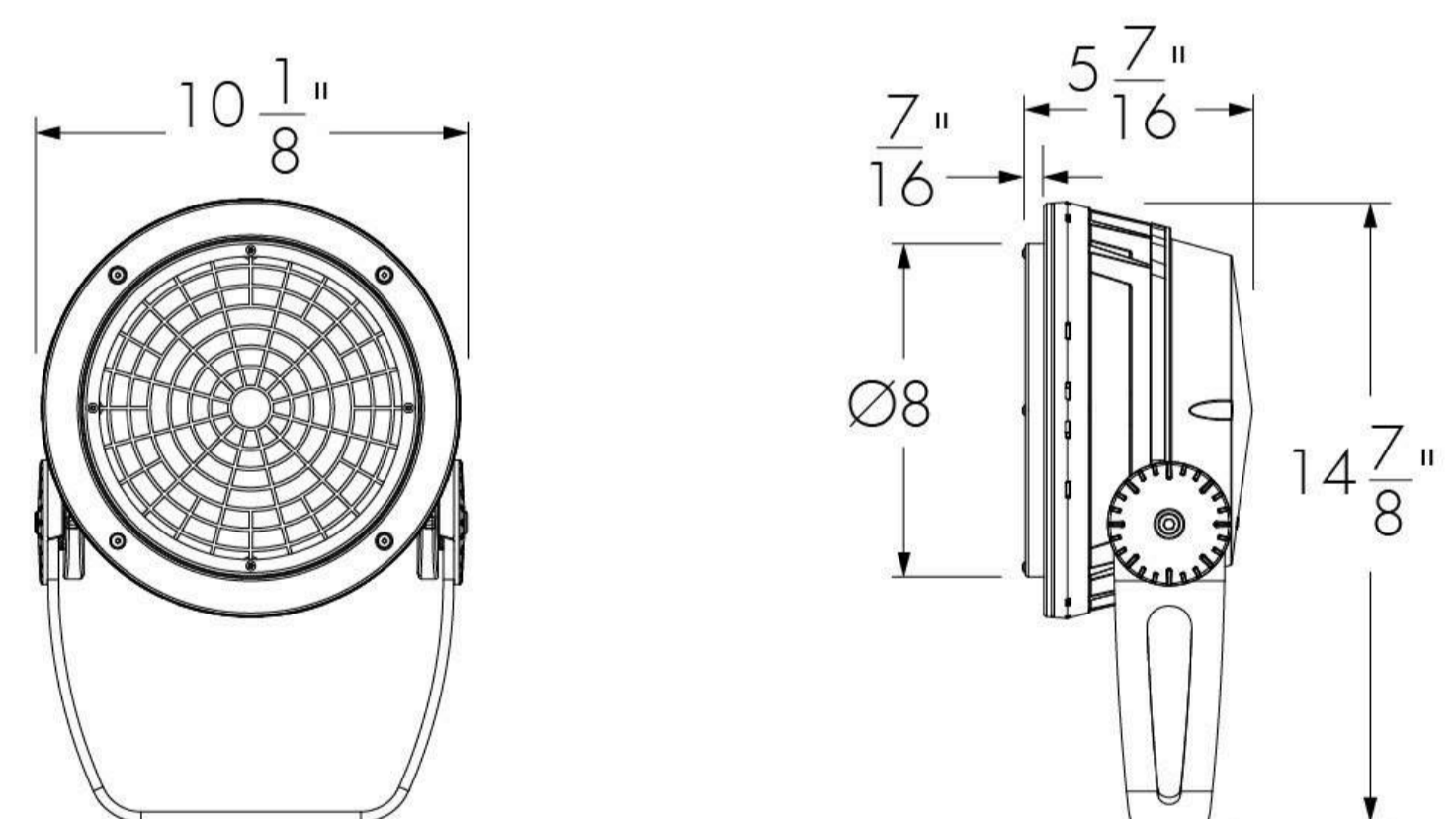
VS - Visor



LBLVS-FINISH-BK

Interior surface painted black. Please specify desired exterior FINISH from list of available finishes.

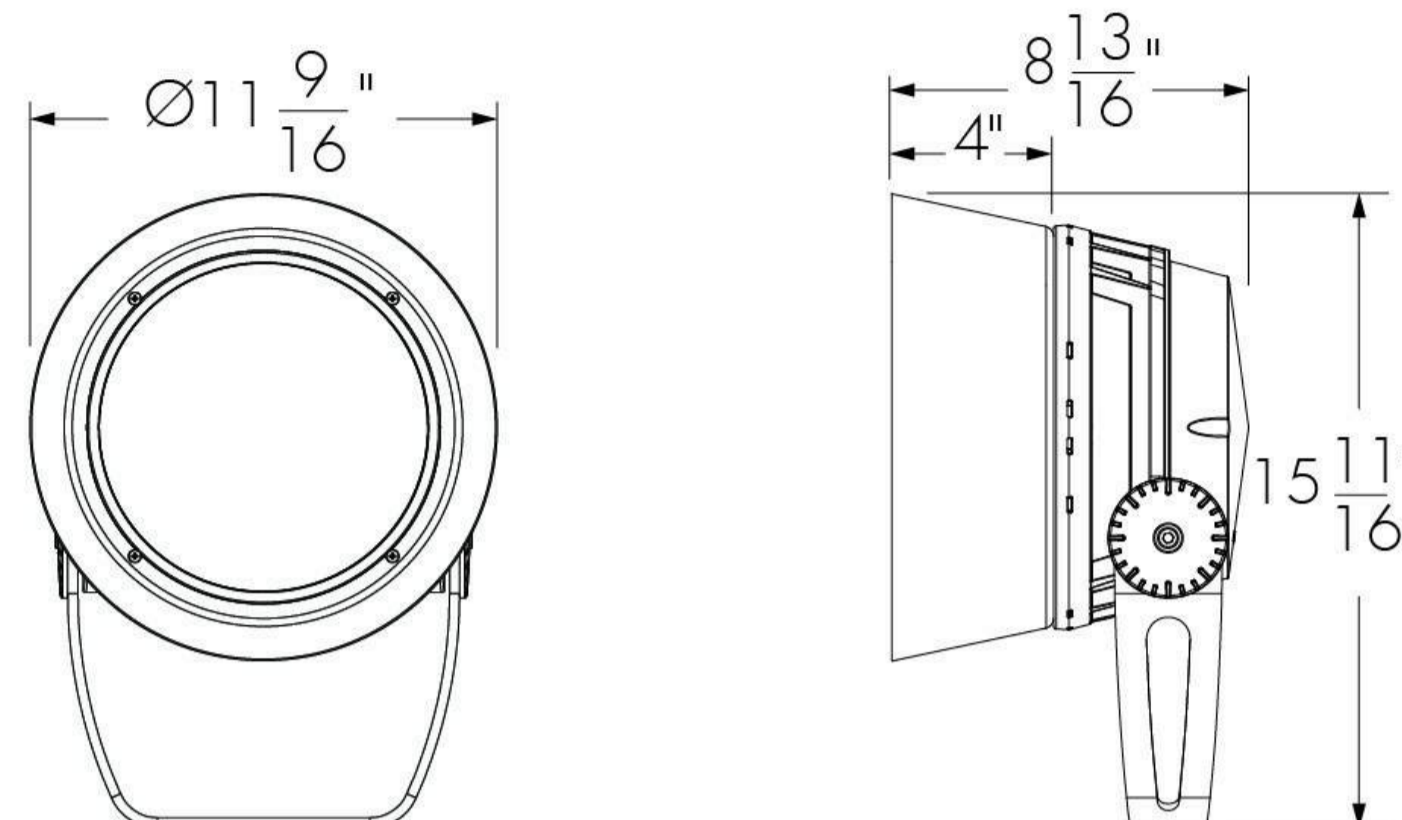
WG - Wire guard



LBLWG-FINISH

Please specify desired exterior FINISH from list of available finishes.

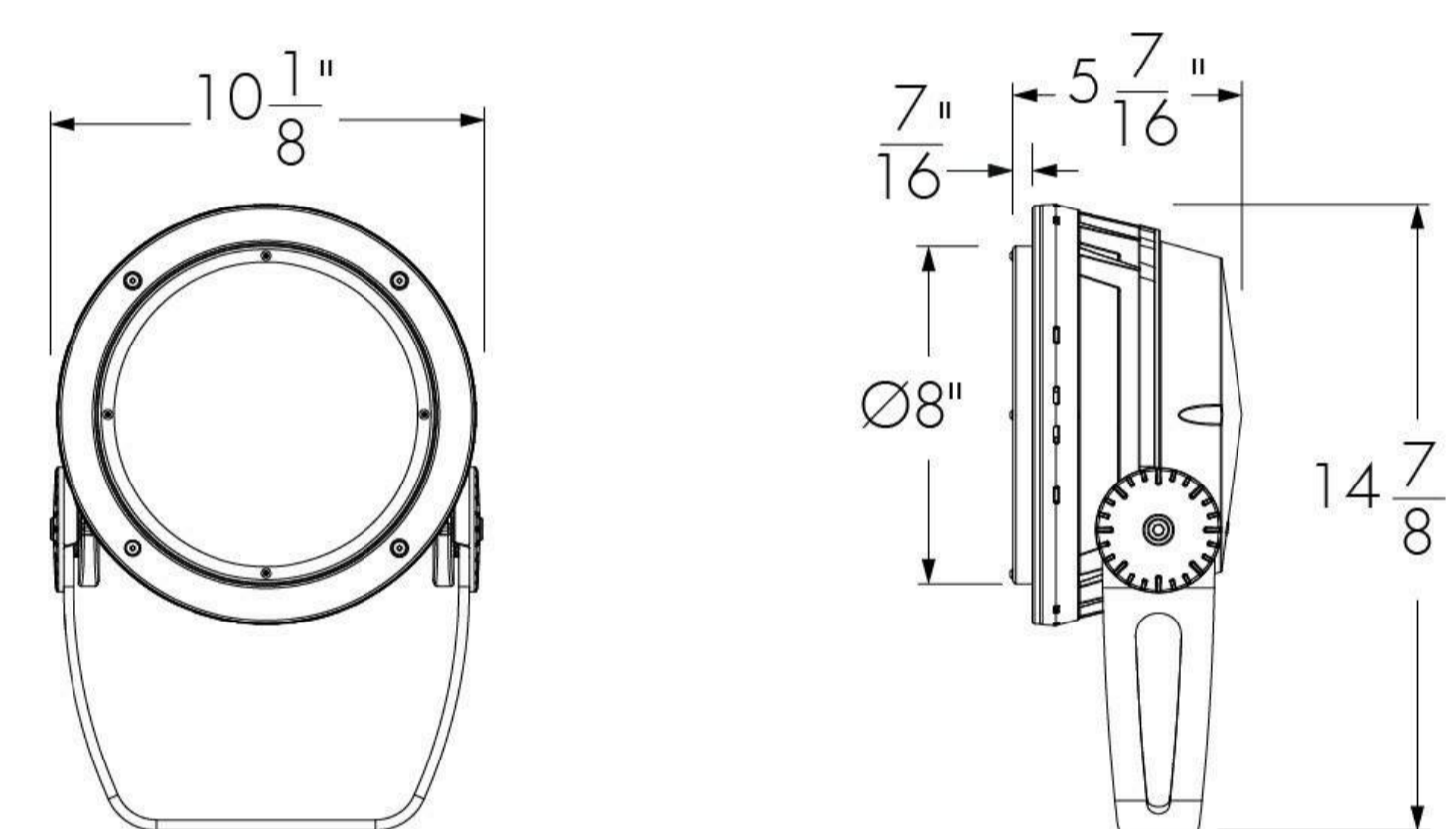
SNW - Snoot wide



LBLSNW-FINISH-BK

Interior surface painted black. Please specify desired exterior FINISH from list of available finishes.

LSLA - Linear spread lens adjustable



LBLSLA-FINISH

Please specify desired exterior FINISH from list of available finishes.

Accessory combinations

	+	Snoot	Snoot wide	Visor
Linear spread lens adjustable		YES	NO*	YES
Wire guard		YES	NO	YES

Accessory combinations must be ordered together on a single line

Ex: A snoot + wire guard combination order code is LBLSNWG-BK-BK.

*Consult factory for a linear spread lens adjustable + snoot wide combination.

Available exterior finishes for optical accessories

BK - Black Sandtex®

BRZ - Bronze Sandtex®

SI - Silver Sandtex®

WH - Smooth white

BKTX - Textured black

BRZTX - Textured bronze, non-metallic

GRATX - Textured medium gray

GRNTX - Textured green

WHTX - Textured white

CC - Custom color and finish (please specify RAL color)*

*Lumenpulse offers a wide selection of RAL CLASSIC (K7) colors with a smooth texture and high-gloss finish. Please consult factory for a list of available K7 colors, other RAL textures and glosses, or to match alternate color charts. Final color matching results may vary.

How to order

1	2	3	4	5	6	7	8
LBL							
9	10						

1 . Housing

LBL Lumenbeam™ Large

2 . Voltage

100 100 volts
120 120 volts
208 208 volts
220 220 volts
240 240 volts
277 277 volts

3 . Color and Color Temperature ⁽¹⁾

RGB Additive RGB
RGBW Additive RGB + white 4000K
RGBA Additive RGB + amber

4 . Optics

VN Very Narrow 6°
NS Narrow Spot 10°
NF Narrow Flood 20°
FL Flood 40°
WFL Wide Flood 60°

5 . Optical Option

LSLH Linear spread lens horizontal distribution ⁽²⁾
LSLV Linear spread lens vertical distribution ⁽²⁾

6 . Finish

BK Black Sandtex®
BRZ Bronze Sandtex®
SI Silver Sandtex®
WH Smooth white
BKTX Textured black
BRZTX Textured bronze non-metallic
GRATX Textured medium gray
GRNTX Textured green
WHTX Textured white
CC Custom color and finish (please specify RAL color) ⁽³⁾

7 . Control

LT Lumentalk ⁽⁴⁾
DMX/RDM DMX/RDM enabled

8 . Options

SY Short Yoke
3GV 3G ANSI C136.31 Vibration Rating for bridge applications
CRC Corrosion-resistant coating for hostile environments ⁽⁵⁾

9 . Certification

UL UL compliant
CE CE compliant

10 . Cable Length ⁽⁶⁾

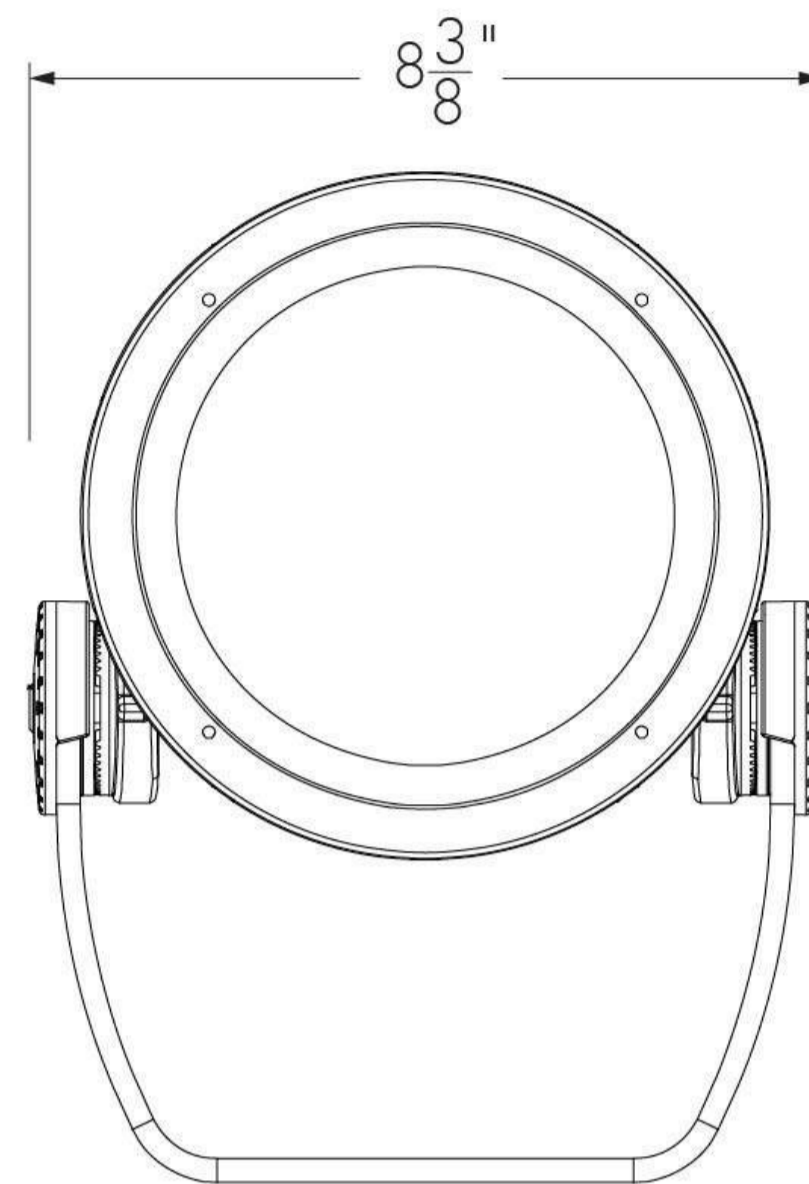
3FT	3 ft ⁽⁶⁾ ⁽⁷⁾
10FT	10 ft
20FT	20 ft
30FT	30 ft
50FT	50 ft
70FT	70 ft
100FT	100 ft

Notes:

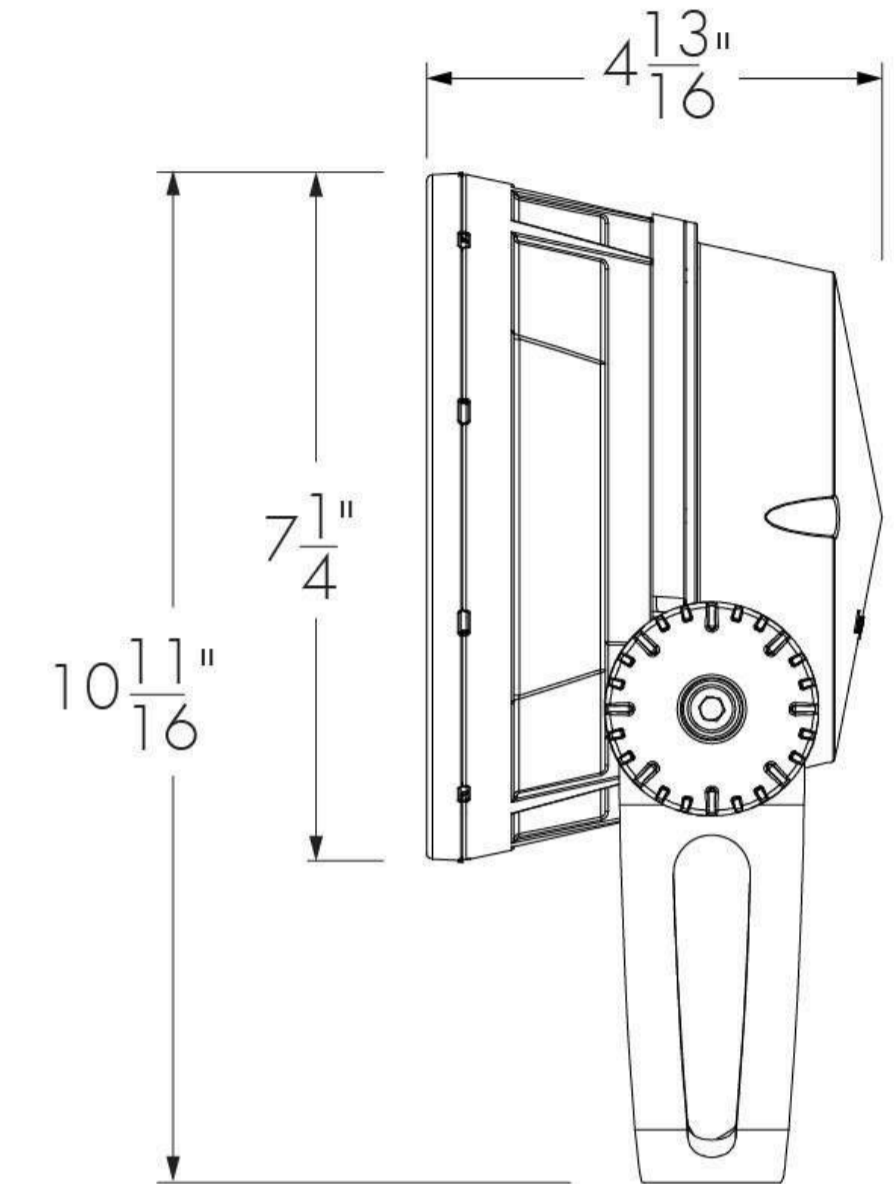
- ⁽¹⁾ Consult factory for color mix with Royal Blue, 3000K or other white color temperature LEDs.
- ⁽²⁾ Factory installed, not available for 60° optic. Field adjustable spread lens optical accessory available, order separately.
- ⁽³⁾ Lumenpulse offers a wide selection of RAL CLASSIC (K7) colors with a smooth texture and high-gloss finish. Please consult factory for a list of available K7 colors, other RAL textures and glosses, or to match alternate color charts. Final color matching results may vary.
- ⁽⁴⁾ A Lumentranslator and LumentalkID (LIDLIT) must be specified for Lumentalk applications. Consult Lumentranslator and Lumentalk pages and specification sheets for details.
- ⁽⁵⁾ Use only when exposed to salt spray and harsh chemicals. This option is not required for normal outdoor exposure.
- ⁽⁶⁾ 3 ft cable length is standard unless otherwise specified.
- ⁽⁷⁾ Maximum of 3 ft cable length for daisy chain DMX applications with CBX-DS.

Project Name Canton Centennial Park Qty _____

Type Type B1, B2 Catalog / Part Number _____



Front view



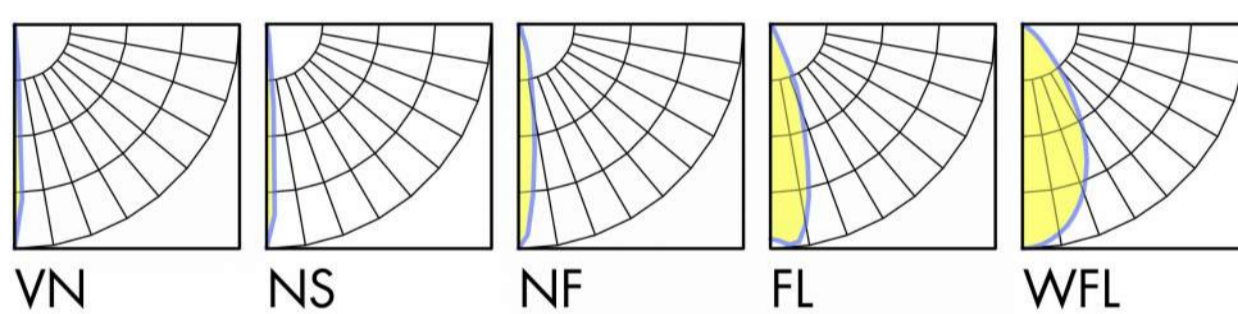
Side view

Photometric Summary

4000K	Delivered output (lm)	Intensity (peak cd)
VN	1,754	75,278
NS	1,552	56,914
NF	1,484	10,878
FL	1,428	4,003
WFL	1,370	1,312

Photometric performance is measured in compliance with IESNA LM-79-08.

Optics



Control

ON/OFF 0-10V DALI DMXrdm

Rating



Description

The Lumenbeam Medium is a high-performance, 28W luminaire for solving numerous interior and exterior challenges such as facades, columns, trees or other architectural and landscape features. It offers a flexible package of options: a choice of optics for flood or accent lighting; a number of color temperatures and colors; various mounting options, accessories, spread lenses and controls.

Features

Color and Color Temperature	2200K, 2700K, 3000K, 3500K, 4000K, 5700K, Red, Green, Blue
Optics (nominal distribution)	6°, 10°, 20°, 40°, 60°
Optical Option	Linear spread lens horizontal distribution, Linear spread lens vertical distribution
Options	Short Yoke, 3G ANSI C136.31 Vibration Rating for bridge applications, Corrosion-resistant coating for hostile environments
Power Consumption	28 W
Warranty	5-year limited warranty

Performance

Delivered Output	1,754 lm (4000K, VN optic)
Delivered Intensity	75,278 cd at nadir (4000K, VN optic)
Illuminance at Distance	Minimum 1 fc at 274 ft distance (4000K, VN optic)
Color Consistency	2 SDCM
Color Rendering	CRI 80+
Lumen Maintenance	L70 120,000 hrs (Ta 25 °C)

Physical

Housing Material	Low copper content high pressure die-cast aluminum
Yoke Material	Heavy aluminum (standard yoke included)
Lens Material	Clear tempered glass
Hardware Material	Stainless steel
Gasket Material	Silicone
Surface Finish	Electrostatically applied polyester powder coat
Weight	6.7 lbs
EPA	Front = 0.46 sq ft, Side = 0.37 sq ft

Electrical and control

Voltage	100 to 277 volts
Fixture Cable	Power and data in 1 cable, 3 ft cord standard (#16-5), other lengths available
Resolution (DMX/RDM)	Per fixture, 8-bit or 16-bit
Control	On/Off control, Dim to Warm via 0-10V (DWW only), DALI dimming, DMX/RDM enabled, Lumentalk system is enabled with LDB accessory - see typical wiring diagrams for details

Environmental

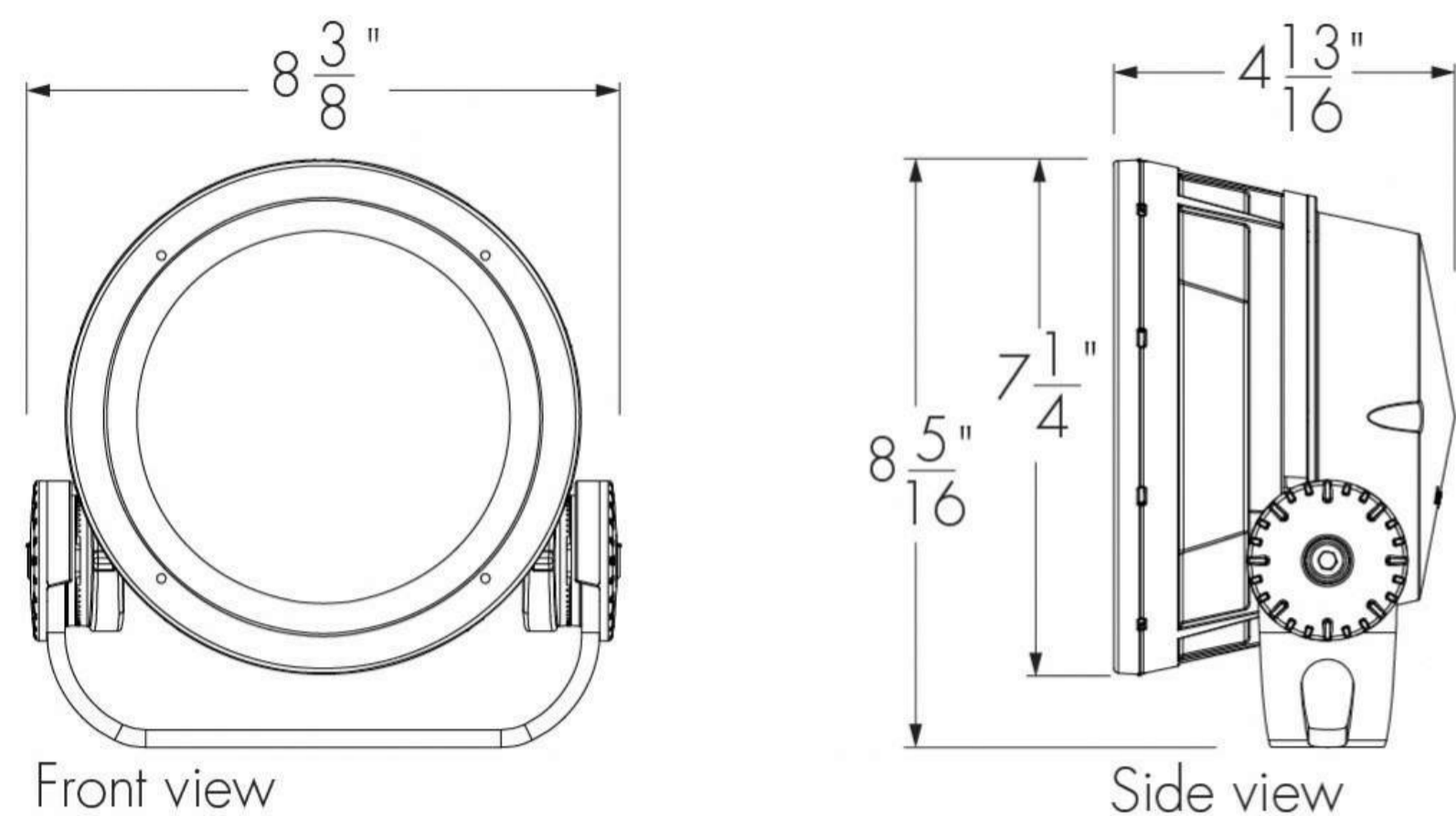
Operating Temperature	-13 °F to 122 °F
IP Rating	IP66
IK Rating	IK09

Accessories (order separately)

Control Boxes	Power and control box - daisy chain configuration, Power and control box - star configuration, Lumentalk Data Bridge
Control Systems	Lumentouch 2.0™, Lumencue, Lumentone
Diagnostic and Addressing Tools	LumenID, LumentalkID

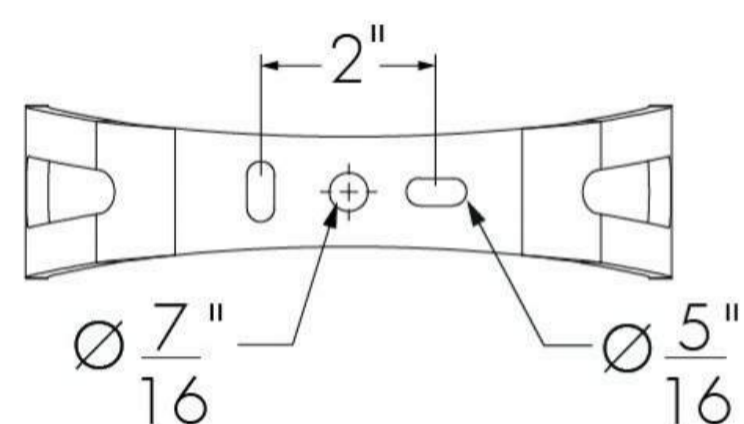
Mounting options

SY - Short yoke

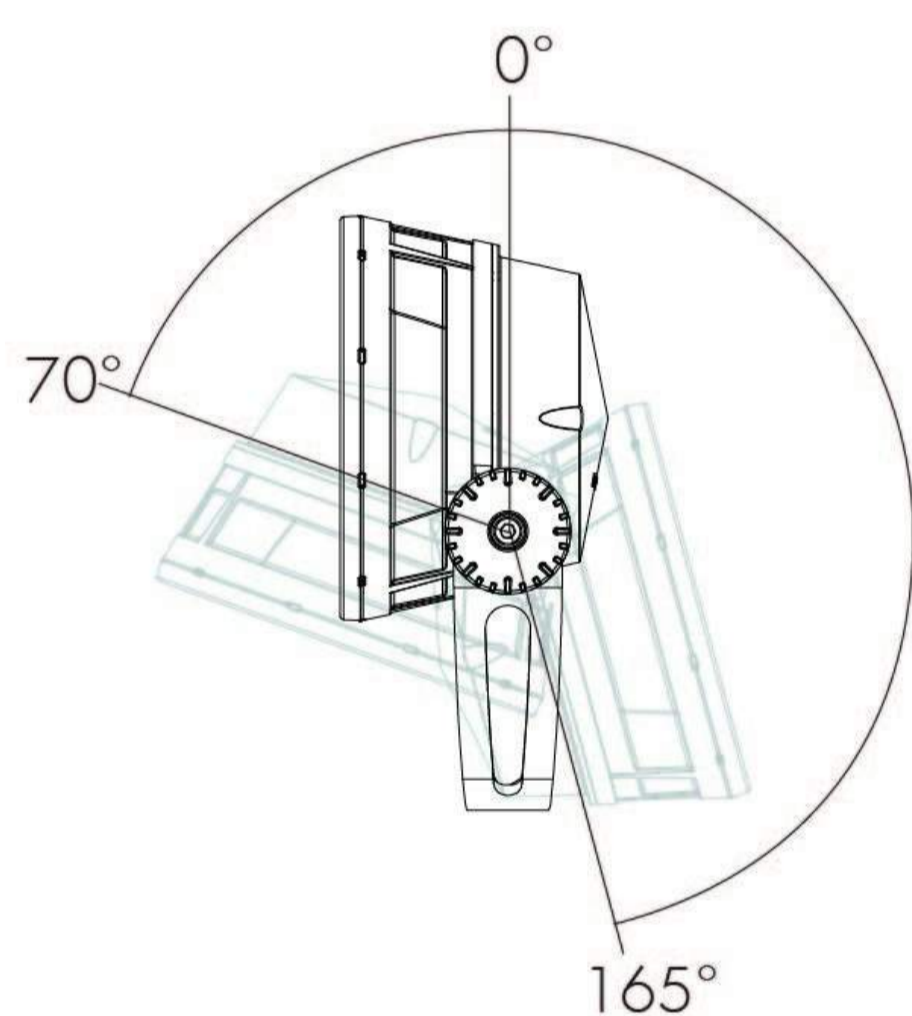


Mounting details

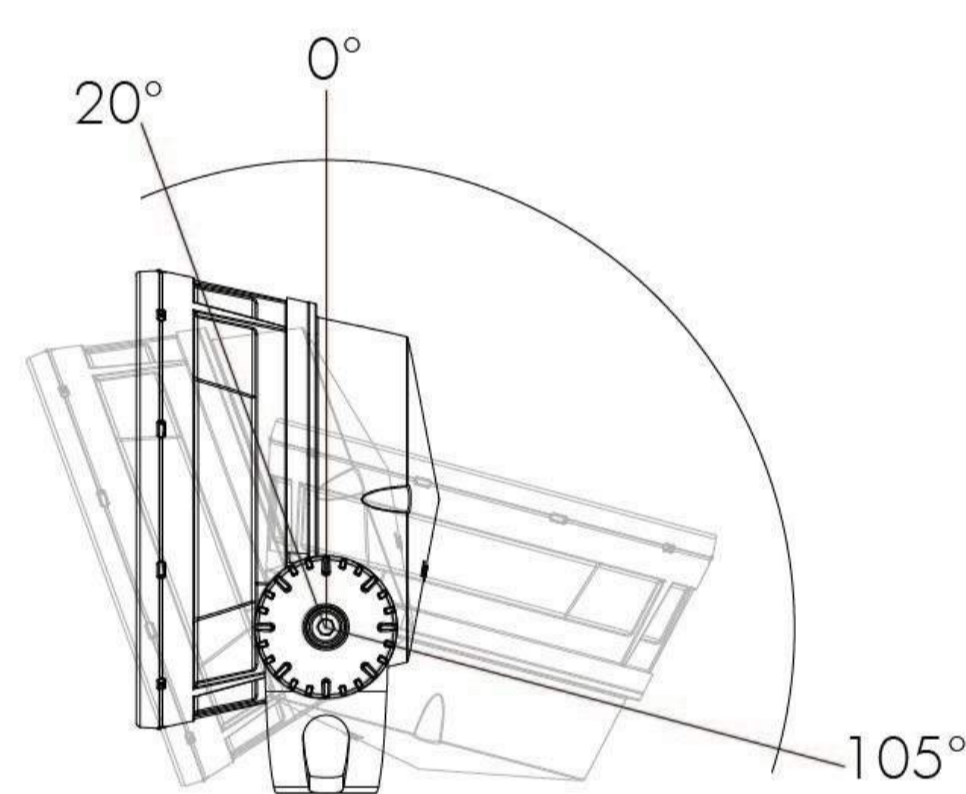
Mounting hole pattern - standard and short yoke



Adjustable pivot limits



Standard yoke

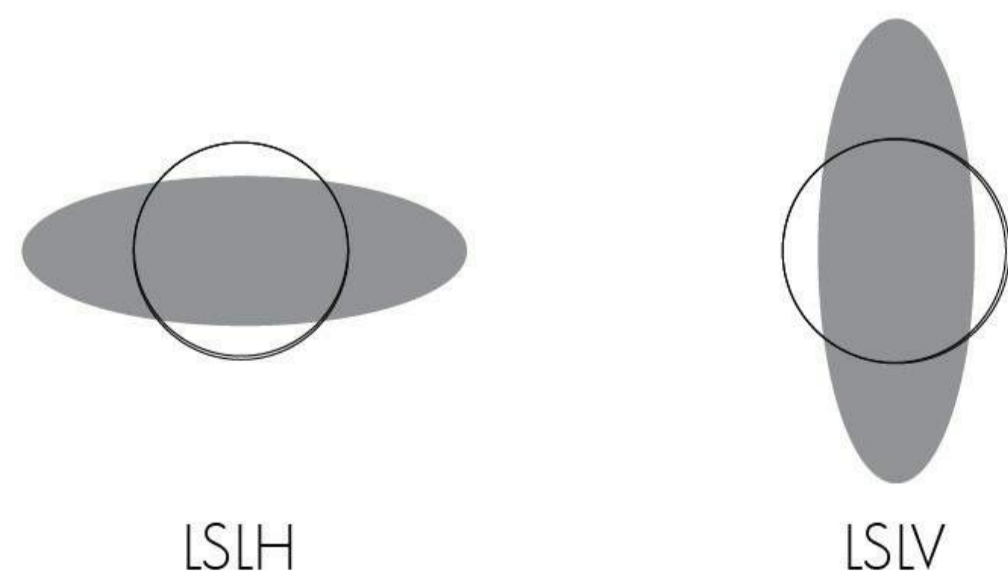


Short yoke

Optical options

LSLH - Linear spread lens horizontal distribution

LSLV - Linear spread lens vertical distribution

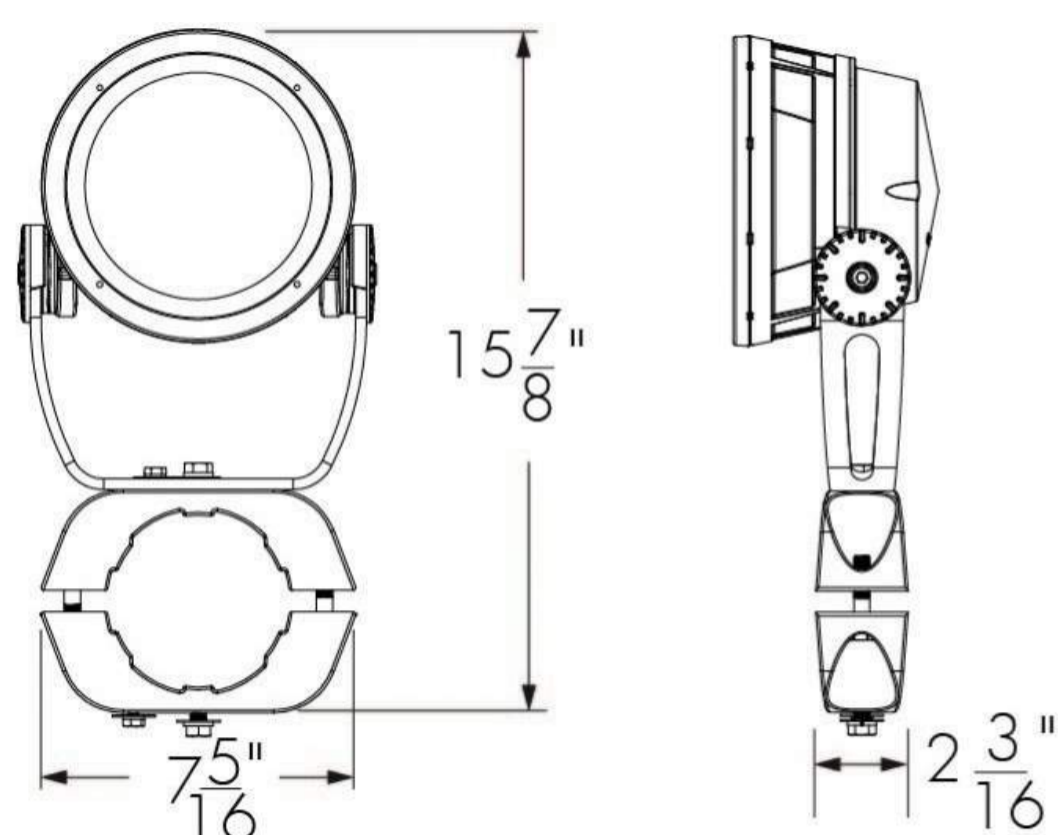


	Beam angle with LSLH/LSLV
VN	8° x 60°
NS	9° x 60°
NF	18° x 65°
FL	32° x 72°

Factory installed, not adjustable on site. Not available for WFL optic.
See 'Optical Accessories' section for field adjustable spread lens (LSLA).

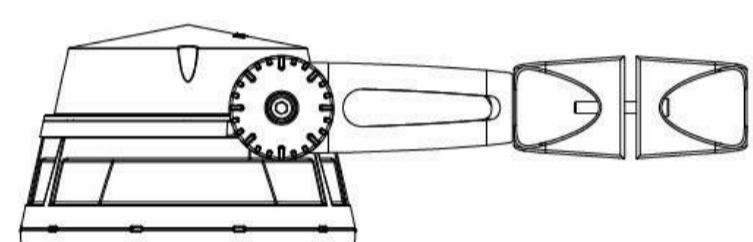
Mounting accessories (order separately)

Round pole mounting accessory

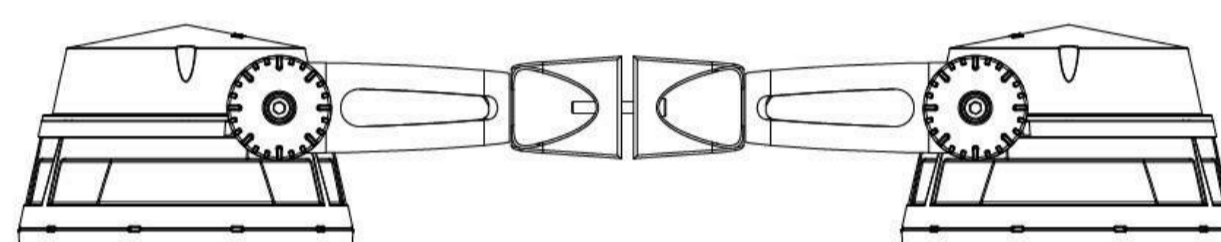


PM4 model shown.

Consult factory for square pole section.



PM4-1, PM4.5-1, PM5-1 - Round pole mounting accessory - single fixture

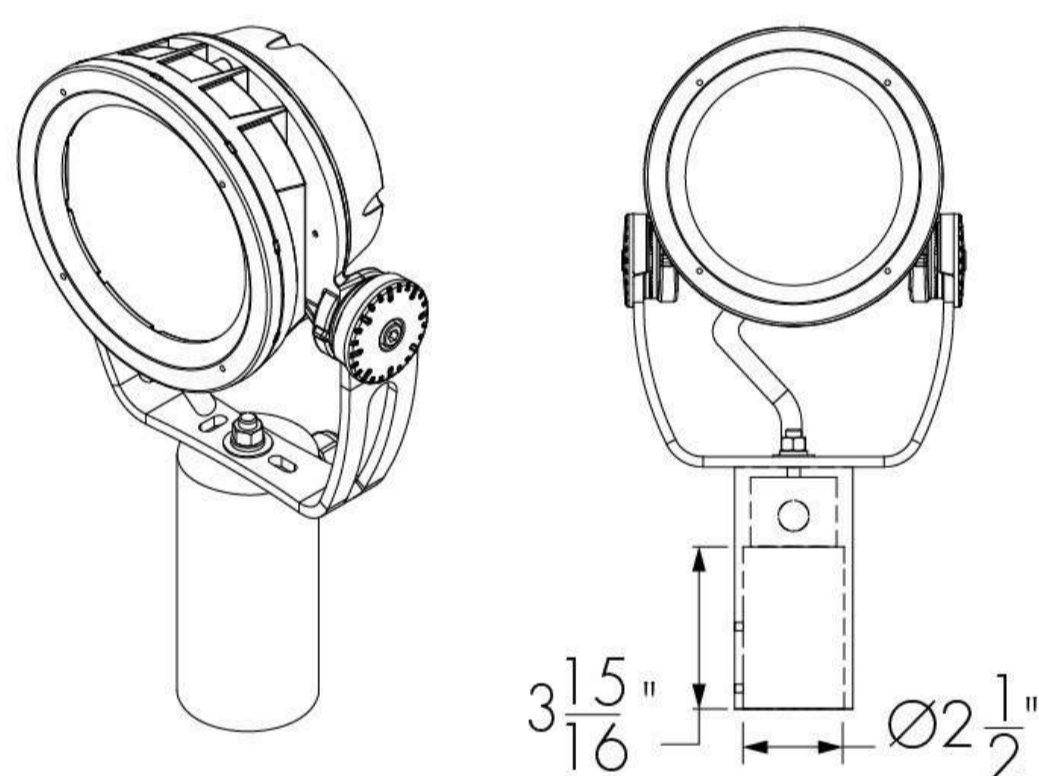


PM4-2, PM4.5-2, PM5-2 - Round pole mounting accessory - twin fixtures
*One bracket assembly is supplied per 2 fixtures unless otherwise specified.

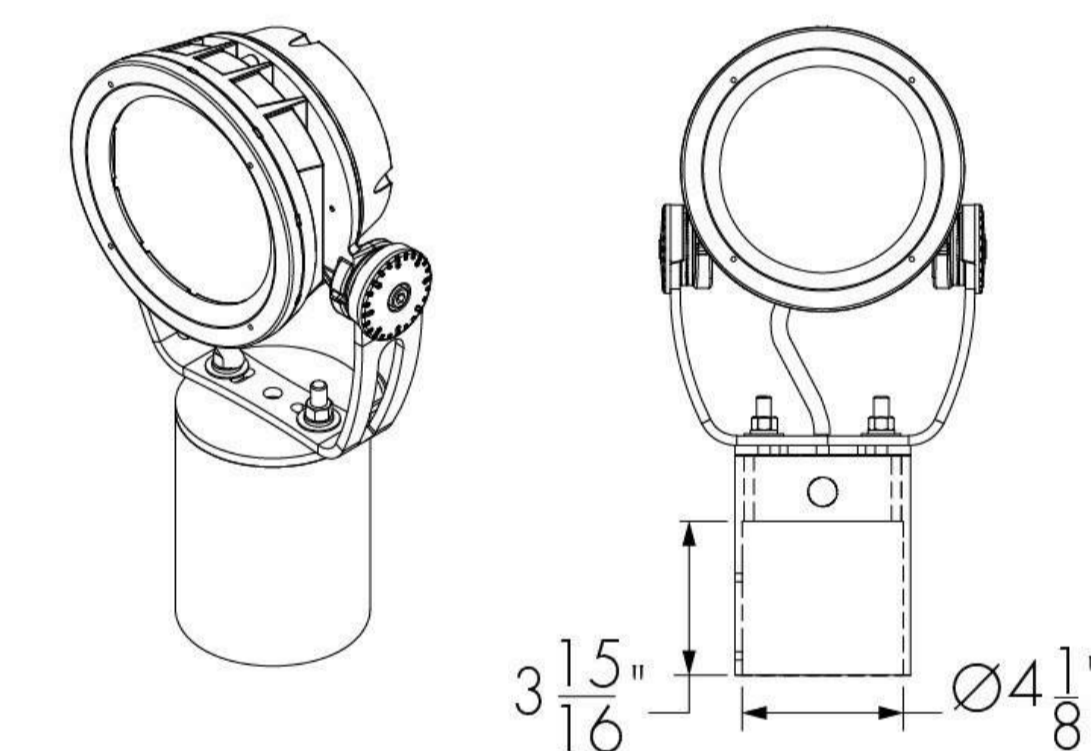
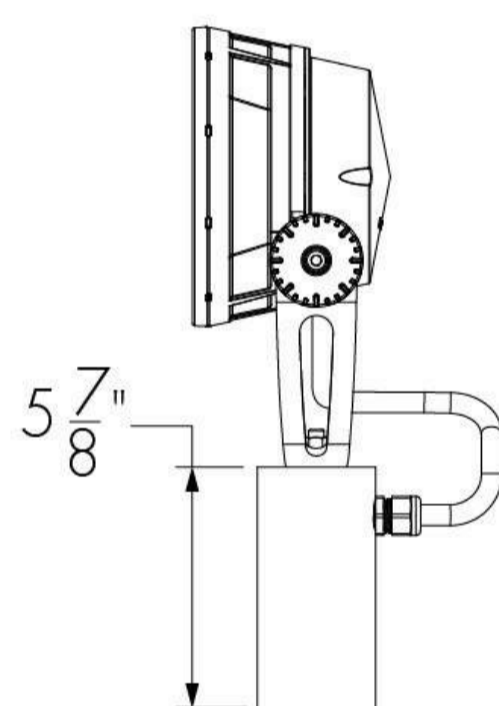
	PM4	PM4.5	PM5
For pole Ø	4" ± 1/16	4.5" ± 1/16	5" ± 1/16

Consult factory for other pole diameters.

Tenon adapter

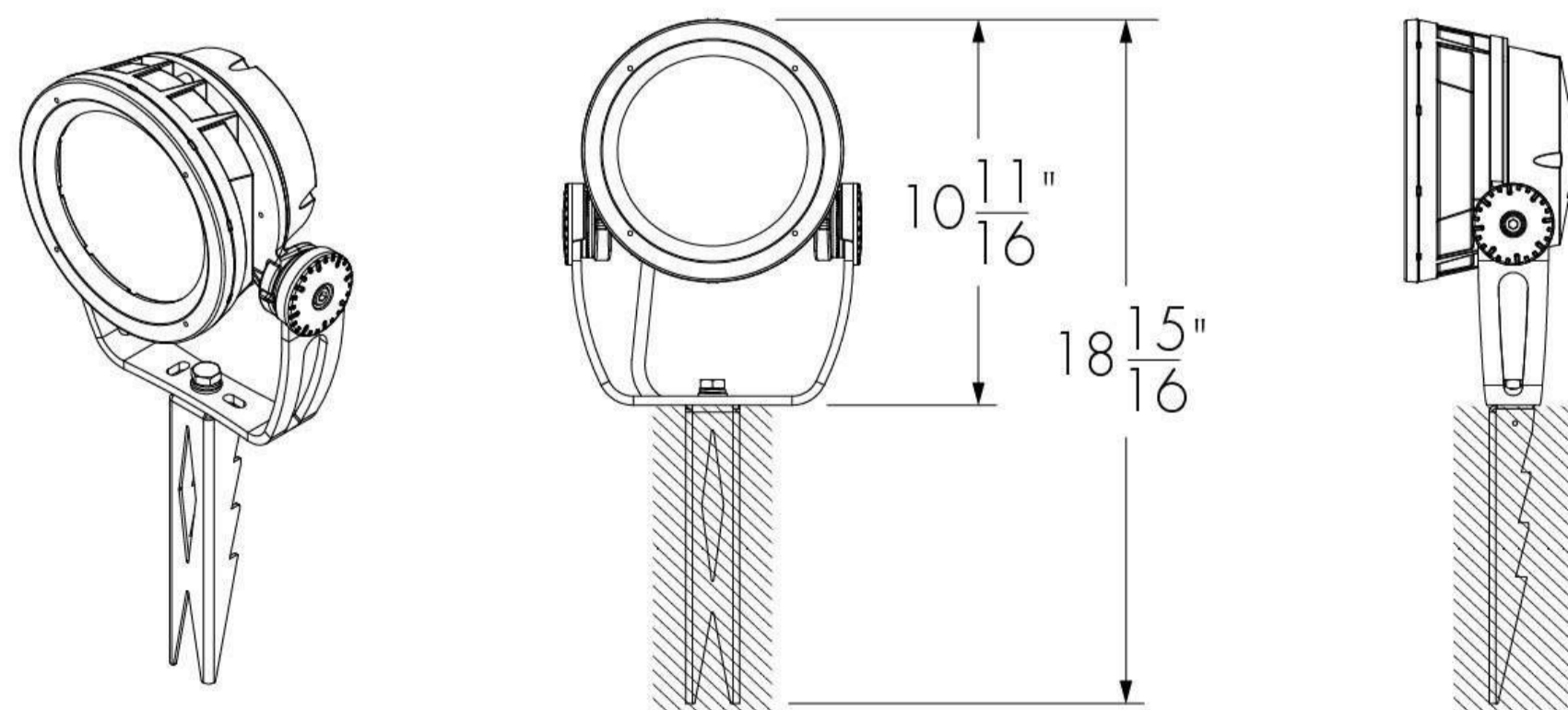


TN2 - Tenon adapter to fit on 2 3/8 in O.D. tenon



TN4 - Tenon adapter to fit on 4 in O.D. tenon

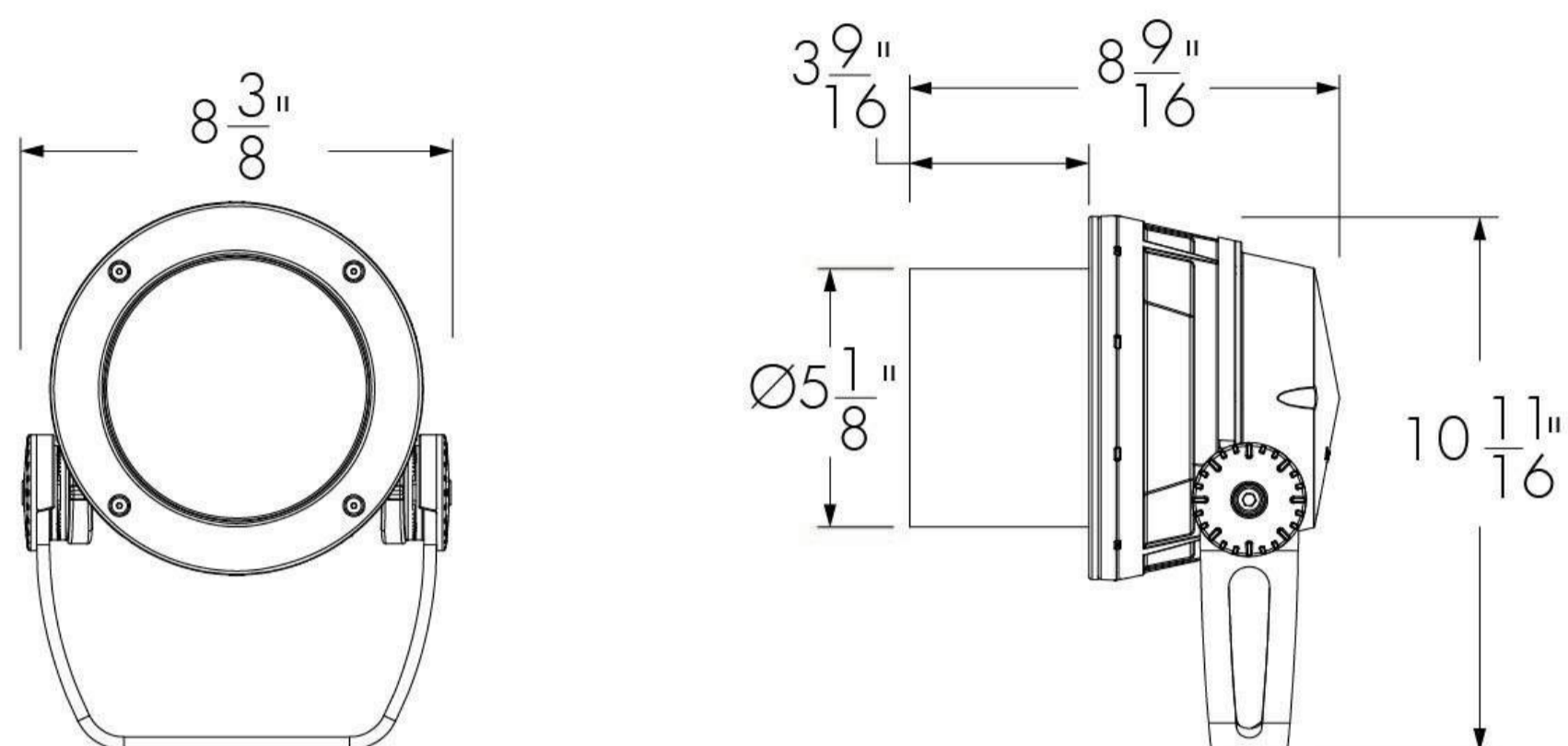
SK - Stake mounting



Optical accessories (order separately)

Installed optical accessories will affect the maximum pivot limits for each mounting option, consult factory for details.

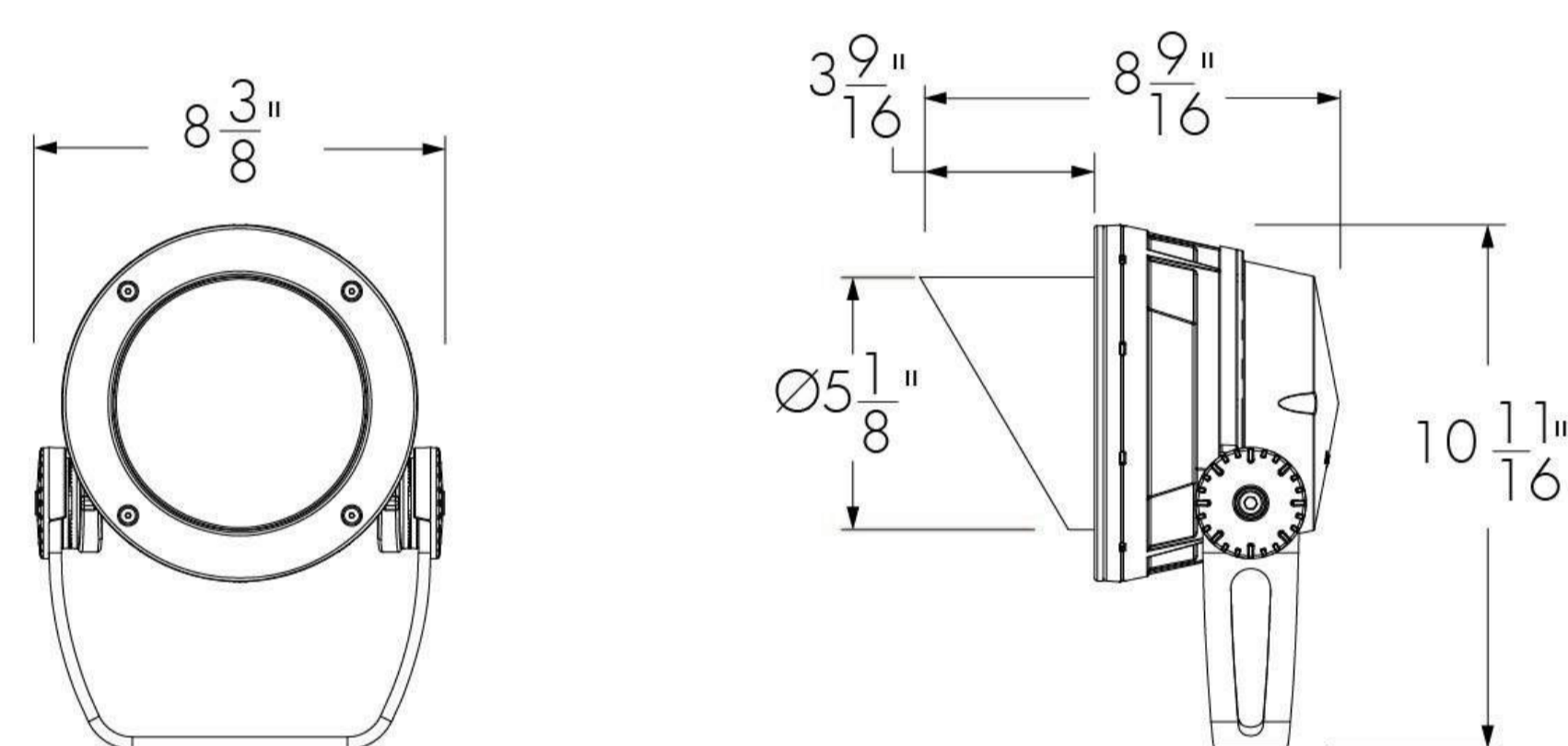
SN - Snoot



LBMSN-FINISH-BK

Interior surface painted black. Please specify desired exterior FINISH from list of available finishes.

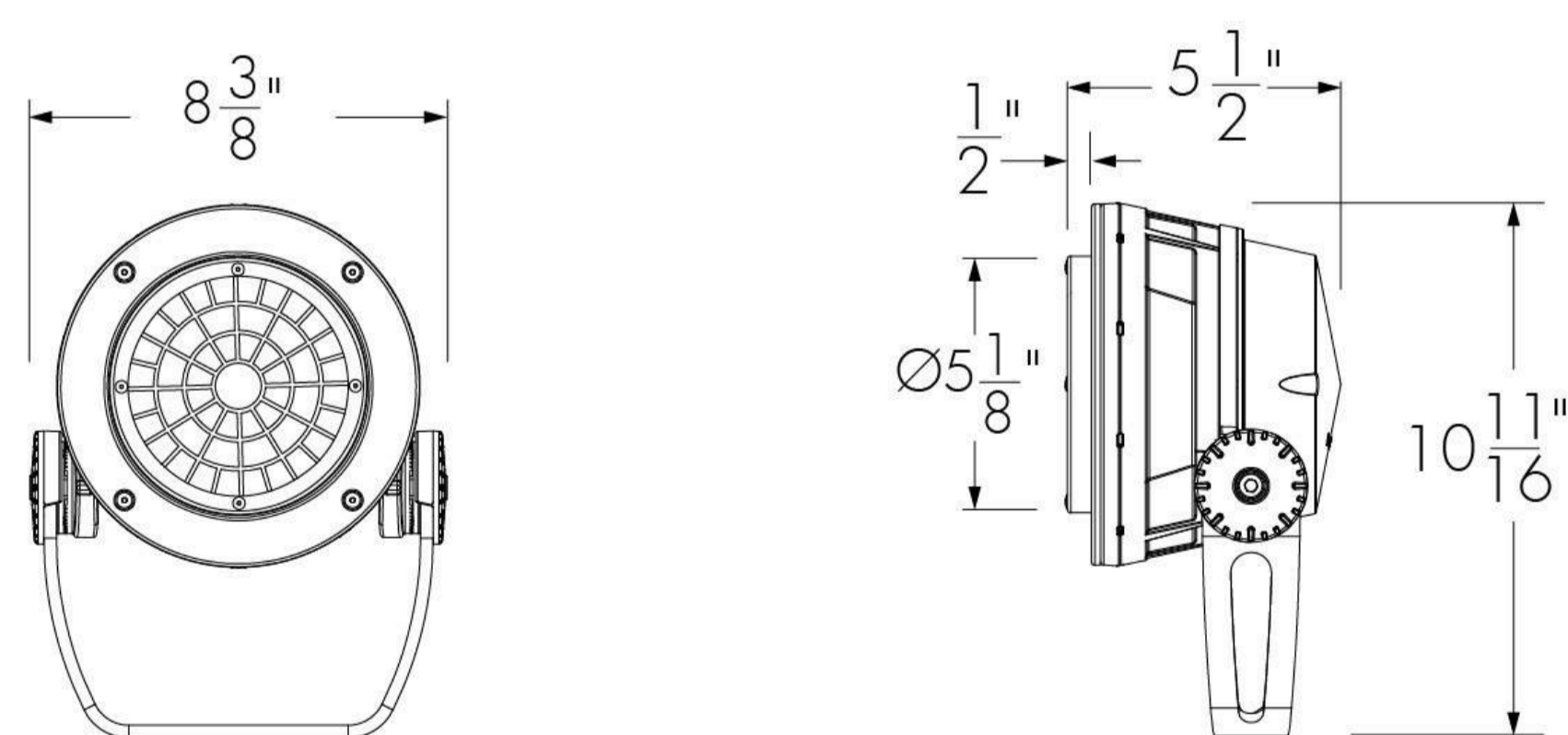
VS - Visor



LBMVS-FINISH-BK

Interior surface painted black. Please specify desired exterior FINISH from list of available finishes.

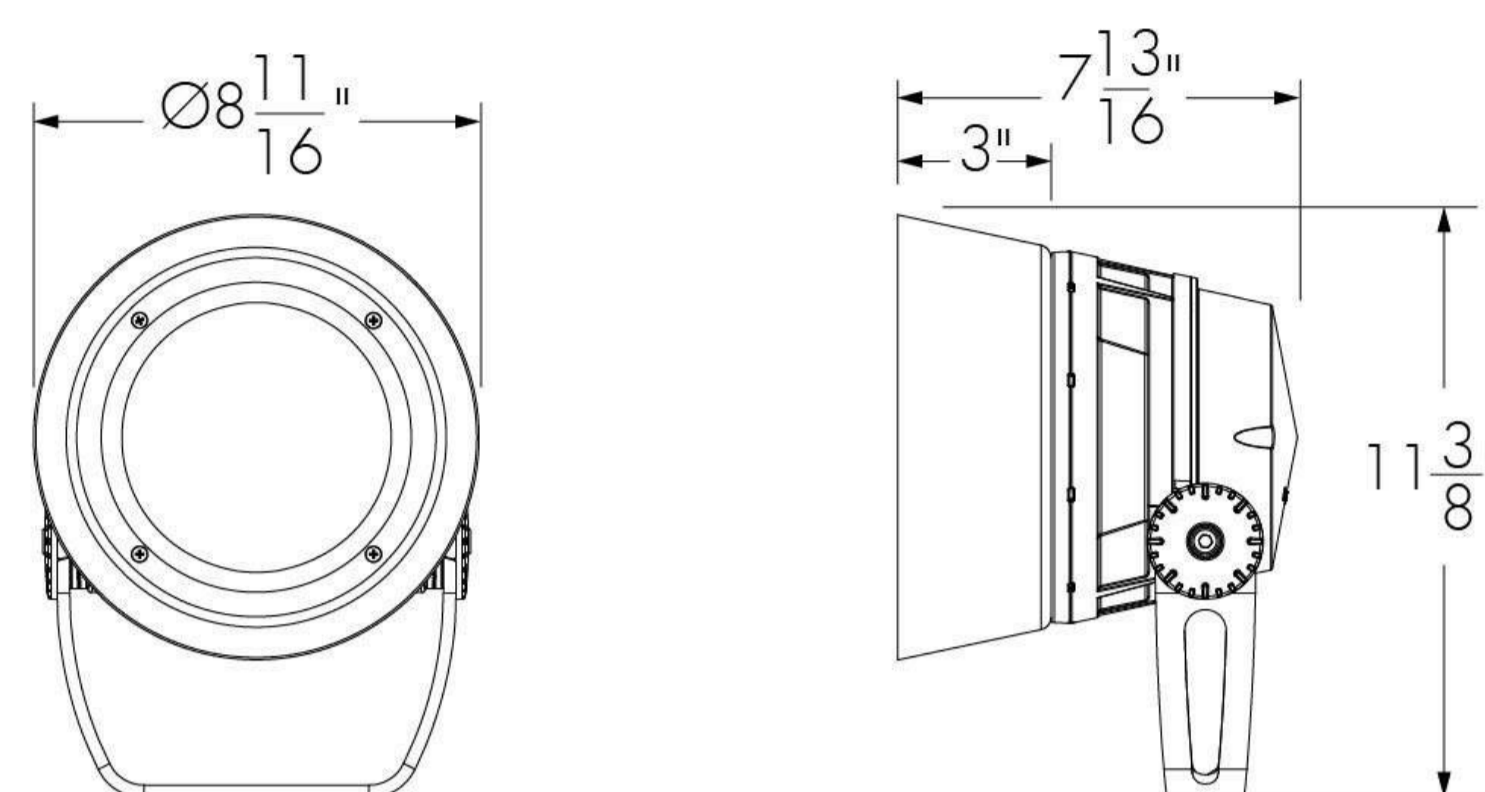
WG - Wire guard



LBMWG-FINISH

Please specify desired exterior FINISH from list of available finishes.

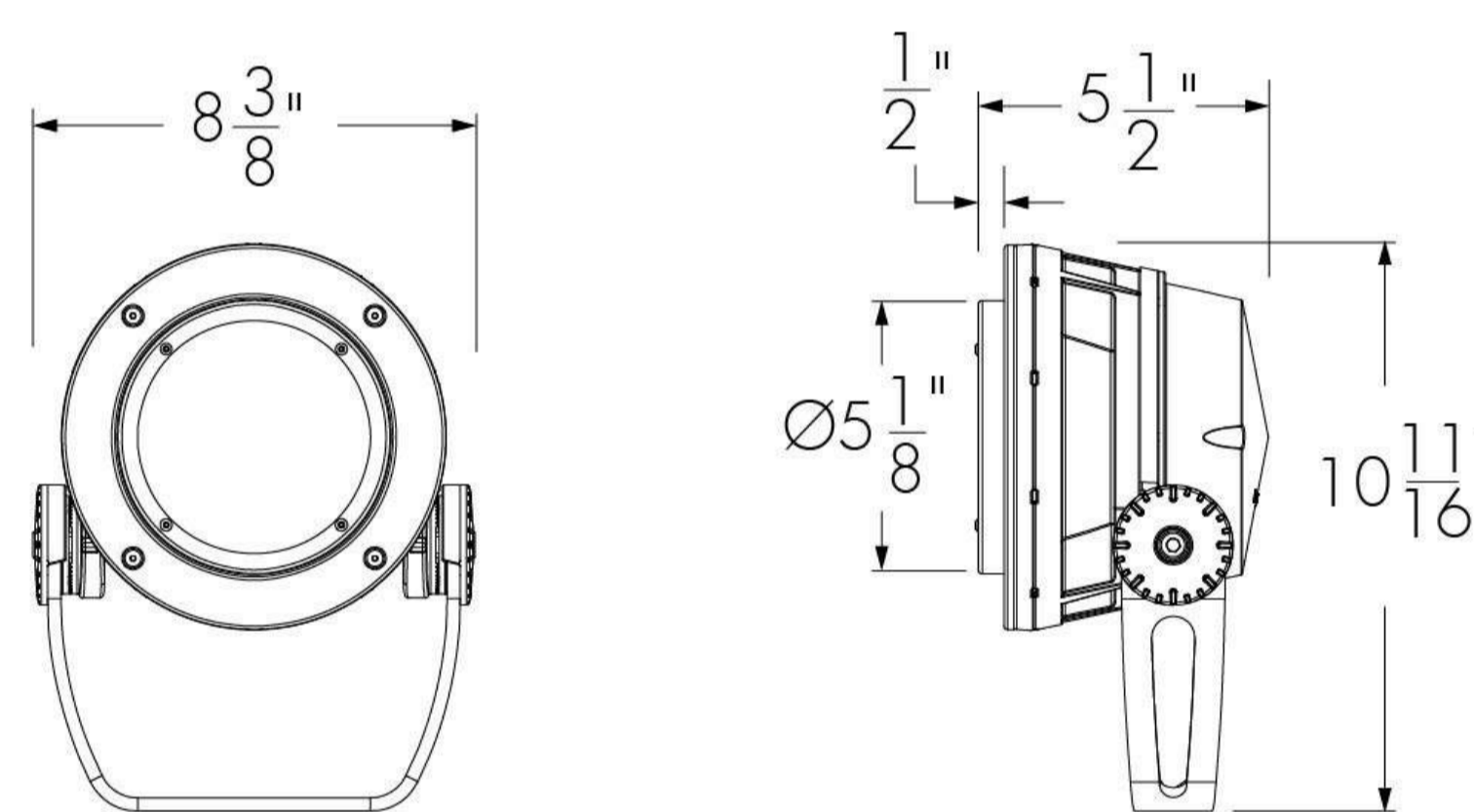
SNW - Snoot wide



LBMSNW-FINISH-BK

Interior surface painted black. Please specify desired exterior FINISH from list of available finishes.

LSLA - Linear spread lens adjustable



LBMLSLA-FINISH

Please specify desired exterior FINISH from list of available finishes.

Accessory combinations

	+	Snoot	Snoot wide	Visor
Linear spread lens adjustable		YES	NO*	YES
Wire guard		YES	NO	YES

Accessory combinations must be ordered together on a single line.

Ex: A snoot + wire guard combination order code is LBMSNWG-BK-BK.

*Consult factory for a linear spread lens adjustable + snoot wide combination.

Available exterior finishes for optical accessories

BK - Black Sandtex®

BRZ - Bronze Sandtex®

SI - Silver Sandtex®

WH - Smooth white

BKTX - Textured black

BRZTX - Textured bronze, non-metallic

GRATX - Textured medium gray

GRNTX - Textured green

WHTX - Textured white

CC - Custom color and finish (please specify RAL color)*

*Lumenpulse offers a wide selection of RAL CLASSIC (K7) colors with a smooth texture and high-gloss finish. Please consult factory for a list of available K7 colors, other RAL textures and glosses, or to match alternate color charts. Final color matching results may vary.

How to order

1	2	3	4	5	6	7	8
LBM							
9	10						

1 . Housing

LBM Lumenbeam™ Medium

2 . Voltage

100 100 volts
120 120 volts
208 208 volts
220 220 volts
240 240 volts
277 277 volts

3 . Color and Color Temperature ⁽¹⁾

22K 2200K
27K 2700K
30K 3000K
35K 3500K
40K 4000K
57K 5700K
RD Red
GR Green
BL Blue

4 . Optics

VN Very Narrow 6°
NS Narrow Spot 10°
NF Narrow Flood 20°
FL Flood 40°
WFL Wide Flood 60°

5 . Optical Option

LSLH Linear spread lens horizontal distribution ⁽²⁾
LSLV Linear spread lens vertical distribution ⁽²⁾

6 . Finish

BK Black Sandtex®
BRZ Bronze Sandtex®
SI Silver Sandtex®
WH Smooth white
BKTX Textured black
BRZTX Textured bronze non-metallic
GRATX Textured medium gray
GRNTX Textured green
WHTX Textured white
CC Custom color and finish (please specify RAL color) ⁽³⁾

7 . Control ^{(4) (5)}

NO On/Off control
DIM 0-10V dimming
DALI DALI dimming
DMX/RDM DMX/RDM enabled

8 . Options

SY Short Yoke
3GV 3G ANSI C136.31 Vibration Rating for bridge applications
CRC Corrosion-resistant coating for hostile environments ⁽⁶⁾

9 . Certification

UL	UL compliant
CE	CE compliant

10 . Cable Length ⁽⁷⁾

3FT	3 ft ⁽⁷⁾ ⁽⁸⁾
10FT	10 ft
20FT	20 ft
30FT	30 ft
50FT	50 ft
70FT	70 ft
100FT	100 ft

Notes:

⁽¹⁾ Consult factory for availability of static Royal Blue, 6500K and 90+ CRI.

⁽²⁾ Factory installed, not available for 60° optic. Field adjustable spread lens optical accessory available, order separately.

⁽³⁾ Lumenpulse offers a wide selection of RAL CLASSIC (K7) colors with a smooth texture and high-gloss finish. Please consult factory for a list of available K7 colors, other RAL textures and glosses, or to match alternate color charts. Final color matching results may vary.

⁽⁴⁾ Lumentalk system is enabled with LDB accessory, DIM or DMX/RDM must be specified in the order code. See the typical wiring diagrams in the specification sheet for details.

⁽⁵⁾ A Lumentranslator and LumentalkID (LIDLTL) must be specified for Lumentalk applications. Consult Lumentranslator and Lumentalk pages and specification sheets for details.

⁽⁶⁾ Use only when exposed to salt spray and harsh chemicals. This option is not required for normal outdoor exposure.

⁽⁷⁾ 3 ft cable length is standard unless otherwise specified.

⁽⁸⁾ Maximum of 3 ft cable length for daisy chain DMX applications with CBX-DS.

ArcSource 1MC tm

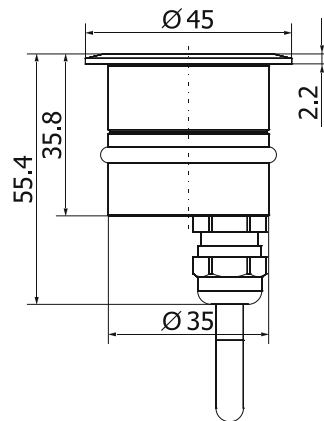


Client: _____
 Project: Canton Centennial Park
 Specifier: Tec Studio
 Type: Type D Qty: _____

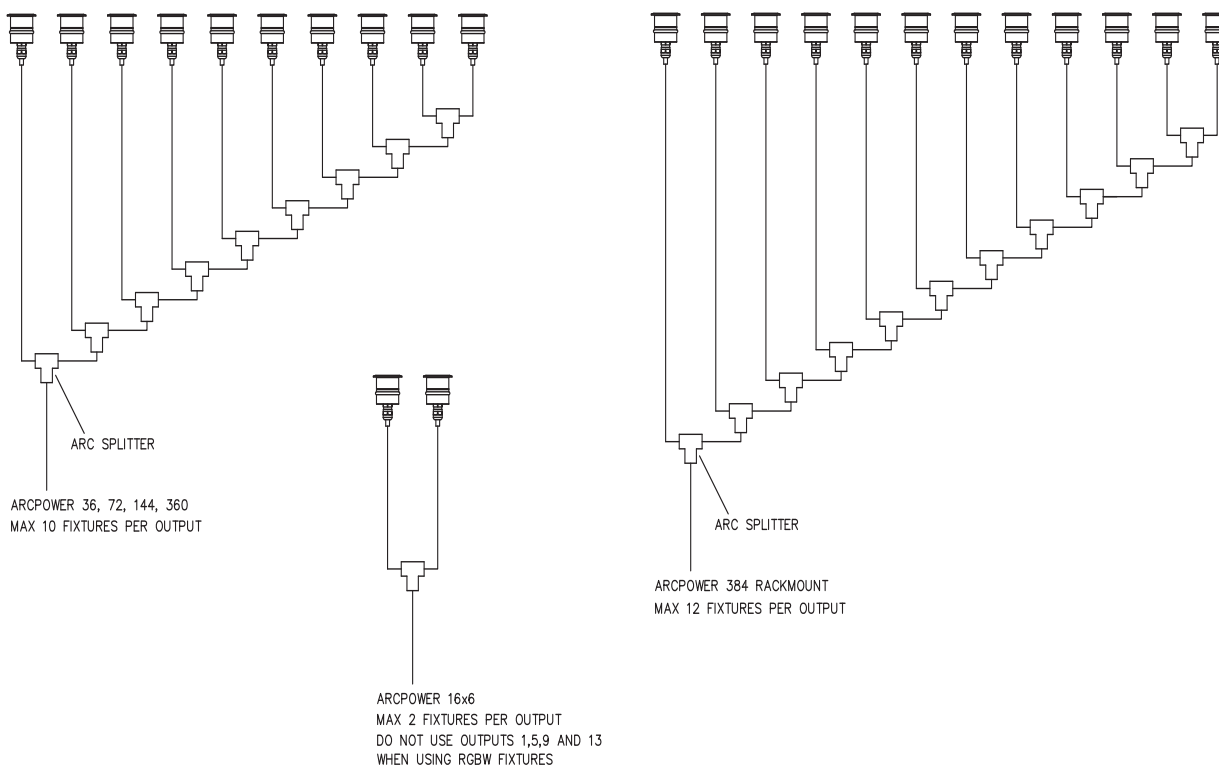


FEATURES:

- Input Voltage: 48V DC Via ArcPower Range
- Power consumption: 4.4W
- Light Source: 1 x MC LED
- Delivered Lumen: 126lm 27dg
- Projected LED Life: 60,000 Hrs
- Lumen Output Per Foot: n/a
- Control: DMX Controller
- Housing: Stainless Steel Flange - Brass Hosing
Glass Cover
- Fixing Method: Rubber Seal
- IP Rating: IP68
- Operating Ambient Temp: -20°C/+40°C (-4°F/+104°F)
- Certification: ETL / cETL, CE, RoHS
- 5 Year Warranty



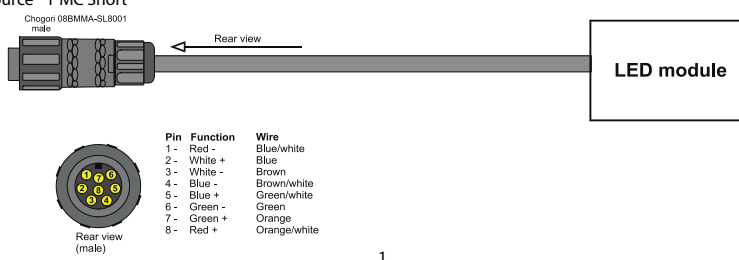
Connection Scheme:



Maximum possible number of LED modules connected to the one LED output of the ArcPower driver is mentioned in the table:

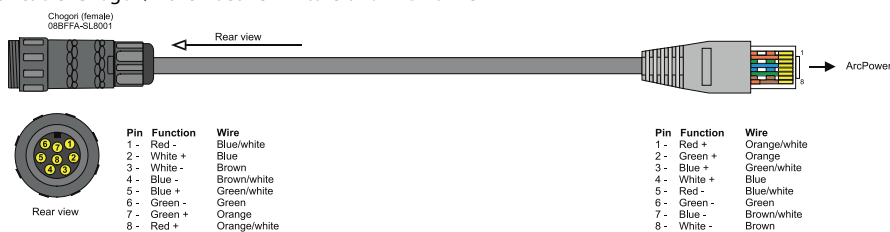
LED module	LED multichips	Max.number of connected modules	Compatible LED drivers
ArcSource 1 MC Short	1	10	ArcPower 36/72/ 144/360
ArcSource 1 MC Short	1	2	ArcPower 16x6
ArcSource 1 MC Short	1	12	ArcPower 384 Rack Mount

3. Connection ArcSource 1 MC Short



1

Adapter cable Chogori/ RJ45 between fixture and LED driver



Product Specification:

Electrical	Input Voltage		48V DC
	Power Consumption		4.4W
Optical	Light Source		1 x 4w Multi-Chip LED
		RGBW	W = 5000-7000K
		SW	2700-6500K
		PW	3200K and 6500K
	LED Channels		RGBW, Pure White, Smart White
	Beam Angle		27°, 35°
Projected Lumen Maintenance		60,000 hrs (L70@ 25°C / 77°F)	
Control	Interface Protocol		N/A
	Wireless DMX (Optional Accessory)		N/A
	Control System		N/A
	Power Supply		ArcPower Range
	Stand Alone Control		No
Physical	Width x Height x Depth	Inches	2.18 x ø1.77
		mm	55.4 x ø45
	Weight	lbs	0.44
		kg	0.2
	Housing		Stainless Steel Top Flange Brass Housing Tempered Glass
	Fixture Cable and Connections		Igus CF9.03.08 - 0.5m Long (1.64ft) - Chogori IP68 Connector
	Fixing Method		Rubber Seal
	Adjustability		N/A
	IP Rating		IP68
	IK Rating		IK**
	Cooling System		Convection
	Operating Ambient Temperature		-20°C / +40°C (-4°F / +104°C)
Operating Temperature		TBC	
Certification	Listings	ETL / cETL, CE, RoHS	

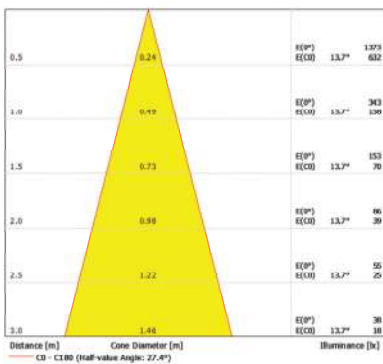
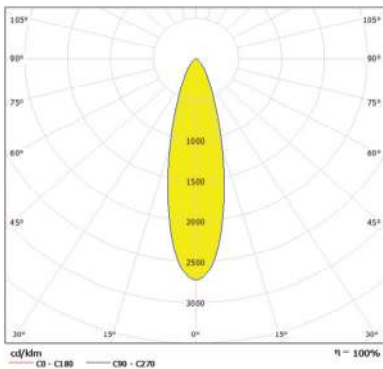
Subject to change without notice - please contact Anolis for clarification

Accessories	Description
	Splitter 1pcs (See Splitter Technical Guide) (Included)
	Connector Chogori CGRBDU-08BFFA (Female) IP68 (Included)
	Connector Chogori CGRBDU-08BMMA (Male) IP68
	Connector Chogori T Piece
	Connector Waterproof Cap (Male)
	Cable Chogori (Female) - RJ45 3m
	Cable Chogori (Female) - RJ45 7m
	Cable Chogori (Female) - RJ45 15m
	Cable Chogori (Female) - RJ45 20m
	<i>other lengths on request</i>

Photometric Data:

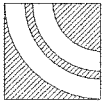
For foot Candles divide lux by 10.7

ArcSource 1MC - 27dg



Total Luminous Flux: 126lm

Type F

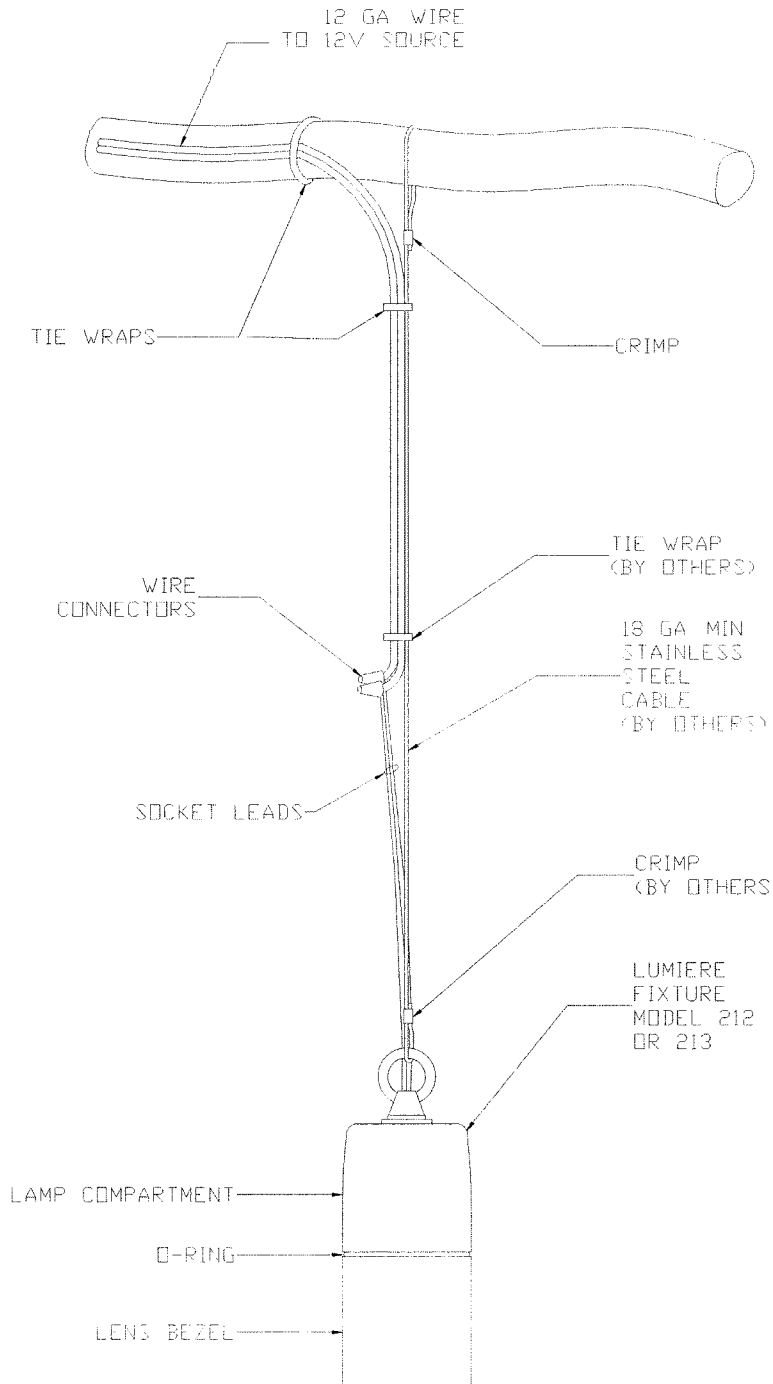


Lumière
2382 Townsgate Road
Westlake Village, CA 91361
Telephone: (805) 496-2003 FAX: (805) 496-2303



INSTALLATION INSTRUCTIONS

MODEL NO. 212, 213



WARNING!

TURN OFF ALL POWER TO THE FIXTURE BEFORE MAINTENANCE, RELAMPING, SERVICING AND INITIAL INSTALLATION

THIS IS A 12 VOLT FIXTURE A REMOTE TRANSFORMER IS REQUIRED (NOT INCLUDED)

NOTE

WIRING AND INSTALLATION MUST BE PERFORMED BY A QUALIFIED ELECTRICIAN ONLY

INSTALLATION INSTRUCTIONS:

1 RUN SUPPLY WIRES FROM TRANSFORMER TO FIXTURE SOCKET LEADS CONNECT THE WIRES TOGETHER USING WIRE NUTS (PROVIDED) AND APPLY MASTIC TAPE TO WATERPROOF THE CONNECTIONS.

RELAMPING

WARNING

TURN POWER OFF BEFORE INSTALLATION, SERVICING, MAINTENANCE, OR RELAMPING

FOR 212: USE 12 VOLT, MR11, 35 WATT MAXIMUM HALOGEN LAMP

FOR 213: USE 12 VOLT, MR16, 50 WATT MAXIMUM HALOGEN LAMP.

CHECK PACKAGE AND FIXTURE LABELING CAREFULLY FOR PROPER LAMP TYPE AND WATTAGE

TO RELAMP:

UNSCREW THE HOOD. PULL LAMP OUT PUSH NEW LAMP IN. SCREW THE HOOD BACK ON. MAKE SURE THAT HOOD SITS SNUGLY ON O-RING FOR A WATERTIGHT SEAL

NOTE

DURING EACH RELAMPING IT IS RECOMMENDED TO LUBRICATE SOCKET WITH WD40 OR EQUIVALENT

Lumière reserves the right to make design changes without notice.

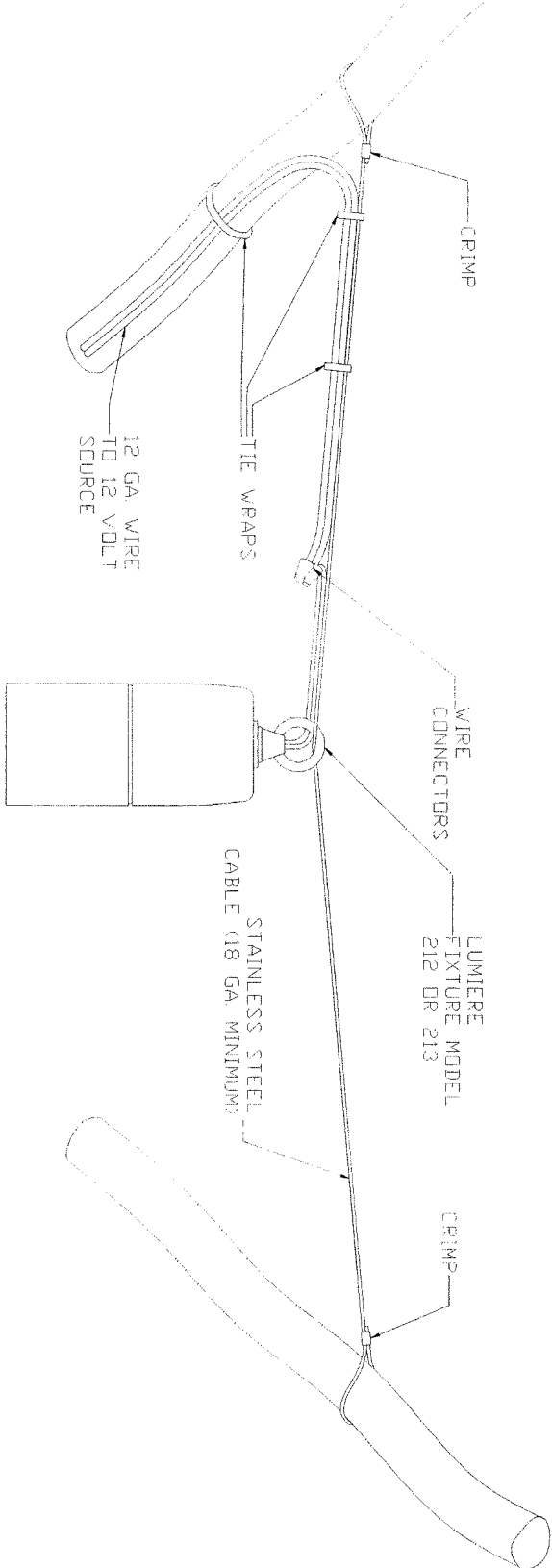
A	10/03/00	PRODUCTION RELEASE	-
REV.	DATE	DESCRIPTION	MCN
TITLE	INSTALLATION		Lumière COOPER Lighting 2382 Townsgate Road

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LUMIERE DESIGN & MFG., INC.

212 & 213 INSTALLATION

MOUNTING DETAIL

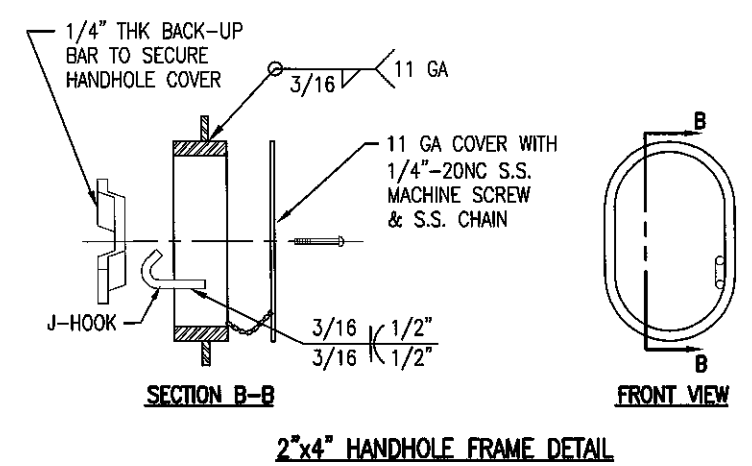
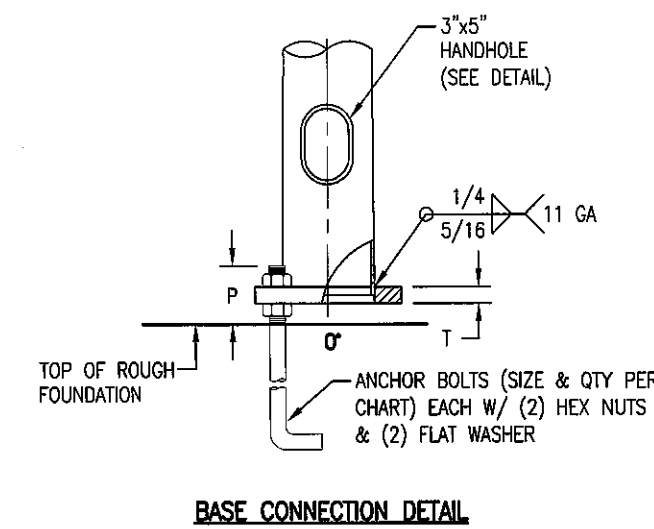
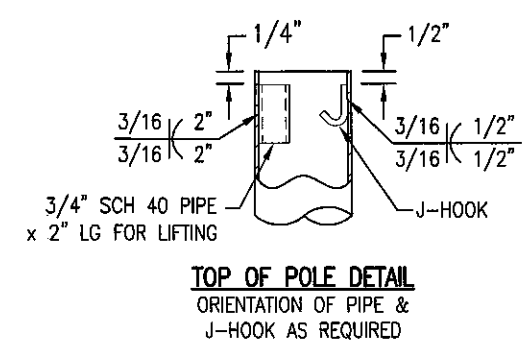
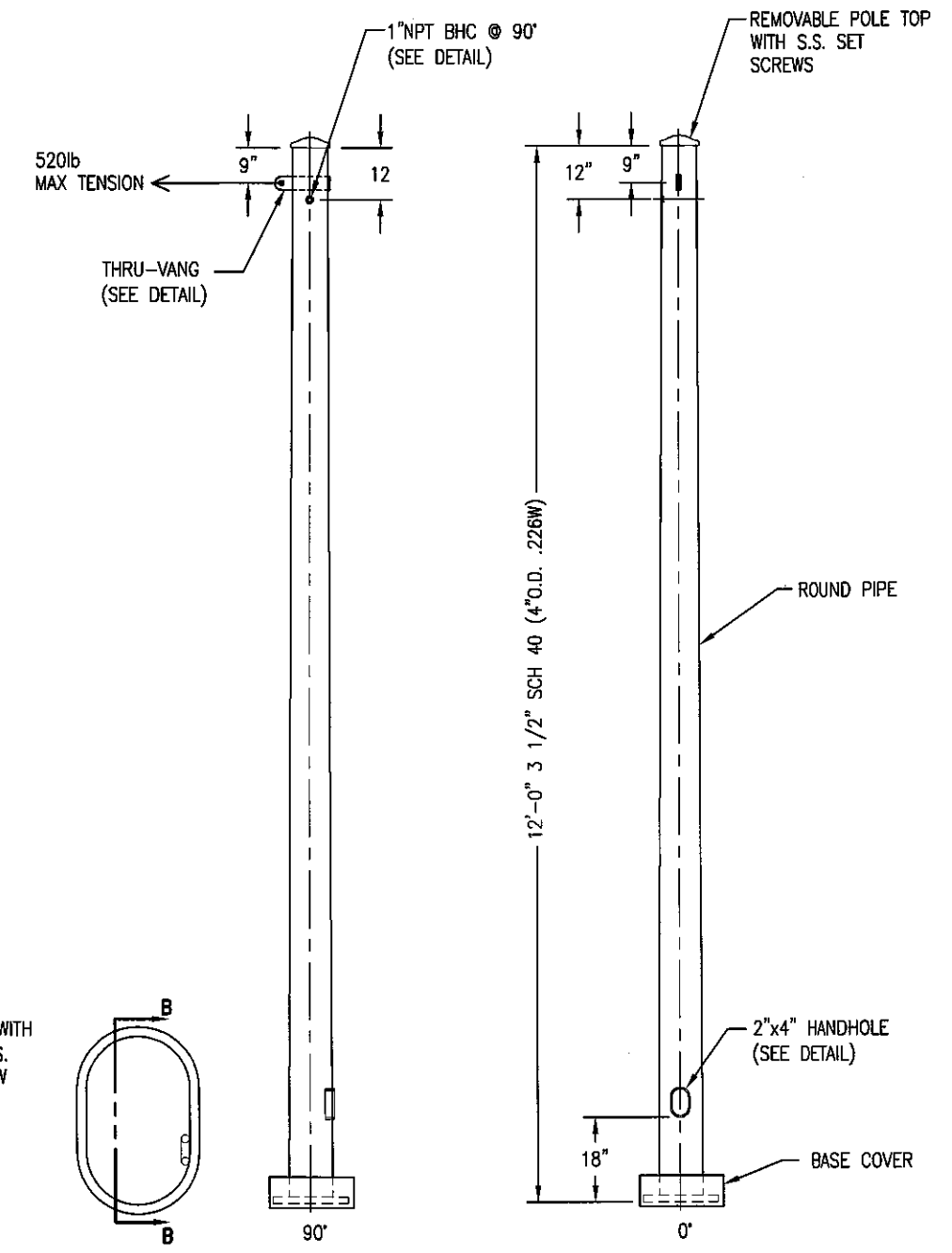
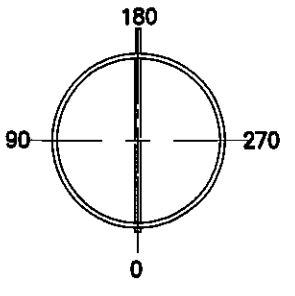
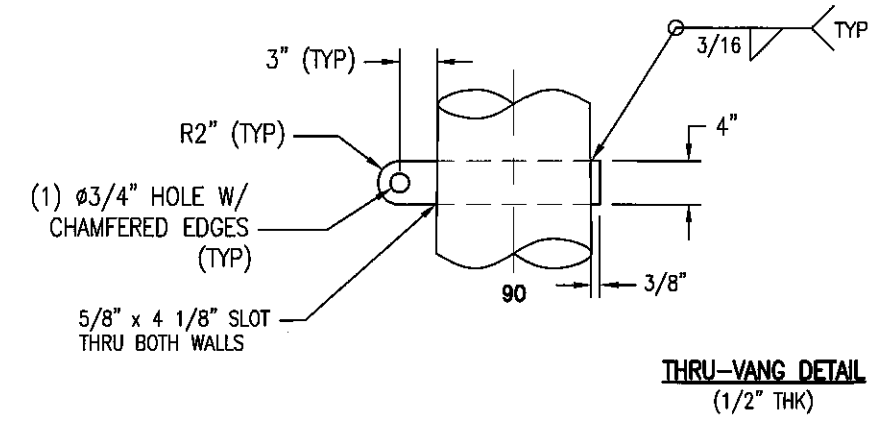
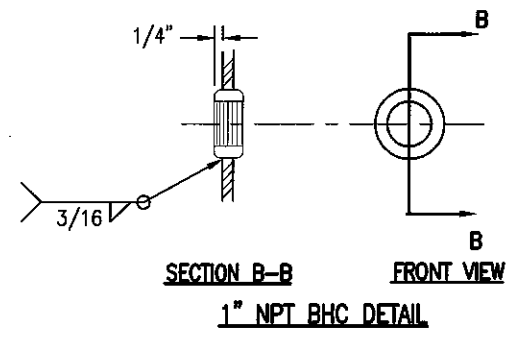


NOTES:
STANDARD FIXTURE SUPPLIED WITH 8 INCH WIRE LEADS AND WIRE CONNECTORS. ALL OTHER HARDWARE SUPPLIED BY OTHERS.



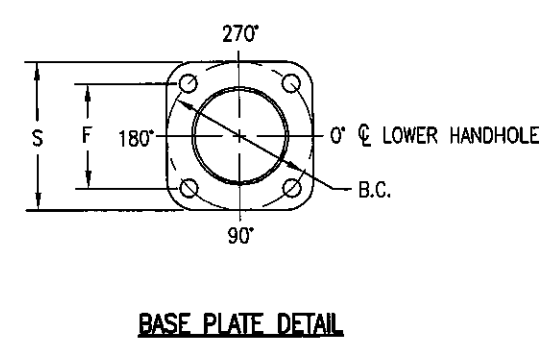
Lumiere Design & Manufacturing, Inc.
2382 Townsgate Road
Westlake Village, CA 91361
Telephone: (805)496-2003
FAX: (805)496-2303

QTY	UMC DESIGN NUMBER	OH	POLE TUBE SIZE	POLE BASE CONNECTION DATA (in)					
				B.C.	S	F	P	T	ANCHOR BOLT SIZE
	787-B111-Y1	12'-0"	SEE DRAWING	8	9	5 5/8	3 1/2	3/4	3/4x27x3



- DESIGN CRITERIA:**
1. THE EXPOSED LENGTH OF THE ANCHOR BOLT BETWEEN THE TOP OF THE FOUNDATION AND THE BOTTOM OF THE LEVELING NUT SHOULD NOT EXCEED ONE BOLT DIAMETER.
 2. POLE IS RATED FOR 525LB. TENSION PER 2001 AASHTO (90MPH WIND SPEED).
 3. CUSTOMER TO CONFIRM ALL DIMENSIONS & ORIENTATIONS BEFORE RELEASING ORDER FOR MANUFACTURING.

MATERIAL SPECIFICATIONS	
PLATE	ASTM A36
BAR HANDHOLE FRAME	ASTM A529 GR 50 or ASTM A572 GR 50 or ASTM A709 GR 50
HANDHOLE COVER	ASTM A36 or A1011
ANCHOR BOLTS	ASTM F1554 GR 55
ANCHOR BOLT NUTS	ASTM A563 GR A
ANCHOR BOLT FLAT WASHERS	ASTM F436
PIPE	ASTM A53 GR B
S.S. HARDWARE	AISI 300 SERIES (18-8)
STRUCTURE FINISH	POWDERCOAT PER ORDER OVER H.D. GALV TO ASTM A123
HARDWARE FINISH	HD GALV TO ASTM A153



STATE: OH	REQ# / SO# : JK-062816-1	REV	DESCRIPTION	DATE	REV BY/CHK BY
PROJECT NAME: GCOCC SITE IMPROVEMENTS			REVISIONS		
ROUND TAPERED STEEL LIGHTING SUPPORT STRUCTURE					
UMC Union Metal Corporation	DESIGNED BY	CHECKED BY	DATE	SCALE	ENG REF
	JLZ	JLD	6/29/16	NTS	787-B110
787-B111				REVISION	SHEET
				R1.0	1 of 1

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DESCRIPTION

Cambria 213 is a small, low voltage dimmable LED and halogen MR16 luminaire. It features a unique hanging design that allows placement where standard mounting methods are not possible. Various lenses, louvers and color or dichroic filters can be combined - up to three at once - to create multiple lighting effects. The Lumière exclusive Siphon Protection System (S.P.S.) prevents water from siphoning into the fixture through its own lead wires.

Catalog #		Type
Project	Canton Centennial Park	Type F
Comments		Date
Prepared by	Tec Studio	

SPECIFICATION FEATURES

Material

Housing and hood are precision-machined from corrosion-resistant billet stock 6061-T6 aluminum, C360 brass, C932 bronze*, C110 copper or 303/304 stainless steel. Mounting ring is die-cast zinc with brass mounting collar, both finished to match housing and hood.

Finish

Fixtures constructed from 6061-T6 aluminum are double protected by an ROHS* compliant chemical film undercoating and polyester powdercoat paint finish, surpassing the rigorous demands of the outdoor environment. A variety of standard colors are available. Brass, Bronze*, Copper or Stainless Steel Fixtures constructed from brass, bronze*, copper or stainless steel are left unpainted to reveal the natural beauty of the material. Brass, bronze* and copper will patina naturally over time.

Hood

Hood is removable for easy relamping and accepts up to three internal accessories at once (lenses, louvers, filters) to achieve multiple lighting effects.

Gasket

Housing and hood are sealed with a high temperature silicone o-ring gasket to prevent water intrusion.

Lens

Tempered glass lens, factory sealed with high temperature adhesive to prevent water intrusion and breakage due to thermal shock.

Socket

Ceramic socket with 250° C Teflon® coated lead wires and GU5.3 bi-pin base.

Electrical

Remote 12V transformer required (not included). Initial power draw on LED equipped fixtures is 12 watts. When sizing transformer use 12 watts

per LED fixture. Nominal power draw after start up is 8 watts. Also, LEDs are more voltage sensitive than standard halogen MR16 lamps. The LED module is designed to operate within the range 12V +/- 1.2V. Any less or more voltage can cause premature failures.

Lamp

Halogen lamp not included. SORAA LED modules are included and are available in three color temperatures (2700, 3000 and 4000) or Amber (585-595nm) and three distributions (spot, narrow, and flood). Both color temperature and distribution must be specified when ordering. Soraalamp compatible (8W Max).

Warranty

Lumière warrants its fixtures against defects in materials & workmanship for three (3) years. Auxiliary equipment such as transformers and lamps carry the original manufacturer's warranty.



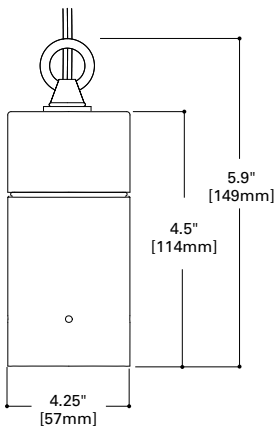
213 CAMBRIA LED HALOGEN

APPLICATIONS:
ACCENT / FLOOD



CERTIFICATION DATA
UL and cUL Wet Location Listed
LM79 / LM80 Compliant
ROHS* Compliant
IP66 Ingressed Protection Rated

TECHNICAL DATA
8W LED, L70/60,000 hours at 25°C
Low Voltage: 50W Halogen MR16



ORDERING INFORMATION

Sample Number: 213-8LED2710-12-CS

Series	Source (for LED, select from each column and combine)	Voltage	Finish
213=LED or MR16 Cambria Hanging Downlight	50MR16=50W Max Halogen MR16, GU5.3 Base	12=12V	Painted BK=Black BZ=Bronze CS=City Silver VE=Verde WT=White Premium Finish NBR=Natural Brass NCP=Natural Copper NBZ=Natural Bronze* NSS=Natural Stainless Steel
	8LED=8W LED 27=2700K 30=3000K 40=4000K 10=10° Spot 25=25° Narrow 36=36° Wide		
	5LED=5W LED AM=Amber (585-595nm) 25=25° Narrow		

NOTES: 1 Dimming is dependant on remote transformer compatibility with LED module. Please see compatibility matrix for dimmer switch and transformer selection. 2 When using a magnetic dimmer switch there are two recommended LED compatible 120V magnetic dimming switches: Lutron Ariadni AVLV-600P and Lutron Diva DVLV-600P

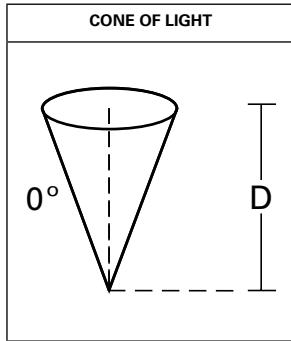
*For natural bronze ROHS material consult factory.

OPTICAL ACCESSORIES - ORDER SEPARATELY

Filters (2.00" Diameter)	Optical Lenses (2.00" Diameter)	Optical Louvers (2.00" Diameter)
F71 = Peach Dichroic F72 = Amber Dichroic F73 = Green Dichroic F74 = Medium Blue F75 = Yellow Dichroic F76 = Red Dichroic F77 = Dark Blue Dichroic F78 = Light Blue Dichroic F79 = Neutral Density Dichroic F80 = Magenta Dichroic F22 = Red Color F33 = Blue Color F44 = Green Color F55 = Yellow Color F66 = Mercury Vapor	LSL =Linear Spread Lens (elongates standard beam spread) DIF =Diffused Lens (provides even illumination) OSL =Overall Spread Lens (increases standard beam spread)	LVR =45° Hex Cell Louver (reduces glare)

CAMBRIA 213 MR16 HALOGEN PHOTOMETRY DATA

Horizontal Illuminance on Surface - Cambria 213 Standard Recessed Hood - 50W MR16



Filename	213-50MR16-12-BK-NSP.ies	
Lamp	50W MR16 NSP	
CBCP	11,000	
Distance	FC	Beam Diameter
2'	2550	1'6"
4'	638	1'0"
6'	283	1'6"
8'	159	2'0"
10'	102	3'0"
15'	45	4'0"

Filename	213-50MR16-12-BK-NFL.ies	
Lamp	50W MR16 NFL	
CBCP	3,200	
Distance	FC	Beam Diameter
2'	725	1'0"
4'	181	2'6"
6'	81	4'0"
8'	45	5'0"
10'	29	6'6"
15'	13	10'0"

CCT MULTIPLIER TABLE

LAMP WATTAGE	MULTIPLIER
20W	0.32
35W	0.57

Filename	213-50MR16-12-BK-FL.ies	
Lamp	50W MR16 FL	
CBCP	2,000	
Distance	FC	Beam Diameter
2'	431	1'6"
4'	106	3'0"
6'	48	5'0"
8'	27	6'6"
10'	17	8'0"
15'	7	12'0"

Filename	213-50MR16-12-BK-WFL.ies	
Lamp	50W MR16 WFL	
CBCP	1,200	
Distance	FC	Beam Diameter
2'	269	2'0"
4'	67	4'6"
6'	30	7'6"
8'	17	9'0"
10'	11	11'6"
15'	5	17'0"

NOTES AND FORMULAS

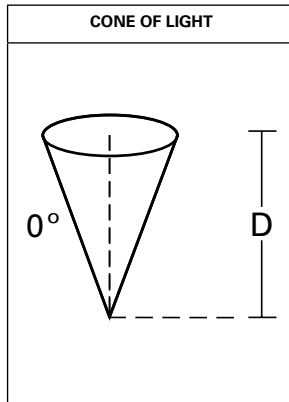
- Beam diameter is to 50% of maximum footcandles, rounded to the nearest half-foot.
- Footcandle values are initial. Apply appropriate light loss factors where necessary.
- Bare lamp data shown. Consult lamp manufacturers to obtain detailed specifications for their lamps.

CAMBRIA 213 LED PHOTOMETRY DATA

LED Lumen and CBCP Table - 4000K

		Flush Hood			Regressed Hood (black)			Regressed Hood (silver)		
		CBCP	LUMENS	LPW	CBCP	LUMENS	LPW	CBCP	LUMENS	LPW
10	BASE	5980	351.3	43.6	5541	298.5	37.1	5052	296.9	39.7
	+DIFF	985	286.9	35.8	968	220.4	27.4	930	233.2	31.2
	+LSL	1310	309.9	38.6	1299	253.1	31.4	1200	252.7	33.8
	+LVR	5270	243.0	30.6	4838	235.3	29.2	4633	225.1	30.1
	+OSL	1686	328.6	41.4	1700	285.7	35.5	1609	291.1	39
25	BASE	2690	417.2	53.5	2559	374.2	47.4	2357	361.8	49.4
	+DIFF	761	338.6	43.4	729	267.7	33.9	720	281.4	36.2
	+LSL	795	375.1	48.1	778	316.3	40.2	719	312.0	42.2
	+LVR	2396	285.9	36.7	2294	272.4	34.1	2092	253.3	35.3
	+OSL	1452	383.4	49.1	1414	345.0	43.8	1328	341.2	45.2
36	BASE	1144	409.2	53.1	1125	369.1	47.6	1080	371.7	49
	+DIFF	542	336.3	43.6	532	264.3	34.1	502	268.6	35.1
	+LSL	486	371.1	48.2	480	305.6	39.4	484	317.4	41.7
	+LVR	1030	267.9	34.8	996	252.1	32.4	967	251.8	33.1
	+OSL	930	384.3	49.9	932	337.8	43.6	910	348.6	45.7

Horizontal Illuminance on Surface - Cambria 213 Standard Recessed Hood -4000K



Filename: 213-SS-8LED4010-12-BK.IES		
Test No.: G2-1802-569-4		
Distance	FC	Beam Diameter
2'	1385.2	0.4
4'	346.3	0.8
6'	153.9	1.2
8'	86.6	1.6
10'	55.4	2
15'	24.6	3.2
20'	13.9	4.2
30'	6.2	6.4
40'	3.5	8.4

Filename: 213-SS-8LED4025-12-BK.ies		
Test No.: G2-1802-569-5		
Distance	FC	Beam Diameter
2'	639.8	0.6
4'	159.9	1.2
6'	71.1	1.8
8'	40	2.4
10'	25.6	3
15'	11.4	4.6
20'	6.4	6
30'	2.8	9.2
40'	1.6	12.2

Filename: 213-SS-8LED4036-12-BK.ies		
Test No.: G2-1802-569-6		
Distance	FC	Beam Diameter
2'	281.2	1
4'	70.3	2.2
6'	31.2	3.4
8'	17.6	4.6
10'	11.2	5.8
15'	5	8.6
20'	2.8	11.6
30'	1.2	17.4
40'	0.7	23.2

CCT MULTIPLIER TABLE

CCT(K) / COLOR	MULTIPLIER
2700K	0.91
3000K	0.89
4000K	1.00

Note: Multiplier can be used to calculate center beam candle power (CBCP), Lumens and footcandle (FC) values.

TECHNICAL INFORMATION

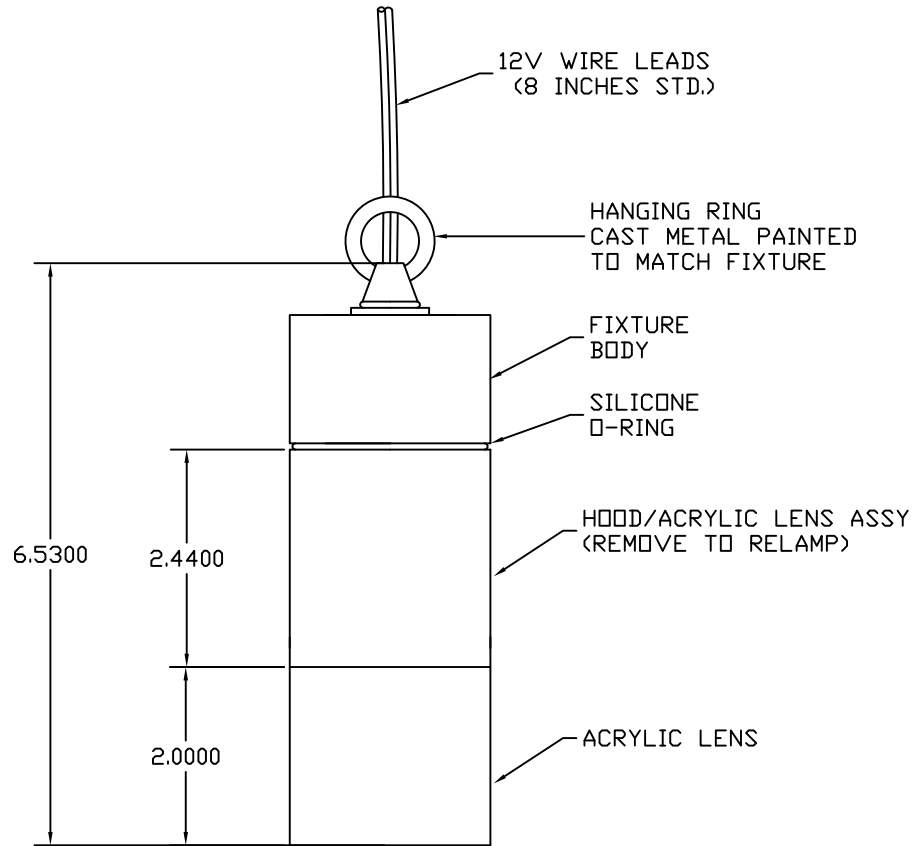
1. Dimming is dependant on remote transformer compatibility with LED module. Please see compatibility matrix for dimmer switch and transformer selection.
2. When using a magnetic dimmer switch there are two recommended LED compatible 120V magnetic dimming switches: Lutron Ariadni AVLV-600P and Lutron Diva DVLV-600P
3. IMPORTANT: When sizing transformer use 12 watts per LED fixture. Nominal power draw after start up is 8 watts. Any less or more voltage can cause premature failures.



Lumière
 Customer First Center
 1121 Highway 74 South
 Peachtree City, Georgia 30269
 770-486-4800
 770-486-4801 (FAX)



TYPE: F



DESCRIPTION:

SPECIFICATION GRADE, LOW VOLTAGE ACCENT FIXTURE.DOWNLIGHT WITH 2 IN ACRYLIC LENS.

BODY AND HOOD ARE PRECISION MACHINED FROM CORROSION RESISTANT 6061-T6 ALUMINUM ALLOY. STAINLESS STEEL HARDWARE. SEALED WITH HIGH TEMPERATURE SILICONE O-RING.

APPLICATIONS:

DOWN LIGHTING OF PATHS, TREES, SHRUBS, WALLS, BUILDINGS AND OTHER TEXTURED SURFACES. SECURITY LIGHTING OF FOLIAGE AND STRUCTURES. GENERAL AREA ILLUMINATION.

ELECTRICAL:

12 VOLTS, 10 WATTS MAXIMUM, MR16 BI-PIN 10LEDXXXX . CERAMIC LAMP SOCKET WITH 250°C TEFLON COATED WIRES. REMOTE TRANSFORMER REQUIRED (NOT INCLUDED).

FINISH:

FIXTURE AND HOUSING ARE DOUBLE PROTECTED BY A CHROMATE CONVERSION UNDERCOATING AND A THERMOPLASTIC POLYESTER POWDER COAT FOR MAR RESISTANCE AND EXTENDED WEATHERABILITY.

COLORS:

ARCHITECTURAL BRONZE, BLACK, WHITE, VERDE GREEN, AND CITY SILVER. CUSTOM COLORS ARE ALSO AVAILABLE.

Lumière reserves the right to make design changes without notice. All dimensions shown on this specification sheet are for reference only, and are not identical to manufacturing specifications.

CANTON CENTENNIAL PLAZA

PROJECT NAME

**PDR53209-213-10LEDXXXX-12-XX-2IN ACRYLICHOOD
 CUSTOM CAMBRIA 10LED DOWN LIGHT**

APPROVAL SIGNATURE

DATE

PRODUCT SPECIFICATION

DRAWN BY: BB 6-9-15

DWG NO: PDR53209-213-10LEDXXXX-12-XX-2IN ACRYLICHOOD

SPECIFICATIONS

STEP



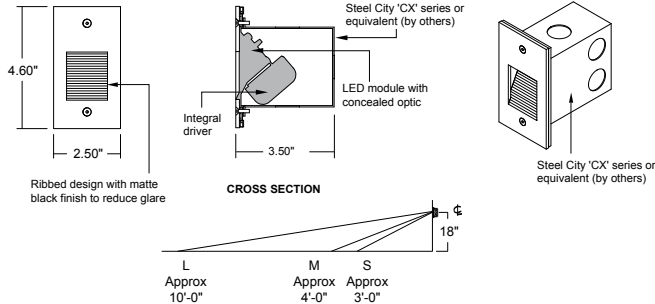
STEP 11

RECTANGLE

Type: **Type G**

Project: **Canton Centennial Park**

Qty:



Construction

Die-cast housing with solid aluminum or stainless steel faceplate. Step11 is a surface mount step light that mounts over a Steel City 'CX' series or equivalent junction box (by others) with two visible fasteners.

Source

Light source is a single powerful LED available in three white color temperatures.

Optics

Concealed optic is available in three light distribution patterns. Short for narrow corridors, Medium for wide corridors, and Long for large area illumination.

Electrical

Integral electronic drivers are multi volt input 120-277V, & available in standard or 0-10V dimming. Non-dimming units consume 2.5W. Dimming units consume 4W.

Environment

ETL / cETL listed dry location or optional wet location.

Finish

Recessed surfaces have a ribbed design with matte black finish to reduce glare. Faceplates are available in one metal finish with protective clear coat or two polyester powder coat painted finishes.

Design2Ship

- Maximum order quantity of 25 units
- 5 business days from clean release of the order

Warranty

5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Assembled in America (Buy American Act Compliant)

Performance Data

Dist.	Lumens	Lm/W
Short	25	10.0
Medium	30	12.0
Long	38	15.2

Performance data based on WHT30K non dimming.



See page 4 for lighting facts labels.



CATALOG NUMBER

Example: **STEP11 QS RECT INT M LST1A 350MA WHT30K MVOLT DMD SGB**

Series	Program	Faceplate Shape	Environment	Distribution	Source
STEP11 Step 11	QS Quick Ship (5 day shipping)	RECT Rectangle	WL Wet Location INT Interior	S Short M Medium L Long	LST1A LED Step 1

Drive Current	Color Temperature	Voltage	Driver	Finish
350mA 350 Milliamps	WHT30K White (30K) WHT35K White (35K) WHT40K White (40K)	MVOLT Multi Volt 120V thru 277V	(Blank) Standard Driver DMD Dimming Driver	BSS Brushed Stainless Steel SGB Semi Gloss Black SGW Semi Gloss White

STEP 1 1

RECTANGLE

Type:

Project:

Qty:

DESIGN2SHIP™ PROGRAM DETAILS

HOW TO ORDER

1. All Design2Ship orders should be activated through Agile. Orders must include the complete Design2Ship catalog number(s), which will include "QS" if part of the program.
2. Products not included in the Design2Ship program must be entered on a separate purchase order. *
3. Please be aware of the maximum order quantity listed on the product specification sheet. **
4. Please indicate any shipping notes or site restrictions.
5. Order Requirements
 - a. Complete ship-to address
 - b. Contact information
 - c. Complete Quick Ship catalog number
 - d. Pricing and commission rate

* Orders that include products not in the Design2Ship program will default to the longest lead time.

** If an order exceeds the product specification sheet quantity, then the following shall apply: If less than or equal to two times the maximum Design2Ship quantity, the order will be split into two delivery dates. The first shipment will go in 5 days, followed by the second in 10 days. If the order is more than two times the maximum Design2Ship quantity, then the order will not qualify as a Design2Ship order.

MAXIMUM OF 25 QUANTITY UNITS ALLOWED PER ORDER

SHIPPING

Shipping lead time is 5 business days from date of clean release. All orders received after 3:30 p.m. EST will be processed the next business day and will receive an estimated ship date (ESD) from that date.

CHANGES/CANCELLATIONS

- Changes to the order are not permitted.
- Cancellation after release will result in a minimum 50% restocking fee.

NOTES

- Specifications subject to change without notice.
- Actual performance may differ as a result of end-user environment and application.

STEP11

RECTANGLE

Type:

Project:

Qty:

WIRING & DIMMING

POWER SUPPLY / DIMMING

Dimming drivers require a 0-10V fluorescent-type dimming control.

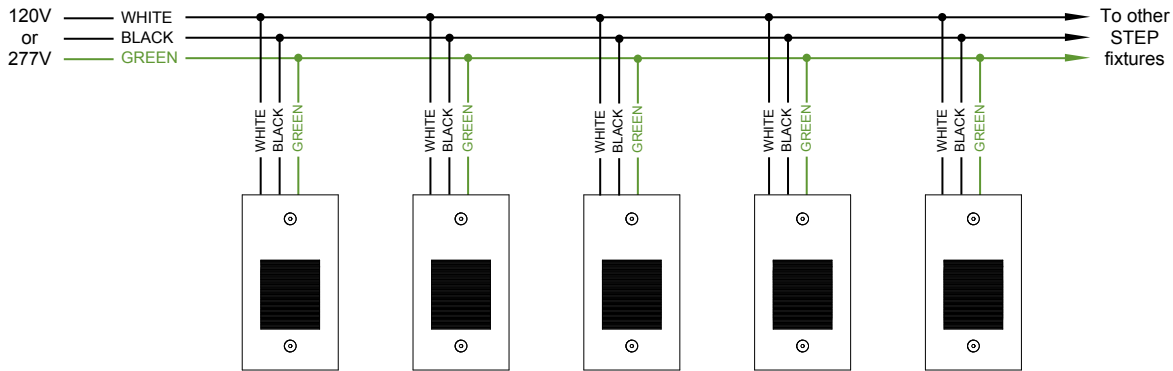
Read all instructions before installation. Do not make live connections!

NON-DIMMING INSTALLATIONS

Connect STEP WHITE wire to power NEUTRAL.

Connect STEP BLACK wire to power HOT.

Connect STEP GREEN wire to power GROUND.



DIMMING INSTALLATIONS

The integral dimming driver is designed to the 0-10V IEC dimming specification 60929 and is compatible with common 0-10V dimmers and dimming systems.

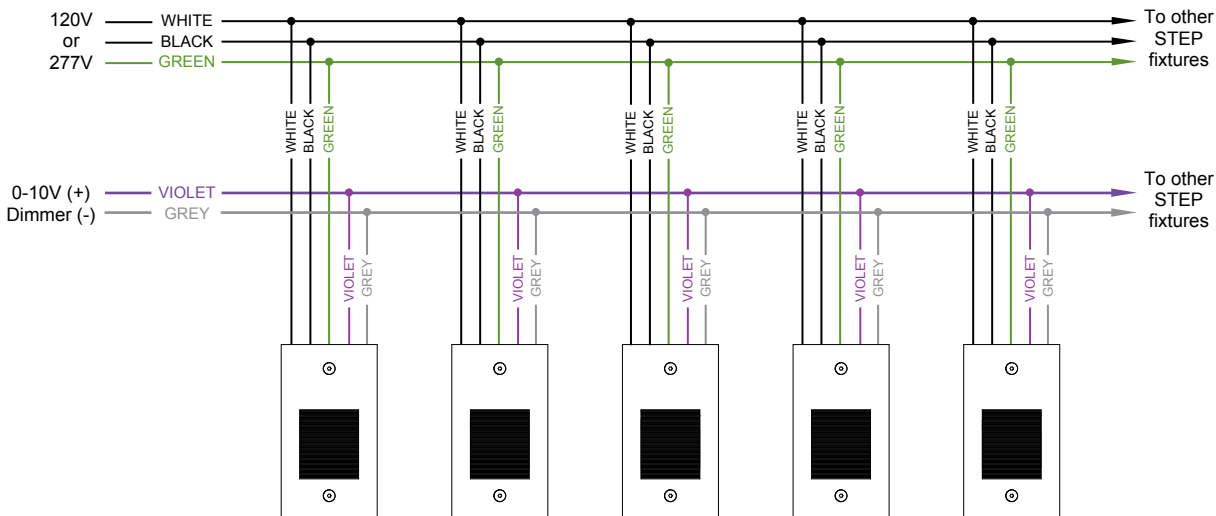
Do NOT connect line voltage to dimming input wires.

Connect STEP WHITE wire to power NEUTRAL.

Connect STEP BLACK wire to power HOT.

Connect STEP VIOLET wire to POSITIVE INPUT of Dimming Control.

Connect STEP GREY wire to NEGATIVE INPUT of Dimming Control.



STEP11

RECTANGLE

Type:

Project:

Qty:

LIGHTING FACTS

LED lighting facts[®]
A Program of the U.S. DOE

Light Output (Lumens)	76
Watts	3.49
Lumens per Watt (Efficacy)	21

Color Accuracy Color Rendering Index (CRI)	86
---	----

Light Color
Correlated Color Temperature (CCT) **3202 (Bright White)**

2700K 3000K 4500K 6500K

Warranty** **Yes**

All results, except LED Lumen Maintenance, are according to IESNA LM-79-2008: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting. The U.S. Department of Energy (DOE) verifies product test data and results.

** See www.lightingfacts.com/products for details.

Registration Number: NJSM-8YSLRJ (9/20/2012)
Model Number: LED-STEP11-RECT-L-30KHO-ND120V
Type: Other

LED lighting facts[®]
A Program of the U.S. DOE

Light Output (Lumens)	60
Watts	3.47
Lumens per Watt (Efficacy)	17

Color Accuracy Color Rendering Index (CRI)	86
---	----

Light Color
Correlated Color Temperature (CCT) **3213 (Bright White)**

2700K 3000K 4500K 6500K

Warranty** **Yes**

All results, except LED Lumen Maintenance, are according to IESNA LM-79-2008: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting. The U.S. Department of Energy (DOE) verifies product test data and results.

** See www.lightingfacts.com/products for details.

Registration Number: NJSM-4XL28G (9/20/2012)
Model Number: LED-STEP11-RECT-M-30KHO-ND120V
Type: Other

LED lighting facts[®]
A Program of the U.S. DOE

Light Output (Lumens)	50
Watts	3.54
Lumens per Watt (Efficacy)	14

Color Accuracy Color Rendering Index (CRI)	86
---	----

Light Color
Correlated Color Temperature (CCT) **3217 (Bright White)**

2700K 3000K 4500K 6500K

Warranty** **Yes**

All results, except LED Lumen Maintenance, are according to IESNA LM-79-2008: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting. The U.S. Department of Energy (DOE) verifies product test data and results.

** See www.lightingfacts.com/products for details.

Registration Number: NJSM-3AMJT2 (9/20/2012)
Model Number: LED-STEP11-RECT-S-30KHO-ND120V
Type: Other

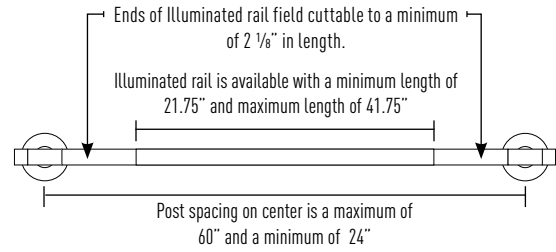
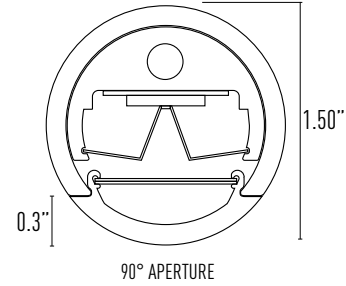
IVR15-SPI

1.5" Solid State Illuminated Rail

2" Post Integral Power Supply



JOB NAME		CATALOG NUMBER	
NOTES		TYPE	



PHOTOMETRIC DATA

- LED: 4.6W High Output
- CCT: 3500K
- Illuminated Rail Length: 41"
- Rail Height: 36"
- Post Spacing: 48"

3'	.11	.11	.11	.11	.11
2'	.22	.22	.22	.22	.22
1'	.30	.31	.32	.31	.30
1'	.30	.31	.32	.31	.30
2'	.22	.22	.22	.22	.22
3'	.11	.11	.11	.11	.11

60° Flood

3'	.5	.5	.5	.5	.5
2'	.17	.17	.18	.17	.17
1'	.53	.54	.55	.54	.53
1'	.53	.54	.55	.54	.53
2'	.17	.17	.18	.17	.17
3'	.5	.5	.5	.5	.5

35° Narrow

3'	.4	.4	.4	.4	.4
2'	.9	.9	.9	.9	.9
1'	.20	.20	.20	.20	.20
1'	.33	.33	.34	.33	.33
2'	.23	.23	.23	.23	.23
3'	.10	.10	.10	.10	.10

30° Asymmetrical

CONSTRUCTION

Internal Rail Construction: Heavy duty extruded 6061-T6 Aluminum Alloy.

External Rail Jacket: Available in 304 or 316 stainless steel. Consult factory for custom powder coat finishes (AAMA 2604).

LED LIGHT SOURCE

Closely packed array of small LEDs allow for smooth seamless illumination with immediate overlap to avoid pixilation and provide a continuous flow of light. Color temperatures options include 2700K, 3000K, 3500K or 4000K.

- 85 CRI
- 50,000 hours of average rated life at 70% output
- LED components are easily accessible to allow for easy maintenance
- Maximum run length per driver: 8'

LED LIGHT ENGINE (PER FOOT)

- System Power Consumption: 4.6W
- Cool White 4000K: 219 lm
- Neutral White 3500K: 207 lm
- Warm White 3000K: 202 lm
- Warm White 2700K: 194 lm

OPTICAL SYSTEM

Innovative optical system includes integral reflector and light shaping diffuser. 92% Transmission efficiency provides precise shaping, control and distribution of light. High-impact acrylic lens is secured with (2) countersunk flush screws, (1) at each end. Distributions include flood, narrow and asymmetric.

MOUNTING / INSTALLATION

Each rail support is secured to the swivel mount on specified mounting system. Post or embedded mount is available. See mounting submittal sheets for detailed information.

EMERGENCY

Remote emergency inverter available. Can be remote up to 1000 ft. available. See IB-IIS specification sheet.

WARRANTY / LISTINGS

- 5-Year Intense LED Limited Warranty (LED & Power Supply Only)
- ETL Wet Location Listed
- IDA Approved
- ADA Compliant

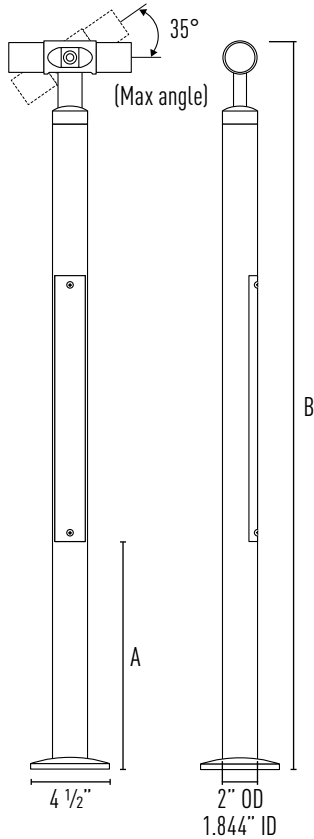
AWARD

- 2013 Next Generation Luminaires - "Recognized Winner"

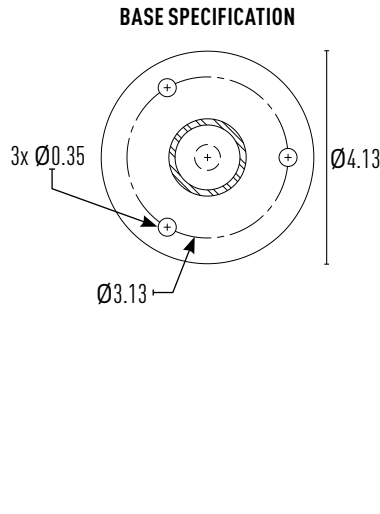
IVR15-SPI

2" Post Mount Assembly

JOB NAME		CATALOG NUMBER	
NOTES		TYPE	



	Guardrail	Handrail
A	17"	14"
B	42"	36"



CONSTRUCTION

Post mount assembly is available in No. 4 polished 304 stainless steel. Consult factory for custom powder coat finishes (AAMA 2604).

MAINTENANCE

Posts include a driver access door where power supply components are easily accessible. Tamper proof hardware and special tools are standard and included.

POWER SUPPLY

Lutron Hi-Lume® A-Series Driver is a high-performance LED driver that provides smooth, continuous 1% dimming. See driver specifications.

- Dimming Range: 100% to 1%
- Operating Voltage: 120-277V @ 50/60Hz
- Rated lifetime of 50,000 hrs. @ $t_c = 65^\circ\text{C}$
- Power Factor: > 0.9 at 40W
- Standby Power Consumption: < 1.0W
- Total Harmonic Distortion: < 20% at 40W
- Inrush Current: < 2A

MOUNTING / INSTALLATION

Post are to be spaced at a maximum of 60" and minimum of 24" on centers. Post mount is to be surface mounted to concrete utilizing 3/8" anchor bolts (supplied by others). Anchoring means must be determined by local codes. Not to be supplied or engineered by Intense Lighting. See post mount installation chart for more information. Anchorage template available by request.

OPERATION

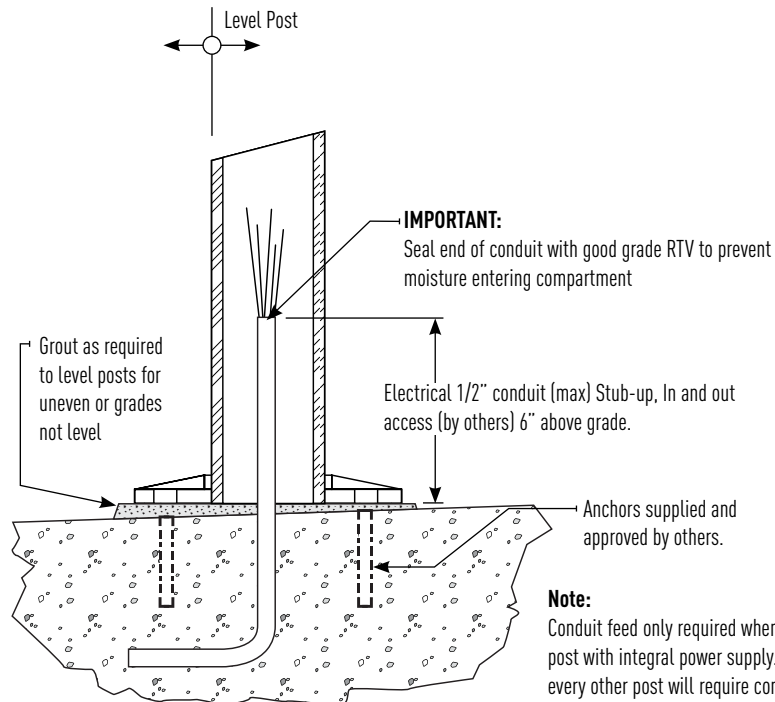
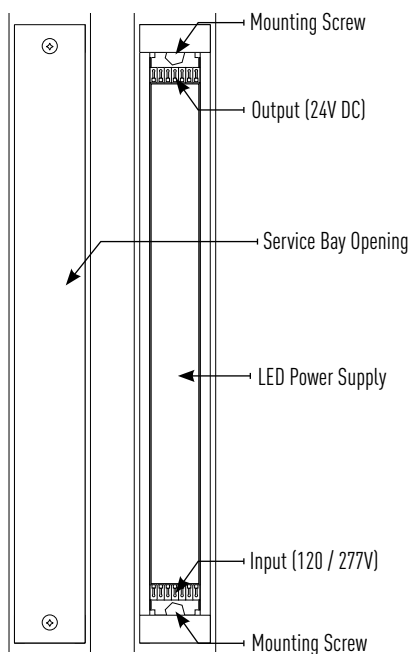
Post with integral power supply will power up to 83 1/2" of illuminated rail.

FITTINGS

Consult factory for standard fittings and epoxy weld adhesive specification.

Post Specification

Post Mount Installation Detail



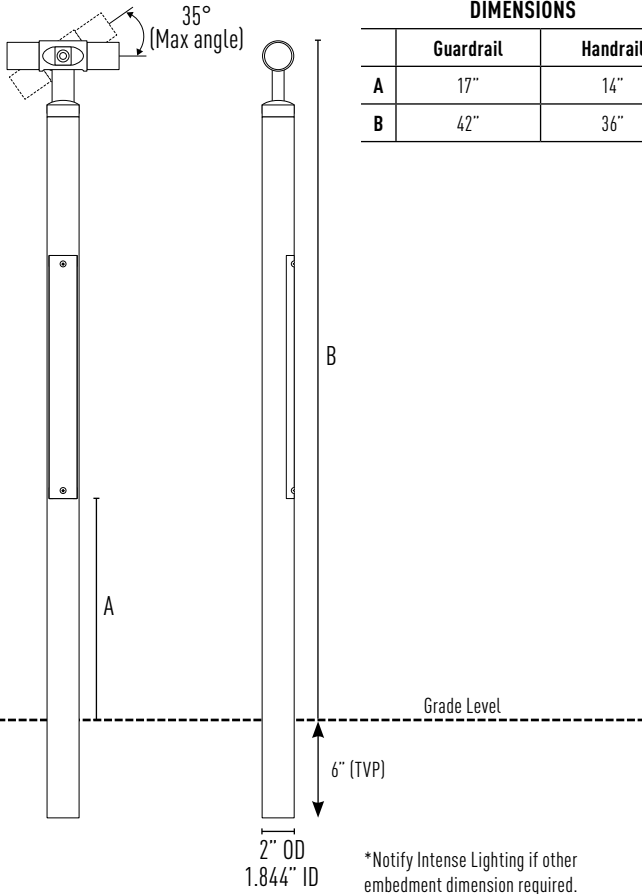
Note:

Conduit feed only required when installing post with integral power supply. Typically every other post will require conduit feed.

IVR15-SPI

2" Post Embedded Assembly

JOB NAME		CATALOG NUMBER	
NOTES		TYPE	



	Guardrail	Handrail
A	17"	14"
B	42"	36"

CONSTRUCTION

Post mount assembly is available in No.4 polished 304 stainless steel. Consult factory for custom powder coat finishes (AAMA 2604).

MAINTENANCE

Posts include a driver access door where power supply components are easily accessible. Tamper proof hardware and special tools are standard and included.

POWER SUPPLY

Lutron Hi-Lume® A-Series Driver is a high-performance LED driver that provides smooth, continuous 1% dimming. See driver specifications.

- Dimming Range: 100% to 1%
- Operating Voltage: 120-277V @ 50/60Hz
- Rated lifetime of 50,000 hrs. @ $t_c = 65^\circ\text{C}$
- Power Factor: > 0.9 at 40W
- Standby Power Consumption: < 1.0W
- Total Harmonic Distortion: < 20% at 40W
- Inrush Current: < 2A

MOUNTING / INSTALLATION

Post are to be spaced at a maximum of 60" and minimum of 24" on centers. Embedded mount post are set into place using Rockite® or Kwixset® anchor cement. A minimum of 6" post must be embedded into concrete to structurally secure post. Anchoring means must be determined by local codes. Not to be supplied or engineered by Intense Lighting. See Embedded Mount Installation chart for more information.

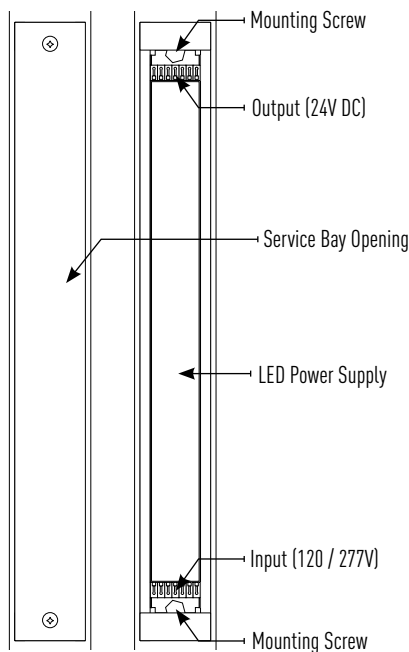
OPERATION

Post with integral power supply will power up-to 83 1/2" of illuminated rail.

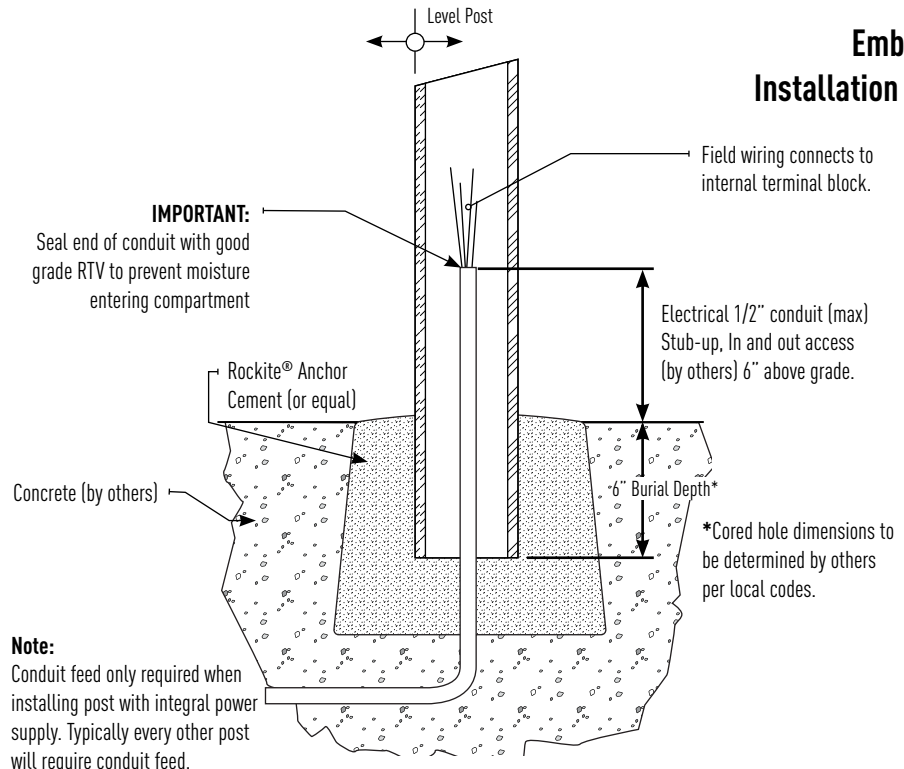
FITTINGS

Consult factory for standard fittings and epoxy weld adhesive specification.

Post Specification



Embedded Installation Detail



Lutron Hi-lume® A-Series Driver

JOB NAME		CATALOG NUMBER	
NOTES		TYPE	



Width: 1.18" Height: 1.00" Length: 14.25"

Maximum Driver-to-LED Light Engine Wire Length	
Wire Gauge	Maximum Lead Length
18	15 ft (4.5 m)
16	25 ft (7.5 m)
14	40 ft (12 m)
12	60 ft (18 m)

DESCRIPTION

Hi-lume® A-Series Driver is a high-performance LED driver that provides smooth, continuous 1% dimming.

FEATURES

- Continuous, flicker free dimming from 100% to 1%
- Compactible with Energi Savr Node™ with EcoSystem® unit, QS control unit, PowPak® dimming allowing for integration into a planned or existing EcoSystem® lighting control solution.
- Standard 3-wire line-voltage phase-control technology for consistent dimming performance and compatibility with all Lutron® 3-wire fluorescent controls.
- Rated lifetime of 50,000 hours @ $t_c = 65^\circ\text{C}$
- UL recognized for United States and Canada
- RoHS Compliant
- Constant Voltage Driver with Pulse Width Modulation (PWM) dimming

PERFORMANCE

- Dimming Range: 100% to 1%
- Operating Voltage: 120-277V ~ at 50/60Hz
- Rated lifetime of 50,000 hours @ $t_c = 65^\circ\text{C}$
- Patented thermal foldback protection
- LEDs turn on to any dimmed level without going to full brightness
- Nonvolatile memory restores all driver settings after power failure
- Power Factor: > 0.9 at 40W
- Standby Power Consumption: < 1.0W
- Total Harmonic Distortion (THD): < 20% at 40W
- Inrush Current: < 2A
- Inrush Current Limiting Circuitry: eliminates circuit breaker tripping, switch arcing and relay failure
- Open circuit protected
- Short circuit protected
- Turn-on time: ≤ 1 second
- PWM Dimming Frequency: 550Hz

ENVIRONMENTAL

- Sound Rating: Class A
- Relative Humidity: Maximum 90% non-condensing
- Minimum operating ambient temperature $t_a = 32^\circ\text{F}$ (0°C)

STANDARDS

- Meets ANSI C62.41 category A surge protection standards up to and including 4 kV
- FCC Part 15 compliant for commercial applications at 120V ~ or 277V ~
- UL 8750 recognized

DRIVER WIRING AND MOUNTING

- Terminal blocks on the driver accept one solid wire per terminal from 18 to 16 AWG (0.75 to 1.5 mm²)
- Fixture must be grounded in accordance with local and national electrical codes

LISTINGS

- UL Recognized for United States and Canada
- RoHS Compliant
- FCC Compliant

IVR15-SPI

1.5" Solid State Illuminated Rail Specification Guide

JOB NAME		CATALOG NUMBER	
NOTES		TYPE	

V-Rail Part Number (Example: IVR15-SPI-ST-P36-H027-60S)
(Specify Quantity By Foot)

A: Family	B: Finish	C: Mounting/Height	D: LED Output	E: CCT	F: Light Distribution	G: Electrical	H: Options
IVR15-SPI	-ST (304 Stainless Steel) ¹ -C (Custom) ²	-P36 (36" Post Mount) -P42 (42" Post Mount) -E36 (36" Embedded Mount) -E42 (42" Embedded Mount)	-HO (High Output 4.6W)	27 (2700K) 30 (3000K) 35 (3500K) 40 (4000K)	-60S (60° Flood) -35S (35° Narrow) -30AS (30° Asymmetric)	blank (24V Input)	-I (Infill) ²

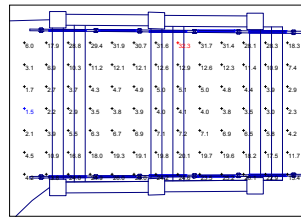
Notes:

1. 316 Stainless steel available by special order
2. Special order, consult factory
3. No LED (rail only), see IVR15-RPS

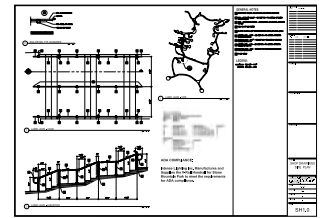
Specification and Delivery Process

Architectural drawings or detailed elevation drawings are required for a V-Rail quotation. A photometric layout will be provided if requested. Once an order is placed, Intense Lighting will provide detailed shop drawings for approval.

V-Rail will be delivered to the job site ready for installation. A detailed assembly drawing will be provided along with dimensions and locations for remote power supplies. All products included will be labeled clearly to match the assembly drawing. Certain tools and equipment will be required for the assembly of V-Rail. A detailed list of tools can be found in the V-Rail Installation Guide. Installation guide available upon request, consult factory.



Photometric Layout

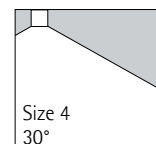
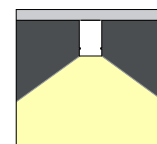
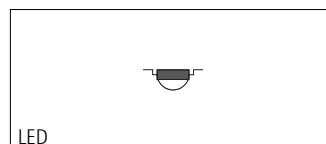
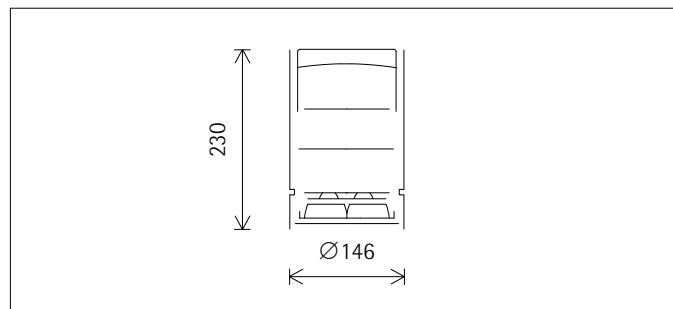


Shop Drawing / Assembly Guide



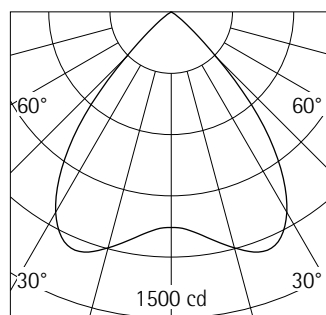
Completed Project

Notes:



84528.000 Graphit m
LED 16W 2200lm 4000K neutral white
Phase dimmable
Version 5
Lens system, extra wide flood

Product description
Cylinder and ceiling fixture: corrosion-resistant cast aluminium, No-Rinse surface treatment. Double powder-coated. Tamper-proof screw. Control gear, dimmable. 2 cable entries. Through-wiring possible. 3 terminals. LED module: high-power LEDs on metal-core PCB. Lens system made of optical polymer. Anti-glare ring with cross-baffle: polymer, aluminium vaporised, silver, ribbed. Optical cut-off 30°. Non-reflective safety glass. Dimming with external dimmers possible (trailing edge). Protection mode IP65: dust-proof and water jet-proof. Weight 3.50kg. Version with 3000K CRI 95 or 2700K, 3500K, 4000K CRI 92 available on request.



h(m)	E(lx)	D(m)
1	1056	1.71
2	264	3.42
3	117	5.12
4	66	6.83
5	42	8.54

Technical data

Luminous flux of the luminaire	1903lm
Connected load	19.0W
Luminaire efficacy	100lm/W
Colour deviation	1.5 SDCM
Colour rendition index	CRI 82
Lumen maintenance (LED manufacturer specifications)	L90/B10 ≤50000h L90 ≤100000h
LED failure rate	0.1% ≤50000h
Dimming range	10%-100%
Dimming method	CCR
LMF	E
Energy efficiency class	EEI A++
Standby power per control gear	--
Luminaires per circuit breaker B16	65

For your regional contact in the ERCO
Sales network click here
www.erco.com/contact

Technical Region: 220V-240V/50Hz
We reserve the right to make technical and design changes.
Edition: 24.11.2018
Current version under
www.erco.com/84528.000

Planning data

Cleaning (a)	1				2				3			
	P	C	N	D	P	C	N	D	P	C	N	D
LMF	0.96	0.94	0.90	0.86	0.93	0.91	0.86	0.81	0.92	0.90	0.84	0.79
RSMF	0.97	0.95	0.91	0.86	0.97	0.94	0.90	0.86	0.97	0.94	0.90	0.86

Hours of operation (h)	1000	5000	10000	20000	30000	40000	50000
LLMF	1.00	0.99	0.98	0.96	0.94	0.92	0.90
LSF	1	1	1	1	1	1	1

MF	LMFxRSMFxLLMFxLSF
MF	Maintenance Factor
LMF	Luminaire Maintenance Factor
RSMF	Room Surface Maintenance Factor
LLMF	Lamp Lumens Maintenance Factor
LSF	Lamp Survival Factor
P	Room pure
C	Room clean
N	Room normal
D	Room dirty

Technical data in accordance with international norms and standards

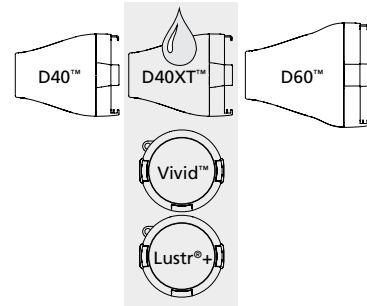
IEC 60598	Luminaires – Part 1+2: general requirements, specific requirements and tests
IEC 62031	LED modules for general lighting – safety requirements
IEC 62471	Photobiological safety of lamps and lamp systems
EN 13032-4	Light and lighting – measurement and representation of photometric data
CIE 13	Method of measuring and specifying colour rendering properties of light sources

All technical data is subject to industrially standard tolerances.
Also see www.erco.com/erco-led



100V 115/120V 230/240V

Desire™ Series



This datasheet covers D40XT fixtures as shown. See other datasheets for other versions.

GENERAL INFORMATION

ETC's Desire Series D40XT puts the seven-color x7 system into a round theatrical wash light fully sealed and rated for IP66 outdoor use. The Selador® x7 Color System™ produces the widest range of spectrally-balanced saturated and tinted color choices available. The D40XT offers a rugged die-cast enclosure, noiseless fan-free operation, multiple lens options and advanced user interface. Its watertight construction makes it ideal for outdoor events and installations.

D40XT LED ARRAY OPTIONS

D40XT fixtures are based on the x7 Color System that uses seven different LED colors to achieve true, usable broad-spectrum color. The D40XT luminaire is available with any one of the following x7 color arrays to best suit the intended application.

- D40XT Vivid™ – the x7 Color System array balanced for best all-around use as a color-changing wash fixture
- D40XT Lustr+™ – optimized with six colors plus high-intensity white LEDs to create an ideal front light wash fixture. Full range color, with an emphasis on lighter colors and white.

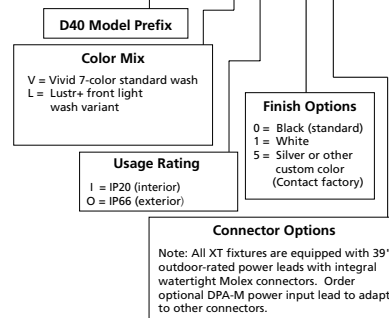
ORDERING INFORMATION

Selador D40XT

MODEL	DESCRIPTION
SELD40VO	D40 Vivid wash fixture – for high-intensity color mixing across the spectrum for widest color wash use
SELD40LO	D40 Lustr+ front light wash fixture – optimized for skin tones and light tints for use as a theatrical front light

Note: D40XT luminaires ship with hanging yoke and attached leads equipped with watertight Molex power connectors and watertight DMX connectors. C-clamp, lenses or separate power lead are not included. Order DPA-M Bare-nd to Molex adaptors separately for XT luminaires if required.

SELD40 VO – 0X



SPECIFICATIONS

GENERAL

- 40 X 2.5W LED variable color-mixing light wash fixture
- ETL listed to UL1573 – the standard for stage and studio lighting units
- IP66-rated for exterior wet location use
- Power and DMX in/thru connections for easy setup
- User-friendly control interface with multiple modes and fixture settings

PHYSICAL

- Rugged die-cast all-metal housing
- Easy access slots for secondary lenses and standard 7.5" PAR accessories
- Available in black (standard), white or silver (optional) or custom colors (contact factory)
- Hanging yoke standard. Optional yoke/floor stand available
- Effective Projected Area (EPA): 0.74

ELECTRICAL

- 100VAC to 240VAC 50/60 Hz universal power input
- Waterproof, 39" power in and thru outdoor rated power leads
- Up to nine fixtures (15A max) may be linked via power thru connector (ten fixtures total per circuit) when used with R20 Relay Module or Unison Echo Relay Panel. Consult breaker trip curves when used with other equipment
- Requires power from a non-dim source
- Inrush-
 - 120V: 15A (First half-cycle)
 - 240V: 40A (First half-cycle)

LED*

- 50,000 hour LED life (50,000 hours to 70% intensity)
- 40 Luxeon® Rebel 2.5W LED emitters

*See additional LED notes on page three

COLOR

- Exclusive x7 *Color System™* seven-color LED array
- Broad spectrum color interacts seamlessly with conventional sources
- Beautifully illuminates skin tones and other objects for natural appearance and high color rendering
- Exclusive red-shift option emulates tungsten dimming performance
- Variable color temperature from 2700K-6500K

OPTICAL

- Primary field angle of 17° and beam angle of 8°
- Secondary lenses available for multiple beam spread options
- Sealed, factory-installed lenses available for permanent installations (special order)
- Lenses must be ordered separately
- Refer to accessories chart for lenses available

CONTROL

- DMX512 in and thru via watertight five-pin XLR connectors on 39" leads
- Multiple control options including RGB, strobe, and console-free Master/Slave mode
- See DMX Control Table for additional information
- 15-bit virtual dimming engine provides smooth, high quality theatrical fades and minimizes color shift during dimming
- RDM functionality for address and setting changes

SPECIFICATIONS

THERMAL

- Ambient operating temperature of -4° to 104°F (-20° to 40°C)
- Active electronic thermal management for droop-free operation
- Noiseless, fan-free convection cooling for acoustically sensitive installations
- Fixture is designed for continuous operation up to 104°F (40°C) ambient temperature and requires free flow of air around fixture housing

ADDITIONAL ORDERING INFORMATION

Power Input Cables

Use information below to order 5' power input leads with factory fitted connectors. Desire D40XT and D40XT Studio™ luminaires ship with 39" outdoor-rated power leads and integral watertight Molex connectors. Order optional DPA-M power cable to adapt to other input connectors

MODEL	DESCRIPTION
DPAM-5*	XT Outdoor UL Power Lead – 1M Molex Female to bare end
DPAM-25*	XT Outdoor UL Power Lead-Long – 25' Molex Female to bare end

*Not included with fixture

Power Pass Thru

DPJM-5	XT Outdoor UL 5' Molex to Molex Extension
DPJM-10	XT Outdoor UL 10' Molex to Molex Extension

Fixtures Accessories

MODEL	DESCRIPTION
SELD40FSY	Yoke with floor stand attachment
400BD*	Barn door (Use only as a flexible top hat to diminish aperture glare. Not for beam shaping)
407CF*	Color Frame (use for round and oblong lenses)
400L*	Egg Crate Louver
400PTH3*	Top Hat 3" Tube
400PTH6*	Top Hat 6" Tube
400PHH*	Half Hat 6" Tube
400CC	C-Clamp (does not ship with fixture)
400SC	Safety Cable (32")

*Note: Accessories are not intended for permanent installations

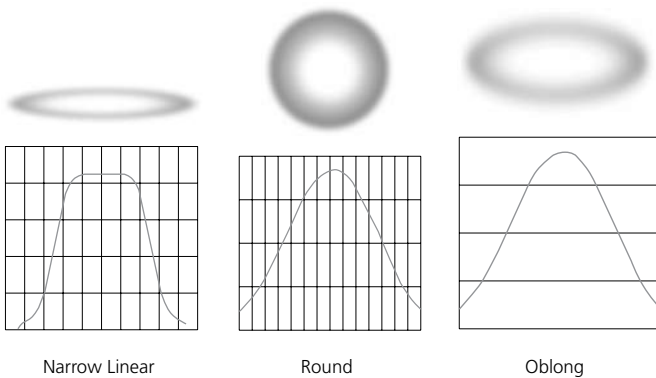
ADDITIONAL ORDERING INFORMATION

Secondary Lens Options

MODEL	DESCRIPTION: The following lenses are cut for D40™ fixtures and create round, linear or oblong field patterns as described below. These lenses are not for use in Selador® Classic (Vivid™, Lustr®, Paletta™, etc.) fixtures.	
Narrow Linear Field	Note: This is the same material as Selador Classic lenses	
SELLVN-7.5	7.5" Very Narrow lens	Linear lenses may be combined to create desired field size
SELLN-7.5	7.5" Narrow lens	
SELLM-7.5	7.5" Medium lens	
SELLW-7.5	7.5" Wide lens	
SELLEW-7.5	7.5" Extra Wide lens	
Round Field	Any one of the following round lenses may be installed permanently in the fixture at the factory as a special order	
SELRVN-7.5	7.5" Very Narrow lens (round field)	
SELRN-7.5	7.5" Narrow lens (round field)	
SELRM-7.5	7.5" Medium lens (round field)	
SELRW-7.5	7.5" Wide lens (round field)	
Oblong Field		
SELON-7.5	7.5" Narrow lens (oblong field)	
SELOM-7.5	7.5" Medium lens (oblong field)	
SELOW-7.5	7.5" Wide lens (oblong field)	

http://www.etconnect.com/docs/docs_downloads/miscdocs/Desire vs PAR EA revB.pdf

Typical Lens Field Profiles



Power Consumption at Full Intensity

MODEL	VOLTAGE (V)	CURRENT (A)	WATTS
D40XT	120 / 240	1 / .5	110

NOTES ABOUT LED LUMINAIRES

All LED sources experience some lessening of light output and some color shift over time. LED output will vary with thermal conditions. Thermal conditions can be effected by ambient temperatures and orientation. See the D40 Ambient Temperature and Power Budgeting Guide for more details. Based on the LED manufacturer's B50 L70 specification, a Selador luminaire will achieve ~70% of its initial output after 50,000 hours of typical usage. In individual situations, LEDs will be used for different durations and at different levels. This can eventually lead to minor alterations in color performance, necessitating slight adjustment to presets, cues or programs.

CRI AND CQS RATINGS

Desire fixtures were evaluated for CRI and CQS performance using measured output spectrum and optimized mix solutions for a best spectral match to black body sources at 3200K and 5600K.

Fixture	CRI	CQS	Color Fidelity	Duv
D40 Vivid™ at 3200K	87	89	89	0.000
D40 Vivid at 5600K	90	92	92	0.000
D40 Lustr+™ at 3200K	86	88	88	0.000
D40 Lustr+ at 5600K	93	92	90	0.000
D40 Studio HD™ at 3200K	89	90	91	0.000
D40 Studio HD at 5600K	92	94	94	0.000
D40 Studio Daylight™ at 5600K	71	70	69	0.001
D40 Studio Tungsten™ at 3000K	86	86	86	0.001

All D40 luminaire versions provide excellent color rendering to the eye, particularly at higher color temperature settings such as 5600K. In most cases the Duv is 0.000. A Duv rating of 0.000 indicates that the color mix used is exactly on the black body line, with no green or magenta tint.

LENS INFORMATION

Desire diffusion angle measurements

NOMINAL									
	No Lens	Very Narrow	Narrow	Medium	Wide	Extra Wide	Narrow Oval	Medium Oval	Wide Oval
D40XT		25°	35°	45°	75°	N/A	20° x 40°	30° x 70°	35° x 80°
LUSTR+	22	26	32	54	77	97	29 x 43	33 x 63	33 x 97
VIVID	22	26	32	54	77	97	29 x 43	33 x 63	33 x 97
STUDIO HD	22	26	32	54	77	97	29 x 43	33 x 63	33 x 97
STUDIO D	31	33	38	60	81	97	36 x 48	33 x 63	35 x 97
STUDIO T	31	33	38	60	81	97	36 x 48	33 x 63	35 x 97

Values in black refer to old lens descriptions.

CONTROL OPTIONS

User settings on D40XT fixtures allow multiple operational modes and settings for either console operation via DMX protocol or stand-alone operation. The expanded LCD display provides easy navigation to all possible settings and choices. Some of the setting options are:

- Multiple DMX options ranging from a simple RGB profile – which effectively controls all seven LED colors via three channels – to nine-channel ‘direct’ color and intensity control
- Multiple dimming curve options
- Preset colors and sequences for stand-alone (no console required) operation
- White point selection – white light and color behavior based on a specific color temperature white light, i.e. 3200K, 5600K, etc
- Loss of data behavior options – instant off, hold last look for two minutes, etc.
- Output modes – Three output options that offer the user a choice between maximum output and maximum consistency

See the user manual for a complete explanation of all of the control settings and options for the D40XT.

Quick Setups

To assist in managing the numerous control and fixture behavior choices, five combinations of operational settings are available to quickly get started. These settings are specifically created for different applications and are easily accessible at the fixture display. Each setting can then be modified as required to take advantage of all of the possible control features.

Setting Title	Profile	Description	Typical Features*
General	Direct	Factory Default: For general purpose use including interior architectural applications	<ul style="list-style-type: none"> • Standard dimming curve • Regulated output for color consistency
Stage	HSI Plus 7 Enabled	Theatrical lighting: Duplicates the color and dimming behavior of tungsten stage lighting fixtures.	<ul style="list-style-type: none"> • Incandescent dimming curve • Regulated output for color consistency • 3250K white point setting
XT Arch	HSI	Exterior Architectural lighting: Provides a high degree of color consistency in high ambient temperature environments.	<ul style="list-style-type: none"> • Standard dimming curve • Protected output • 3200K white point setting
High Impact	RGB	Event lighting: Enables quickest response, simple RGB control and strobe channel for maximum effect usage	<ul style="list-style-type: none"> • Quick dimming curve • Boost mode for maximum intensity • 5600K white point setting
Studio	Studio	Video/film lighting: Enables three parameter control of white light (intensity, white point, and tint) via DMX from console or from fixture display – no console required	<ul style="list-style-type: none"> • Linear dimming curve • Regulated output mode for color consistency

*See user manual for complete list of features for each Quick Setup

CONTROL OPTIONS

DMX Input Channel Profiles

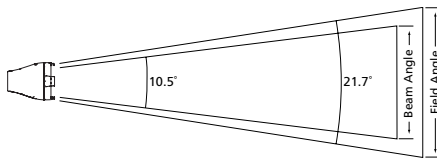
DMX Profile	DMX Channels	Channel Assignments	Notes
Direct	9	1 – Red 2 – Orange (white if Lustr+) 3 – Amber 4 – Green 5 – Cyan 6 – Blue 7 – Indigo 8 – Intensity 9 – Strobe	Direct control of each individual color with a separate master intensity channel. Color calibration of LEDs is not active in this mode. The nine-channel profile will produce the highest quality color cross-fades.
HSI	5	1 – Hue (coarse) 2 – Hue (fine) 3 – Saturation 4 – Intensity 5 – Strobe	High resolution hue (two-channels), saturation, and intensity control. HSI mode will produce color cross-fades around the color space.
HSIC	6	1 – Hue (coarse) 2 – Hue (fine) 3 – Saturation 4 – Intensity 5 – Strobe 6 – Color Point (CCT)	High-resolution hue, saturation and intensity control as above, with the addition of a color point channel to adjust the color temperature of the fixture in both white light and color. Color cross-fade performance is the same as EHSI.
RGB	5 (Ch. 4 not used)	1 – Red 2 – Green 3 – Blue 4 – n/a 5 – Strobe	Effectively addresses all seven colors via three channels of control. RGB profile will produce medium quality color cross-fades
Studio	3	1 – Intensity 2 – Color Point (CCT) 3 – Tint	Controls fixture as a white light unit. If no DMX, i.e. console input, is present, fixture can be adjusted for these three parameters on the UI at the back of the unit.
Additional profile options			
Plus 7		Seven additional color control channels are available in RGB, HSI, HSIC, and Studio profile settings. For example HSI with ‘Plus 7’ enabled becomes a 14-channel profile:	
		1 – Hue (coarse) 2 – Hue (fine) 3 – Saturation 4 – Intensity 5 – Strobe 6 – n/a 7 – Plus 7 Control on/off 8 – Red 9 – Orange (white if Lustr+) 10 – Amber 11 – Green 12 – Cyan 13 – Blue 14 – Indigo	<p>The desired color and intensity is achieved by using the HSI or RGB channels.</p> <p>Placing channel seven at a value over 51% gives the fixture a 14-channel profile.</p> <p>Channels 8-14 represent the native colors of the fixture and allow the operator to adjust individual color channels to fine tune the color output.</p>
Strobe		Variable strobe control: 0% is no strobe. The fixture output will strobe more rapidly as the strobe channel value approaches 100%.	

PHOTOMETRICS

D40XT Vivid™

Mode	Degree	Candela	Field Lumens	Beam Lumens	Lumens Per Watt
Boost Full	10.5°	57,265	2,252	845	23.6
Regulated Full	10.5°	47,449	1,866	700	22.7
Regulated 3200K	10.5°	32,749	1,288	438	24.1
Regulated 5600K	10.5°	33,876	1,332	500	22.2

Metric conversions: For meters, multiply feet by 0.3048
For lux, multiply footcandles by 10.76

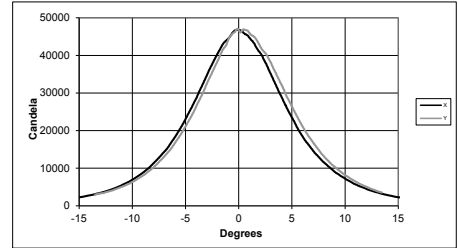


Throw Distance (d)	10.0ft	15.0ft	20.0ft	30.0ft	217.8ft
	3.0m	4.6m	6.1m	9.1m	66.4m
Field Diameter	3.8ft	5.7ft	7.7ft	11.5ft	-
	1.2m	1.8m	2.3m	3.5m	-
Illuminance (fc)	474	211	119	53	1
Illuminance (lux)	5,107	2,270	1,277	567	10.76

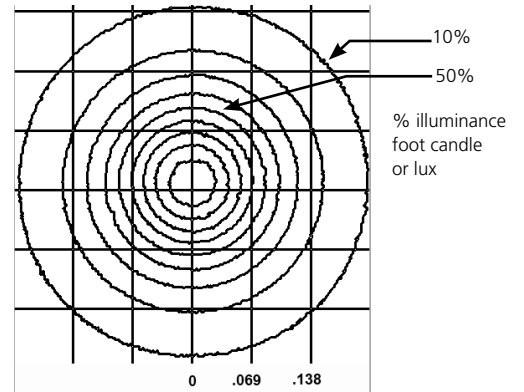
To determine center beam illumination in footcandles at any throw distance, divide candela by the throw distance squared

For field diameter at any distance, multiply distance by 0.383
For beam diameter at any distance, multiply by 0.184

Cosine Candela Plot



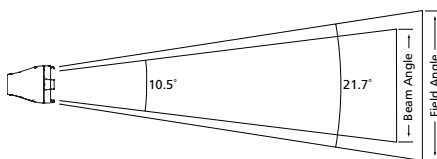
Iso-Illuminance Diagram (Flat Surface Distribution)



D40XT Lustr+™

Mode	Degree	Candela	Field Lumens	Beam Lumens	Lumens Per Watt
Boost Full	10.5°	71,324	2,593	1,042	25.2
Regulated Full	10.5°	64,071	2,329	936	25.0
Regulated 3200K	10.5°	46,299	1,683	676	29.4
Regulated 5600K	10.5°	40,173	1,460	587	26.8

Metric conversions: For meters, multiply feet by 0.3048
For lux, multiply footcandles by 10.76

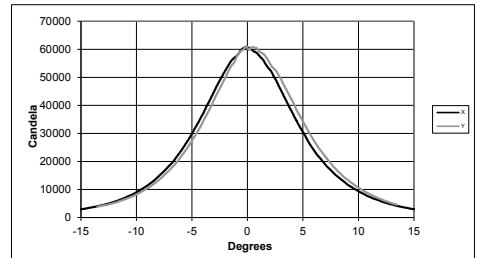


Throw Distance (d)	10ft	15.0ft	20.0ft	30.0ft	253.1ft
	3.0m	4.6m	6.1m	9.1m	77.2m
Field Diameter	3.8ft	5.7ft	7.7ft	11.5ft	-
	1.2m	1.8m	2.3m	3.5m	-
Illuminance (fc)	641	285	160	71	1
Illuminance (lux)	6,987	3,065	1,724	766	10.76

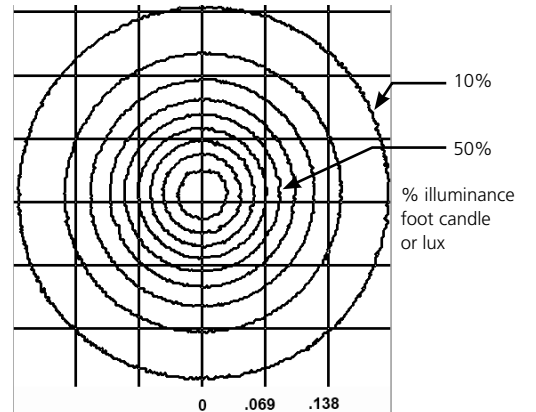
To determine center beam illumination in footcandles at any throw distance, divide candela by the throw distance squared

For field diameter at any distance, multiply distance by 0.383
For beam diameter at any distance, multiply by 0.184

Cosine Candela Plot



Iso-Illuminance Diagram (Flat Surface Distribution)

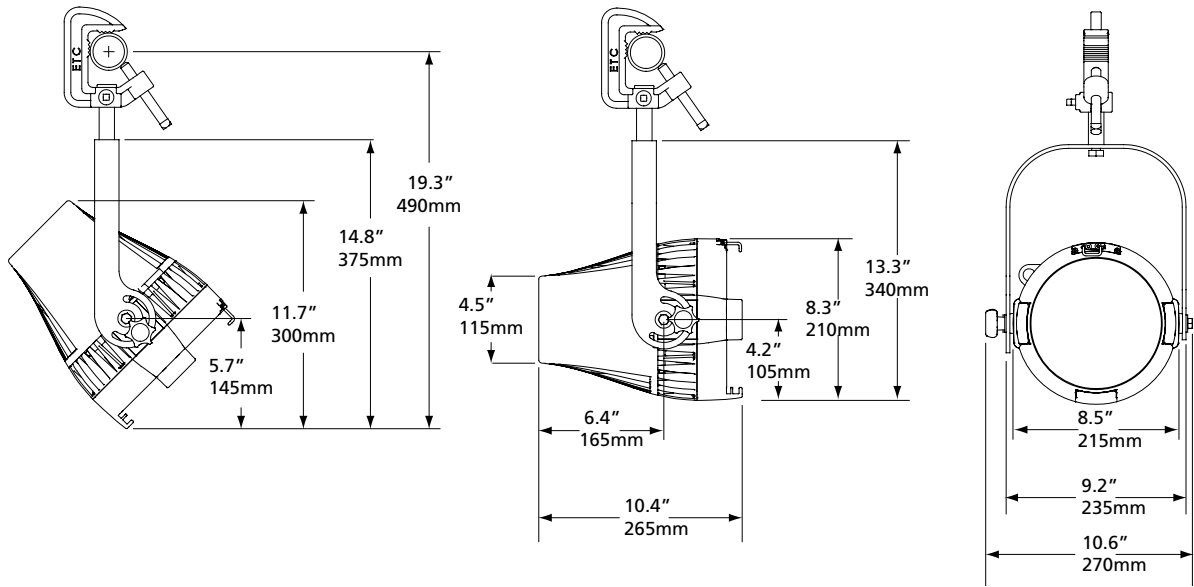


PHYSICAL

Selador D40XT Weights and Dimensions

WEIGHT*		SHIPPING WEIGHT	
lbs	kgs	lbs	kgs
14	6.4	17	7.8

* Does not include mounting hardware



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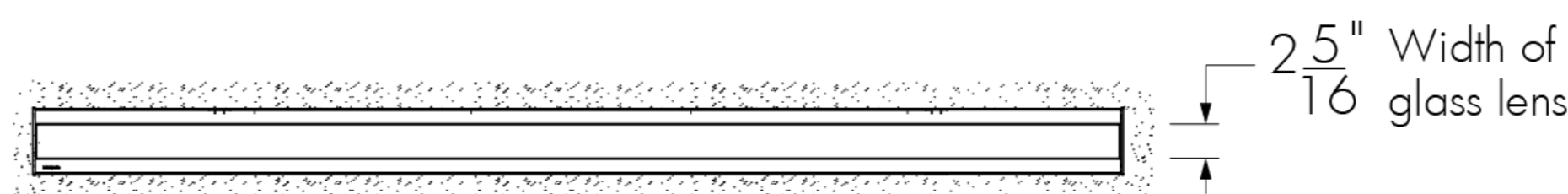
Holzkirchen, DE • Ohmstrasse 3, 83607 Holzkirchen, Germany • +49 (80 24) 47 00-0

Hong Kong • Room 1801, 18/F, Tower 1 Phase 1, Enterprise Square, 9 Sheung Yuet Road, Kowloon Bay, Kowloon, Hong Kong • +852 2799 1220

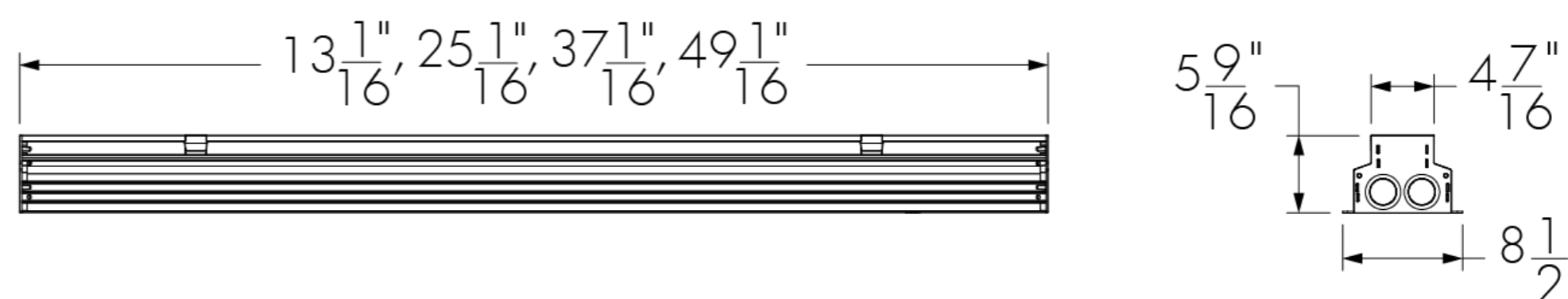
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Project Name Canton Cent Park Qty _____

Type Type L Catalog / Part Number LOI 120/277 48 RGBW 10x60 TS2.5 DMX/RDM



Top view



Front and side views

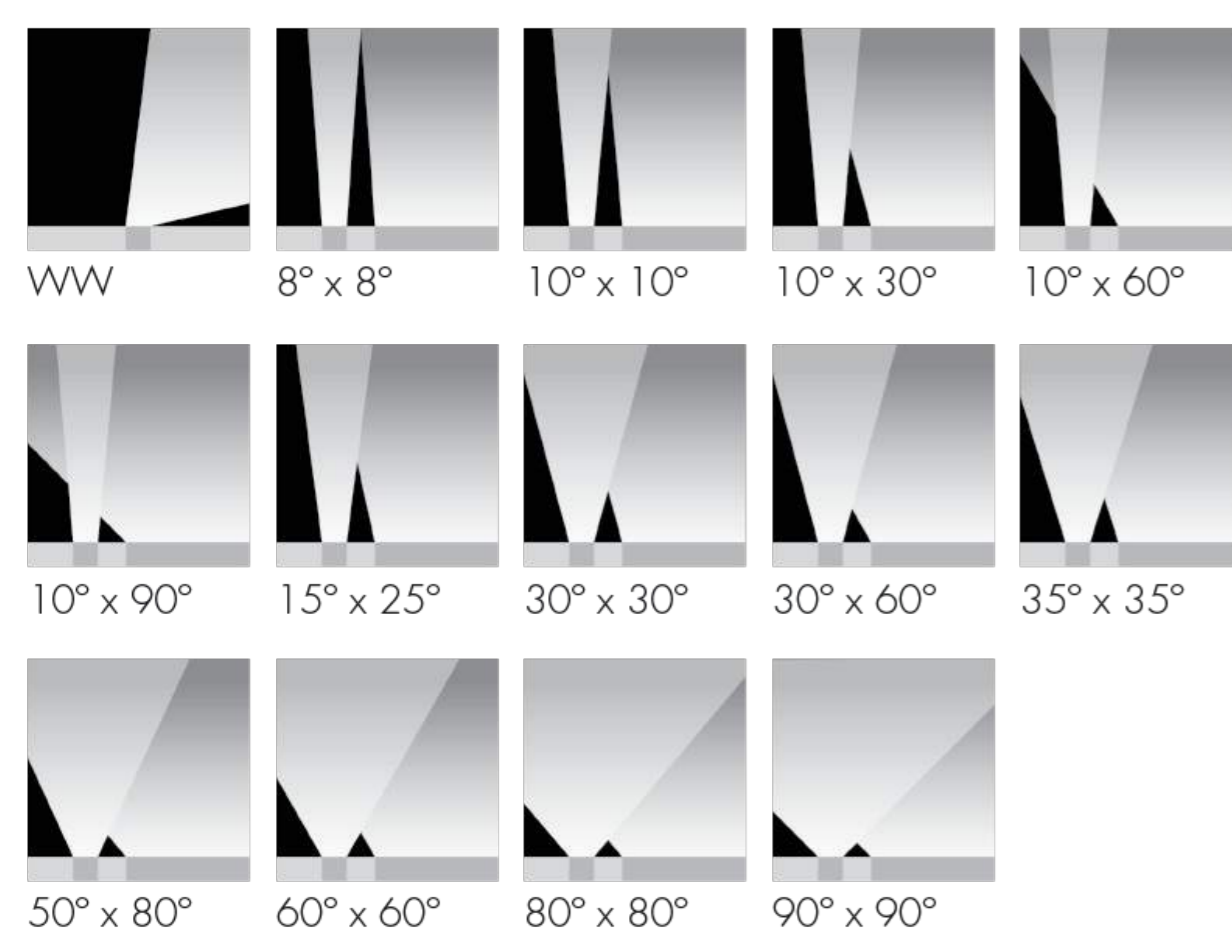
Photometric Summary

	Delivered output (lm)	Intensity (peak cd)
WW	1,600*	1,206*
8°x8°	2,121*	27,842*
10°x10°	1,837*	16,501*
10°x30°	2,155*	11,889*
10°x60°	1,724*	4,765*
10°x90°	1,964*	2,919*
30°x30°	2,202*	7,936*
30°x60°	1,896*	2,499*
60°x60°	1,807*	1,439*
90°x90°	1,913*	1,002*

Based on RGB full output, 4ft [1219mm], 0° tilt setting, DMX/RDM configuration.

*Estimated. Consult website for the latest photometric files.

Optics



Colors and Color Temperatures



Description

The Lumenfacade Inground Color Changing is a high-performance linear LED luminaire designed for colorful asymmetric wall washing, grazing and linear wayfinding. Featuring second generation LED technology, the Lumenfacade Inground Color Changing is available in four different sizes (12 in, 24 in, 36 in or 48 in), with a wide number of options, including a choice of optics; RGB, RGBW or RGBA color mixing; various mounting options, finishes, accessories and controls. A unique asymmetric wallwash distribution is also available, providing exceptional uniformity and brightness for walls and signage.

Features

Construction	Walk over compliant up to 500 kg in any type of ground, Walk over compliant up to 1000 kg in concrete
Color and Color Temperature	Additive RGB, Additive RGB + white 4000K, Additive RGB + amber
Length (nominal)	12 in, 24 in, 36 in, 48 in
Optics	Asymmetric Wallwash, 8° x 8°, 10° x 10°, 10° x 30°, 10° x 60°, 10° x 90°, 15° x 25°, 30° x 30°, 30° x 60°, 35° x 35°, 50° x 80°, 60° x 60°, 80° x 80°, 90° x 90°
Tilt Setting (factory set)	0 degrees, 2.5 degrees, 5 degrees, 20 degrees
Optical Option	Internal louver
Options	Anti-slip lens, CE (certification covers European Economic Area)
Power Consumption	17.25 W/ft, Typically 20% higher for 12 in fixture lengths
Warranty	5-year limited warranty

Controls

lumen **talk**™ 

Ratings

IP68 IK10

Certifications



Performance

Delivered Output	1,435 lm (48 in fixture, RGB full output, 10° x 60°, 2.5° tilt setting, DMX/RDM), 1,775 lm (48 in fixture, RGBW full output, 10° x 60°, 2.5° tilt setting, DMX/RDM), 800 lm (24 in fixture, RGBA full output, 10° x 60°, 0° tilt setting, DMX/RDM)
Delivered Intensity	4,525 cd at nadir (48 in fixture, RGB full output, 10° x 60°, 2.5° tilt setting, DMX/RDM), 4,477 cd at nadir (48 in fixture, RGBW full output, 10° x 60°, 2.5° tilt setting, DMX/RDM), 1,785 cd at nadir (24 in fixture, RGBA full output, 10° x 60°, 0° tilt setting, DMX/RDM)
Lumen Maintenance	L70 280,000 hrs, L95 35,000 hrs

Physical

Optical Chamber Material	Aluminum
Blockout Material	Polymer recycled PVC reinforced with a stainless steel frame
Trim Material	Anodized aluminum
Lens Material	Tempered glass
End Cap Material	Die cast aluminum
Hardware Material	Stainless steel
Weight	12 in: 7.5 lbs, 24 in: 15.3 lbs, 36 in: 21.4 lbs, 48 in: 27 lbs

Electrical and control

Voltage	120 to 277 volts
Fixture Cable	Power and data in one cable
Leader Cable Conductor	5C #16-5
Connectors	IP68 push-lock
Control	Lumentalk, DMX/RDM enabled
Resolution (DMX/RDM)	Per foot or per fixture (configured with LumenID V3 software), 8-bit or 16-bit, 3 channels (RGB) or 4 channels (RGBW, RGBA)
RGB Color Mixing	12 LEDs per 12 in (4x Red, 4x Green, 4x Blue)
RGBW Color Mixing	12 LEDs per 12 in (3x Red, 3x Green, 3x Blue, 3x White)
RGBA Color Mixing	12 LEDs per 12 in (3x Red, 3x Green, 3x Blue, 3x Amber)

Environmental

Storage Temperature	-40 °F to 185 °F (device must reach start-up temperature value before operating)
Start-up Temperature	-13 °F to 122 °F
Operating Temperature	-40 °F to 122 °F
Ingress Protection Rating	IP68 rated for up to 1 ft, not suitable for permanent immersion applications
Impact Resistance Rating	IK10

Accessories (order separately)

Cables	Lumenfacade Inground Leader Cable, Lumenfacade Inground Junction Cable
Electrical Accessories	Lumenfacade Inground Junction Box
Control Boxes	DMX/RDM enabled (daisy chain or star configuration), Ethernet enabled (daisy chain or star configuration)
Control Systems	Lumentone™ 2, Pharos® kit
Diagnostic and Addressing Tools	LumenID, LumentalkID

How to order

1	2	3	4	5	6	7	8
LOI	120/277	48	RGBW	10x60	TS2.5		DMX/RDM
9							

1 . Housing ⁽¹⁾ ⁽²⁾ ⁽³⁾

LOI Lumenfacade™ Inground

⁽¹⁾ A Lumenfacade Inground fixture includes one optical chamber (LOIC), one power and control box (PACBOX) and one recessed blockout (RBO). The LOIC, PACBOX and RBO are provided according to the output/color, length and control configuration.

⁽²⁾ Consult the installation instructions to plan all aspects of the fixture installation. A completed Certificate of Installation must be returned to Lumenpulse to activate the warranty.

⁽³⁾ Power consumption is typically 20% higher for 12 in fixture lengths.

2 . Voltage

120/277 120-277 volts

3 . Length

12	13 1/16 in (7.5 lbs) ⁽¹⁾
24	25 1/16 in (15.3 lbs)
36	37 1/16 in (21.4 lbs)
48	49 1/16 in (27 lbs)

⁽¹⁾ Power consumption is typically 20% higher for 12 in fixture lengths.

4 . Color and Color Temperature

RGB	Additive RGB
RGBW	Additive RGB + white 4000K standard. 2700K, 3000K and 3500K available, consult factory. ⁽¹⁾
RGBA	Additive RGB + amber

⁽¹⁾ Longer lead times apply for Royal Blue, 2700K, 3000K and 3500K white color temperature mixes.

5 . Optics

WW	Asymmetric Wallwash ⁽¹⁾
8x8	8° x 8° ⁽¹⁾ ⁽²⁾
10x10	10° x 10° ⁽¹⁾ ⁽²⁾
10x30	10° x 30° ⁽¹⁾
10x60	10° x 60° ⁽¹⁾
10x90	10° x 90° ⁽¹⁾
15x25	15° x 25° ⁽¹⁾
30x30	30° x 30°
30x60	30° x 60°
35x35	35° x 35°
50x80	50° x 80°
60x60	60° x 60°
80x80	80° x 80°
90x90	90° x 90°

⁽¹⁾ 8x8, 10x10, 10x30, 10x60, 10x90, 15x25 and WW distributions come with a half-frosted lens to bring light low on the wall for grazing applications. Clear lens also available, consult factory.

⁽²⁾ For best results, we recommend a 6 in setback from surface. Contact factory for application support.

6 . Tilt Setting ⁽¹⁾ ⁽²⁾

TS0	0 degrees
TS2.5	2.5 degrees
TS5	5 degrees
TS20	20 degrees

⁽¹⁾ Do not specify a tilt setting for the asymmetric wallwash option. The asymmetric wallwash optic is factory set with a 2.5 degree tilt.

⁽²⁾ Tilt setting is factory set and cannot be adjusted in the field.

7 . Optical Option

INTL Internal louver ⁽¹⁾

⁽¹⁾ The addition of an internal louver will affect beam distribution. Consult factory for application support.

8 . Control

LT	Lumentalk ⁽¹⁾
DMX/RDM	DMX/RDM enabled ⁽²⁾

⁽¹⁾ A Lumentranslator 2 and LumentalkID (LIDL) must be specified for Lumentalk applications. Consult Lumentranslator 2 and Lumentalk pages and specification sheets for details.

⁽²⁾ A control box (CBX) and LumenID (LID) must be specified.

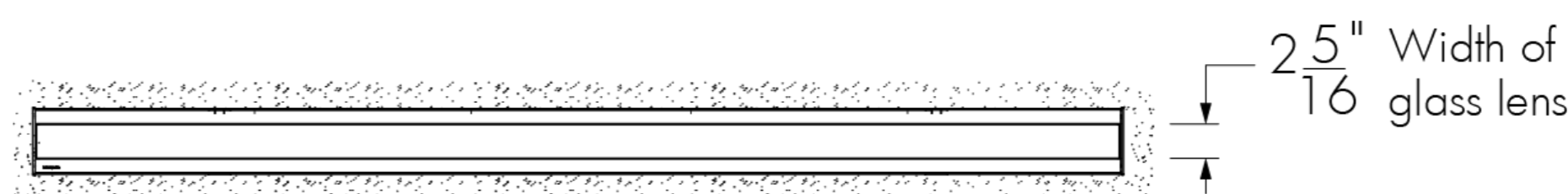
9 . Options

ASL	Anti-slip lens
CE	CE (certification covers European Economic Area) ⁽¹⁾

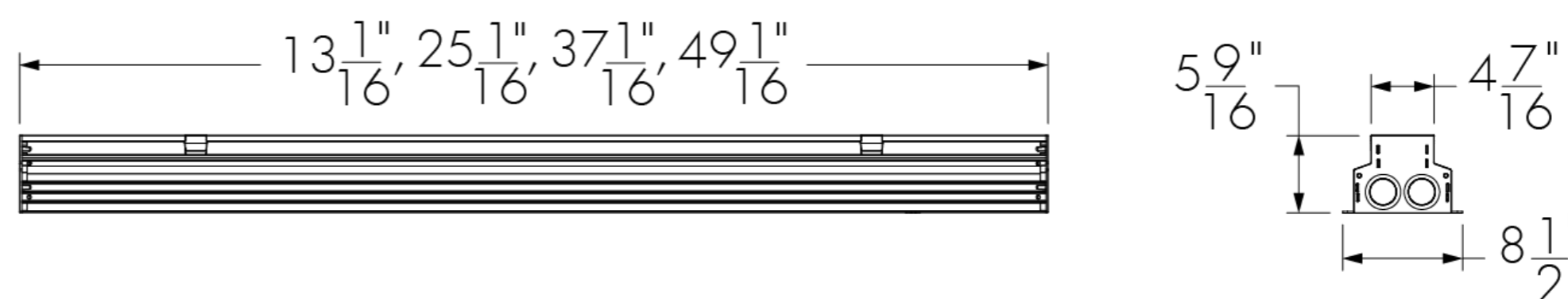
⁽¹⁾ Consult European specification sheet and installation instructions for CE wiring information.

Project Name _____ Qty _____

Type _____ Catalog / Part Number _____



Top view



Front and side views

Photometric Summary

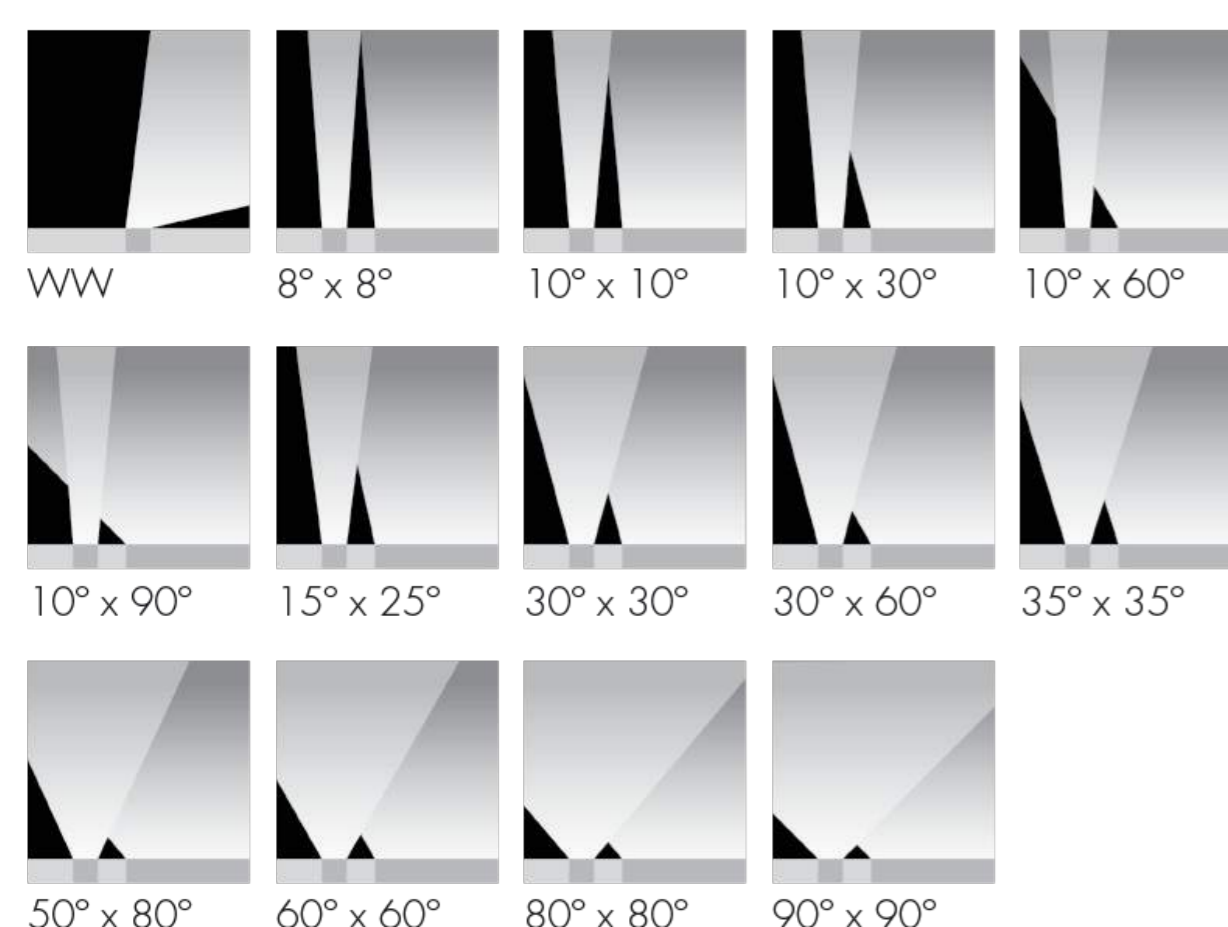
	Delivered output (lm)	Intensity (peak cd)
WW	2,770*	4,766*
8°x8°	4,512*	59,238*
10°x10°	3,908	35,109
10°x30°	4,586*	25,296*
10°x60°	3,876*	12,062*
10°x90°	4,178*	6,210*
30°x30°	4,686*	16,886*
30°x60°	4,035	5,317
60°x60°	3,845	3,062
90°x90°	4,070*	2,132*

Based on HO 4000K, 4ft [1219mm], 0° tilt setting configuration.

Photometric performance is measured in compliance with IESNA LM-79-08.

*Estimated. Consult website for the latest photometric files.

Optics



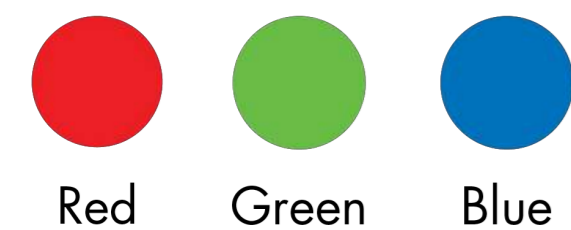
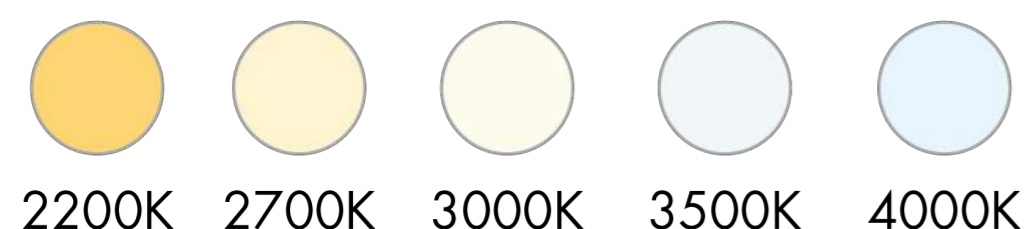
Description

The Lumenfacade Inground is an LED luminaire designed for ground-recessed lighting applications, including asymmetric wall washing, grazing, and linear wayfinding. An innovative, plug and play design simplifies installation, protecting the system from water infiltration and ensuring long-lasting performance. Featuring second generation LED technology, the Lumenfacade Inground is available in four different sizes (12 in, 24 in, 36 in or 48 in), with a wide choice of outputs, color temperatures, color-mixing systems, optics and controls. A unique asymmetric wallwash distribution is also available, providing exceptional uniformity and brightness for walls and signage.

Features

Construction	Walk over compliant up to 500 kg in any type of ground, Walk over compliant up to 1000 kg in concrete
Color and Color Temperature	2200K, 2700K, 3000K, 3500K, 4000K, Red, Green, Blue
Length (nominal)	12 in, 24 in, 36 in, 48 in
Optics	Asymmetric wallwash, 8° x 8°, 10° x 10°, 10° x 30°, 10° x 60°, 10° x 90°, 15° x 25°, 30° x 30°, 30° x 60°, 35° x 35°, 50° x 80°, 60° x 60°, 80° x 80°, 90° x 90°
Tilt Setting (factory set)	0 degrees, 2.5 degrees, 5 degrees, 20 degrees
Optical Option	Internal louver
Options	Anti-slip lens, CE (certification covers European Economic Area)
Power Consumption	5 W/ft (meets ASHRAE standards for linear lighting on building facades - not available for 12 in fixture lengths), 8.5 W/ft (RO version), 15.25 W/ft (HO version), Typically 20% higher for 12 in fixture lengths
Warranty	5-year limited warranty

Colors and Color Temperatures



Controls

ON/OFF 0-10V DALI



Ratings

IP68 IK10

Certifications



Performance

Illuminance at Distance Minimum 1 fc at 94 ft (HO 4000K, 48 in fixture, 10° x 60°, 2.5° tilt setting, DMX/RDM)

Color Consistency 2 SDCM, 3 SDCM (2200K)

Color Rendering Minimum CRI 80

Lumen Maintenance L70 280,000 hrs, L95 35,000 hrs

Physical

Optical Chamber Material Aluminum

Blockout Material Polymer recycled PVC reinforced with a stainless steel frame

Trim Material Anodized aluminum

Lens Material Tempered glass

End Cap Material Die cast aluminum

Hardware Material Stainless steel

Weight 12 in: 7.5 lbs, 24 in: 15.3 lbs, 36 in: 21.4 lbs, 48 in: 27 lbs

Electrical and control

Voltage 120 to 277 volts

Fixture Cable Power and data in one cable

Leader Cable Conductors 5C #16-5

Connectors IP68 push-lock

Control On/Off control, Lumentalk, 0-10V dimming, DALI dimming, Lutron® EcoSystem® Enabled dimming, DMX/RDM enabled

Resolution (DMX/RDM) Per foot or per fixture (configured with LumenID V3 software), 8-bit or 16-bit

Environmental

Storage Temperature -40 °F to 185 °F (device must reach start-up temperature value before operating)

Start-up Temperature -13 °F to 122 °F

Operating Temperature -40 °F to 122 °F

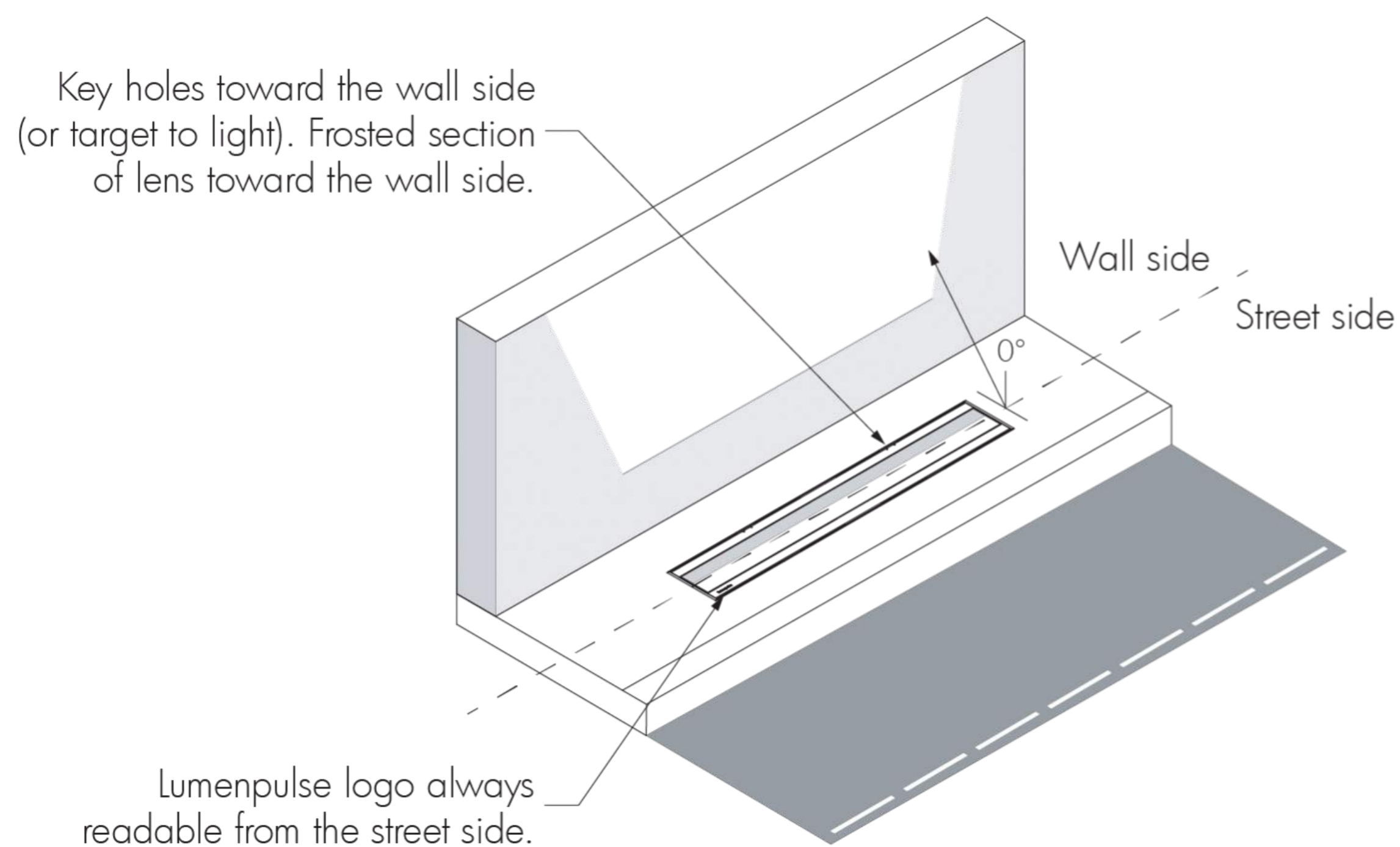
Ingress Protection Rating IP68 rated for up to 1 ft, not suitable for permanent immersion applications

Impact Resistance Rating IK10

Accessories (order separately)

Cables	Lumenfacade Inground Leader Cable, Lumenfacade Inground Junction Cable
Electrical Accessories	Lumenfacade Inground Junction Box
Control Boxes	DMX/RDM enabled (daisy chain or star configuration), Ethernet enabled (daisy chain or star configuration)
Control Systems	Lumentone™ 2, Pharos® kit
Diagnostic and Addressing Tools	LumenID, LumentalkID

Optical chamber orientation



Cables (order separately)

LOILC - Leader cable for Lumenfacade Inground



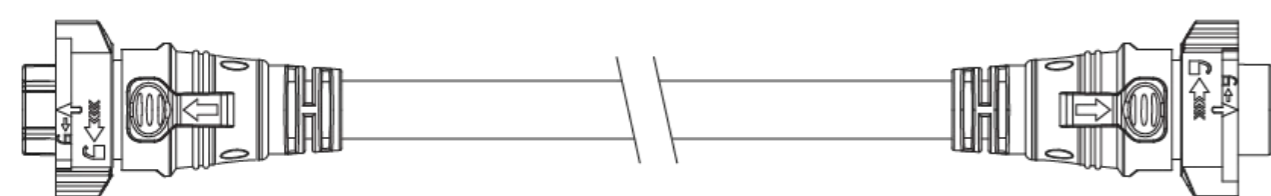
LOILC-CERTIFICATION-LENGTH

Please specify:

CERTIFICATION: UL or CE; **LENGTH:** 10 ft, 25 ft or 50 ft

- Suitable for dimming/data and non-dimming applications.
- Sealing end cap is mandatory for any unused connector. One (1) included with every leader cable.
- Consult Lumenfacade Inground leader cable specification sheet for details.

LOIJC - Jumper cable for Lumenfacade Inground



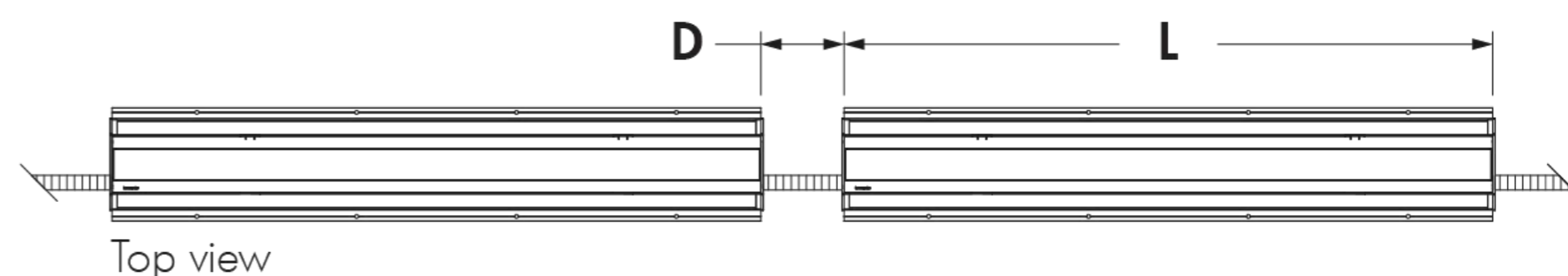
LOIJC-CERTIFICATION-LENGTH

Please specify:

CERTIFICATION: UL or CE; **LENGTH:** 2 ft, 4 ft or 10 ft

- Suitable for dimming/data and non-dimming applications.
- Consult Lumenfacade Inground jumper cable specification sheet for details.

Jumper cable length selection



D - distance between two fixtures

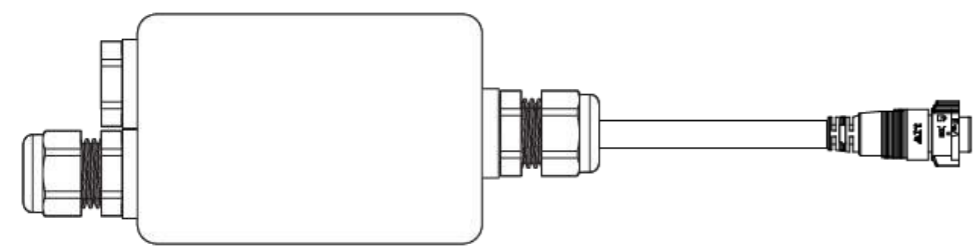
L - length of fixture

Add the length of one fixture to the distance between two fixtures: $L + D$. Order the next longest jumper cable available: 2 ft, 4 ft or 10 ft.

Example: if the distance between two 4 ft fixtures is 0.5 ft, $L + D = 4.5$ ft, therefore a 10 ft jumper cable is required.

Electrical accessories (order separately)

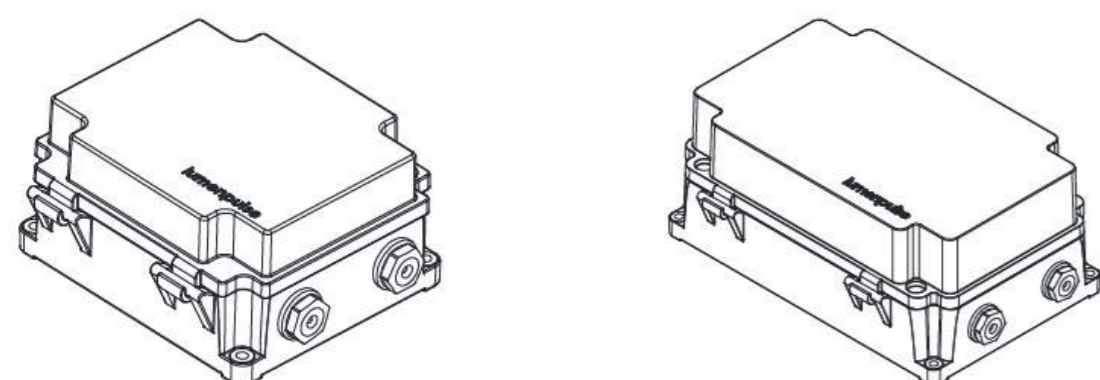
LOI-JBOX - Lumenfacade Inground Junction Box



Lumenfacade Inground IP68 sealed junction box starter kit. Use for stand alone fixtures and/or first of run installations. The LOI-JBOX accessory does not fit in 12 in fixtures.

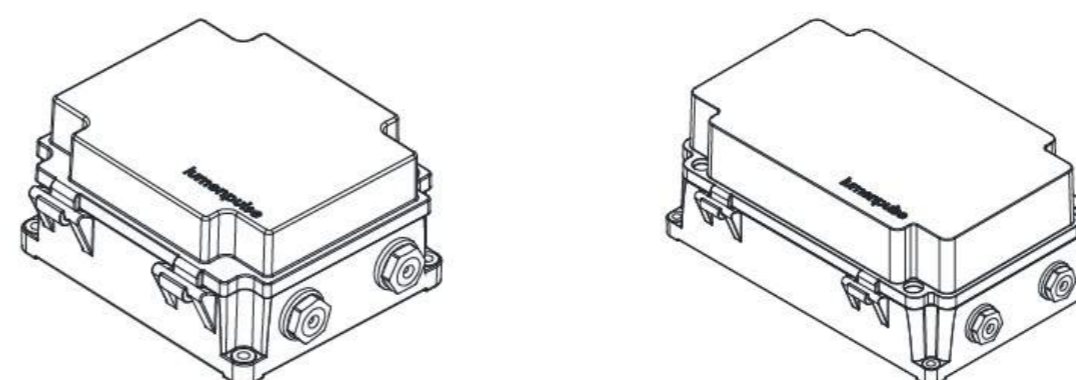
Control boxes (order separately)

CBX-DMX/RDM - DMX/RDM enabled (daisy chain or star configuration)



DMX/RDM control box. Up to six power and data outputs to fixtures or fixture runs. Consult CBX specification sheet and installation instructions for details. Lumenterminators provided with CBX (2x for daisy chain configuration, 6x for star configuration), consult factory to order spares.

CBX-ENET - Ethernet enabled (daisy chain or star configuration)



Ethernet control box. Up to four power and data outputs to fixture or fixture runs. Consult Ethernet CBX specification sheet and installation instructions for details.

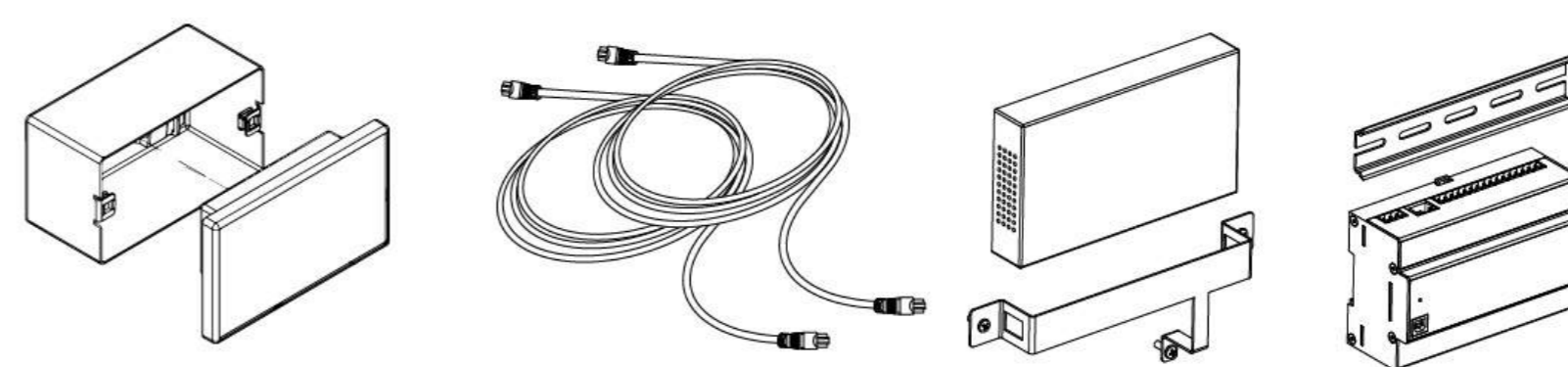
Control systems (order separately)

LTN2 - Lumentone™ 2



Lumentone 2 is a simple pre-programmed DMX 512 controller with a push button rotary dial and live feedback.

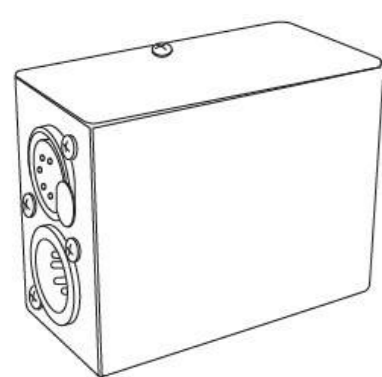
PHAROS - Pharos® kit



The Pharos kit, available for 1 or 2 DMX universes, allows for complete control of large lighting installations. 2 DMX universes kit shown.

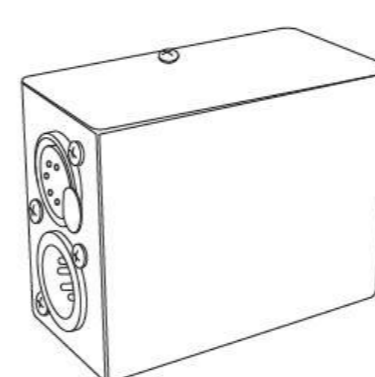
Diagnostic and addressing tools (order separately)

LID - LumenID



LumenID is a diagnostic and addressing DMX/RDM tool. It must be specified on all DMX applications. Consult LID specification sheet for details.

LID-LT - LumentalkID



LumentalkID is a diagnostic and addressing tool. It must be specified for all Lumentalk (LT) applications. Consult LID-LT specification sheet for details.

Resolution details

DMX/RDM control, resolution per foot: each 12 in section is addressed independently

DMX addresses:



DMX/RDM control, resolution per fixture: each fixture is addressed independently

DMX addresses:



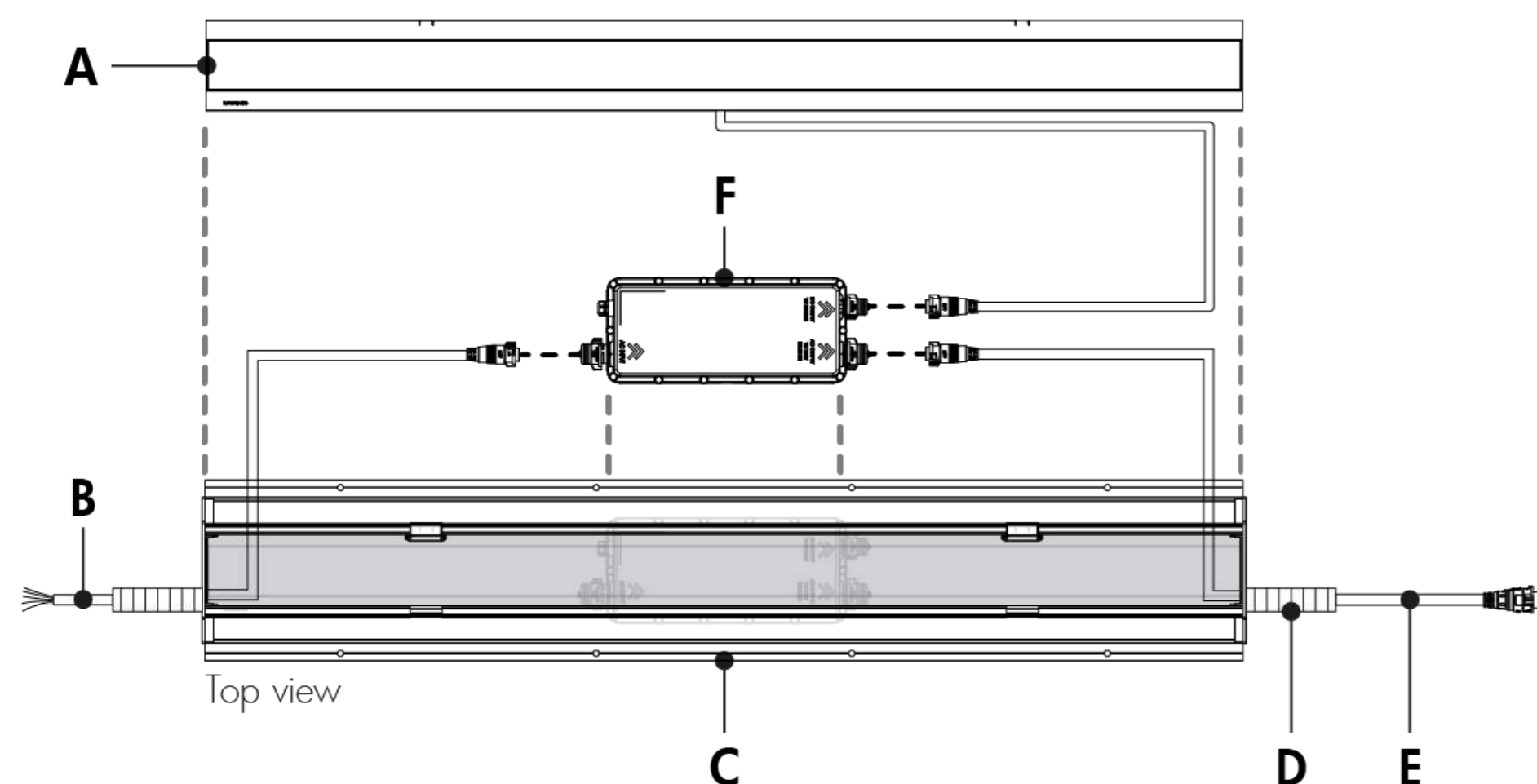
- 48 in fixtures shown.
- Applicable for DMX/RDM control option only. Fixture resolution can be configured on-site within the LumenID V3 software. A DMX/RDM enabled CBX is required.

Typical wiring diagrams

Wiring color code

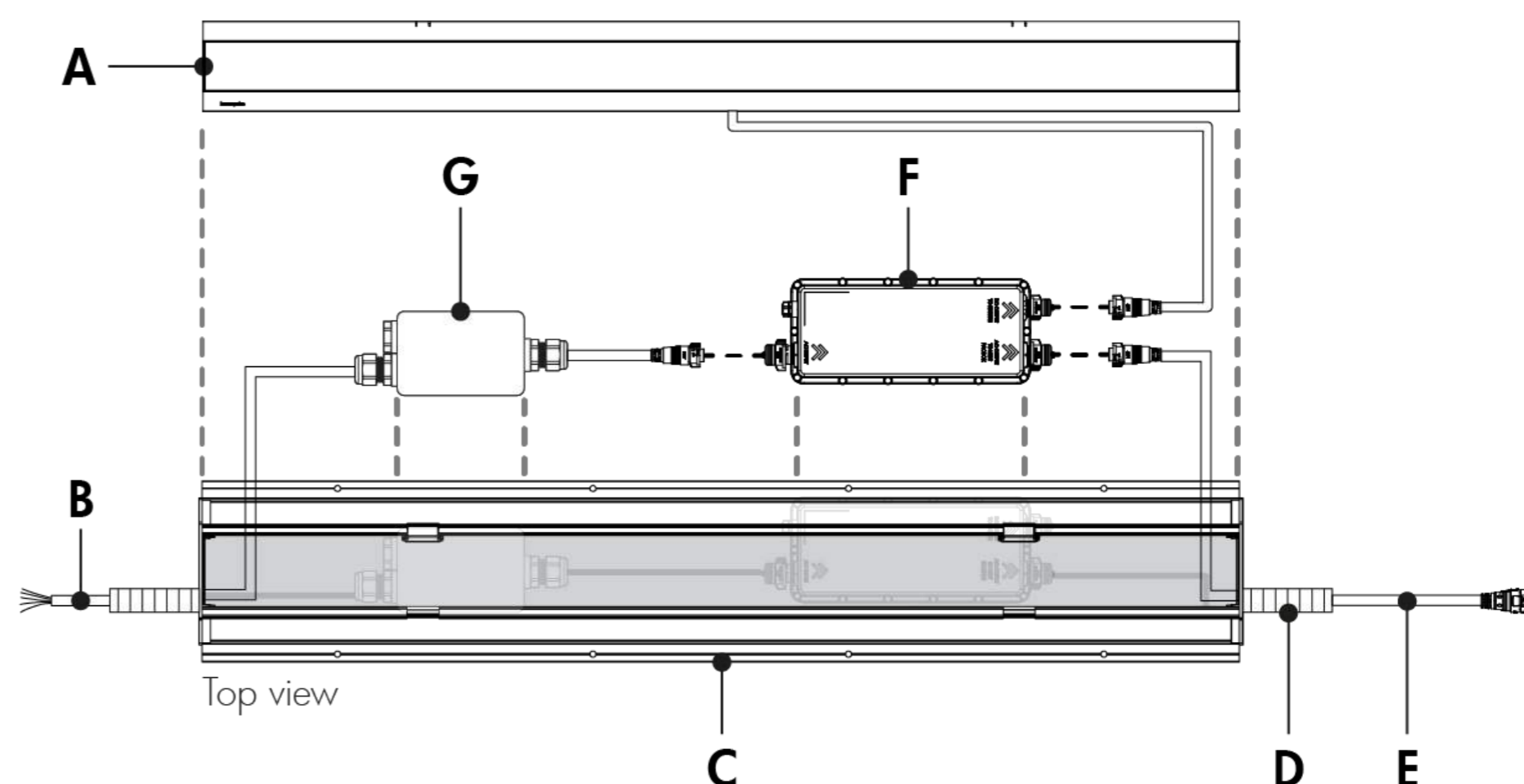
UL Color Code	USE
Green	Ground
Black	Line
White	Line/Neutral
Red or Purple	0-10V / Data +
Orange	0-10V / Data -

Typical installation with leader cable



- A** - Optical chamber
- B** - Leader cable (LOILC, order separately)
- C** - Blockout
- D** - Conduit (by others)
- E** - Jumper cable to next fixture (LOIJC, order separately, for continuous run installations)
- F** - PACBOX

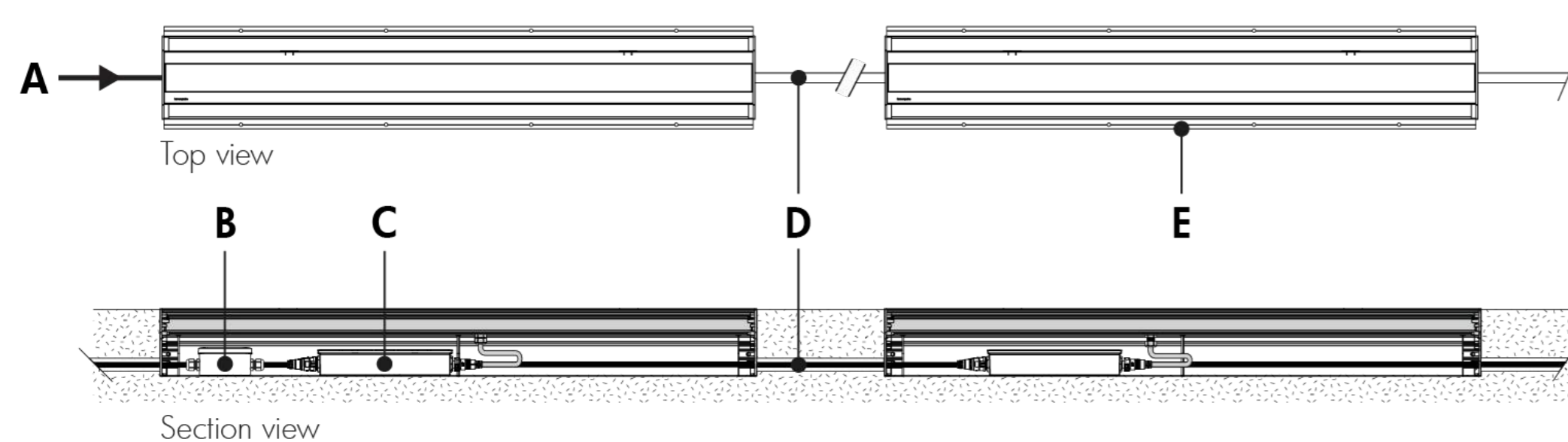
Typical installation with IP68 LOI-JBOX accessory



- A** - Optical chamber
- B** - Power and data input cable (by others)
- C** - Blockout
- D** - Conduit (by others)
- E** - Jumper cable to next fixture (LOIJC, order separately, for continuous run installations)
- F** - PACBOX
- G** - IP68 LOI-JBOX (order separately)

The IP68 LOI-JBOX accessory cannot be used with 12 in fixtures.

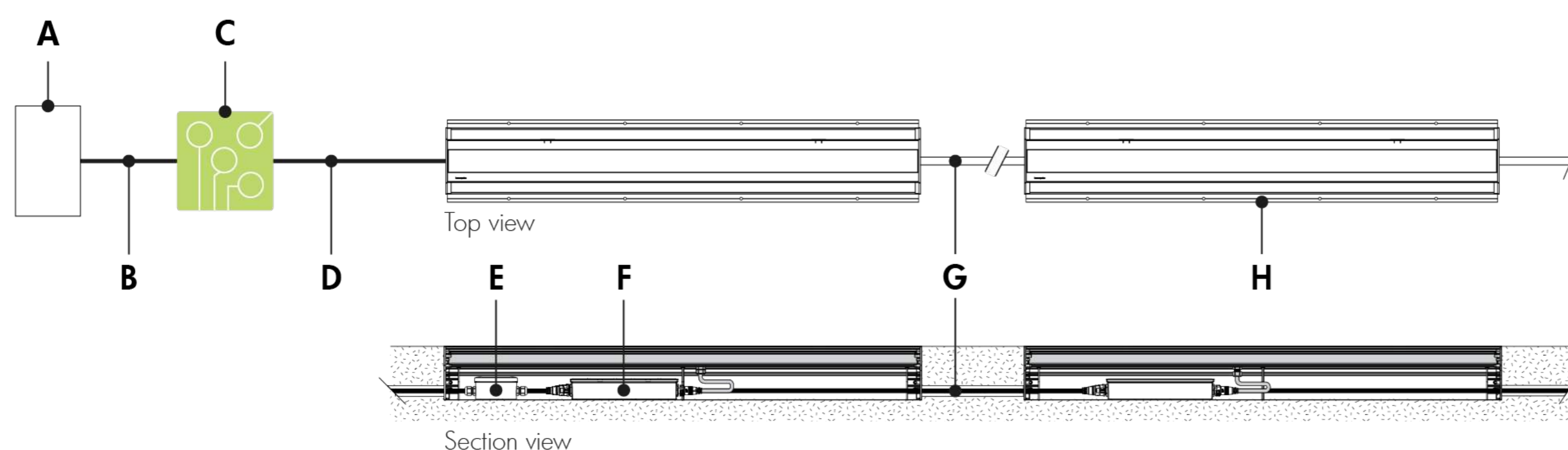
On/Off control (NO)



- A** - Power input (120-277V, wiring by others)
- B** - IP68 LOI-JBOX (optional)
- C** - PACBOX
- D** - Jumper cable (LOIJC)
- E** - Lumenfacade Inground

- Consult the installation instructions for additional wiring details.
- Consult factory for specific applications and maximum fixture count/cable length recommendations.
- ASHRAE version (not available for 12 in fixture lengths): 5 W/ft; Regular Output version: 8.5 W/ft; High Output version: 15.25 W/ft.

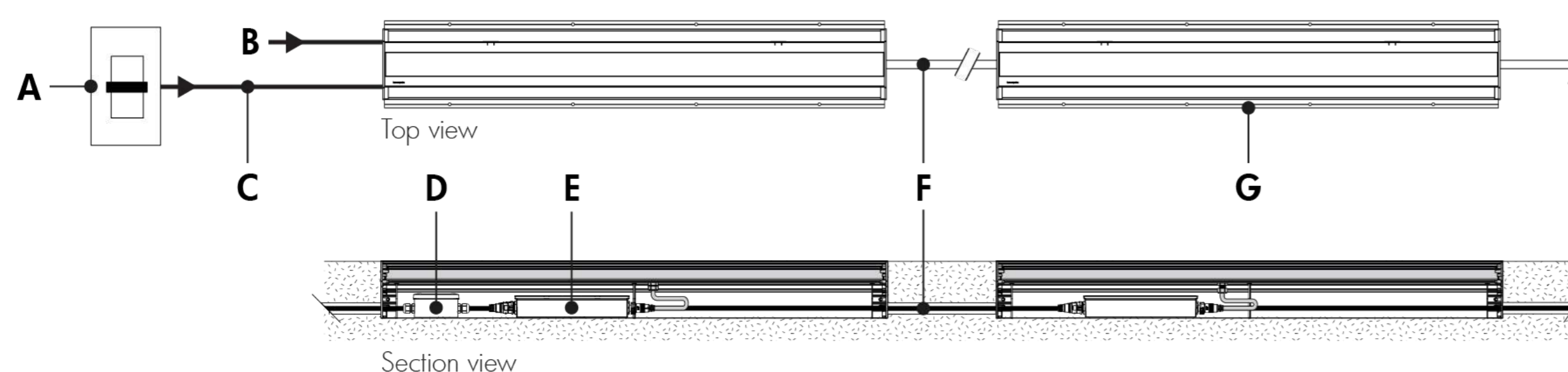
Lumentalk (LT)



- A** - Dimmer/controller (order separately from Lumenpulse, or by others)
- B** - Data wiring (by others)
- C** - Lumentranslator (LTL-010, -DMX, -TRIAC, -DALI)
- D** - Power line (120-277V AC, wiring by others)
- E** - IP68 LOI-JBOX (optional)
- F** - PACBOX
- G** - Jumper cable (LOIJC)
- H** - Lumenfacade Inground

- Consult the installation instructions for additional wiring details.
- Consult factory for specific applications and maximum fixture count/cable length recommendations.
- Lumentalk enabled fixtures must be commissioned using LumentalkID software and a LID-LT. Consult factory for details.
- Maximum of 1 transmitter (Lumentranslator or Lumenlink) per system.
- No third party fixtures allowed on the same circuit.
- For DMX applications: 1 DMX controller per Lumentalk network, maximum of 48 DMX channels per Lumentalk network (minimum step transition update rate is 1 second, minimum fade time between two colors is 1 minute). Consult factory for applications that require additional capabilities.
- Consult factory for DALI Lumentalk applications.
- 1% minimum dimming value.
- ASHRAE version (not available for 12 in fixture lengths): 5 W/ft; Regular Output version: 8.5 W/ft; High Output version: 15.25 W/ft.

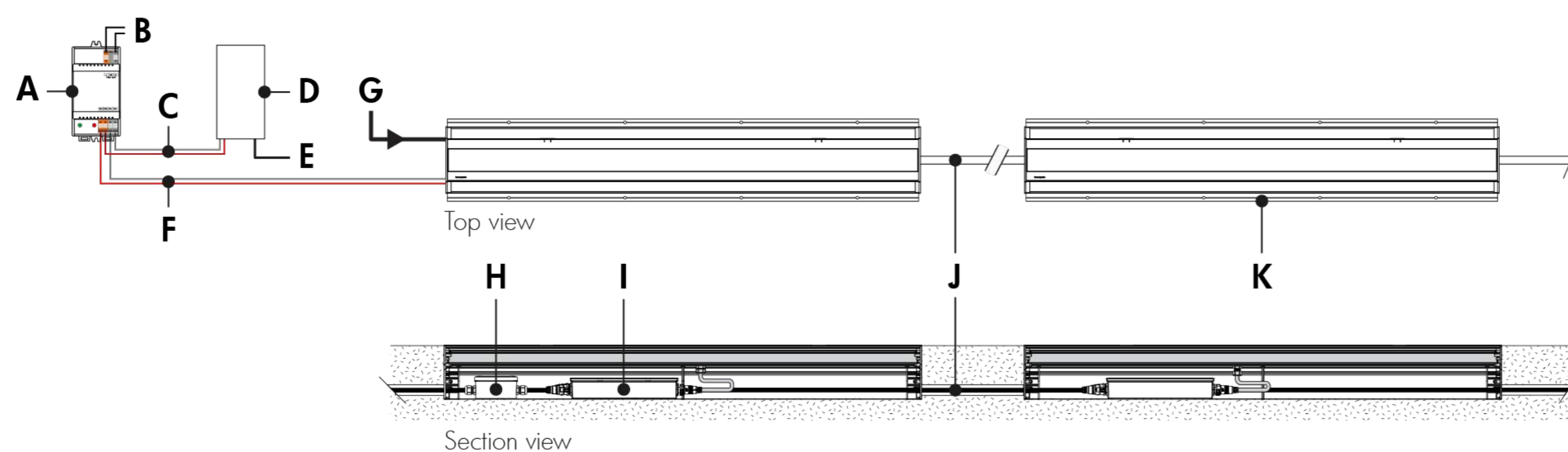
0-10V dimming (DIM)



- A** - Dimmer (by others)
- B** - Power input (120-277V, wiring by others)
- C** - Data wiring (by others)
- D** - IP68 LOI-JBOX (optional)
- E** - PACBOX
- F** - Jumper cable (LOIJC)
- G** - Lumenfacade Inground

- Consult the installation instructions for additional wiring details.
- Consult factory for specific applications and maximum fixture count/cable length recommendations.
- 0-10V mA ratings: passive dimmer (Current Sink): 3 mA per fixture, active dimmer (Current Source): 0.5 mA per fixture.
- 10% minimum dimming value.
- ASHRAE version (not available for 12 in fixture lengths): 5 W/ft; Regular Output version: 8.5 W/ft; High Output version: 15.25 W/ft.

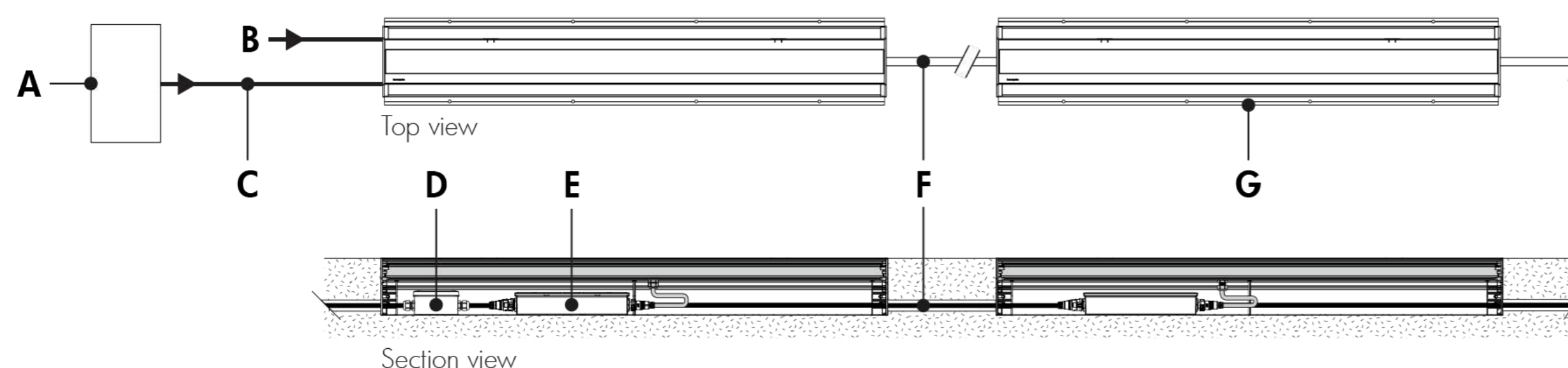
DALI dimming (DALI)



- A** - DALI bus power supply (by others)
- B** - Power input for DALI bus power supply (wiring by others)
- C** - Data output to DALI controller (wiring by others)
- D** - DALI controller (by others)
- E** - Power input for DALI controller (wiring by others)
- F** - Data output to fixture (wiring by others)
- G** - Power input (120-277V, wiring by others)
- H** - IP68 LOI-JBOX (optional)
- I** - PACBOX
- J** - Jumper cable (LOIJC)
- K** - Lumenfacade Inground

- Consult the installation instructions for additional wiring details.
- Consult factory for specific applications and maximum fixture count/cable length recommendations.
- Maximum of 64 DALI fixtures per DALI loop.
- 1% minimum dimming value.
- ASHRAE version (not available for 12 in fixture lengths): 5 W/ft; Regular Output version: 8.5 W/ft; High Output version: 15.25 W/ft.

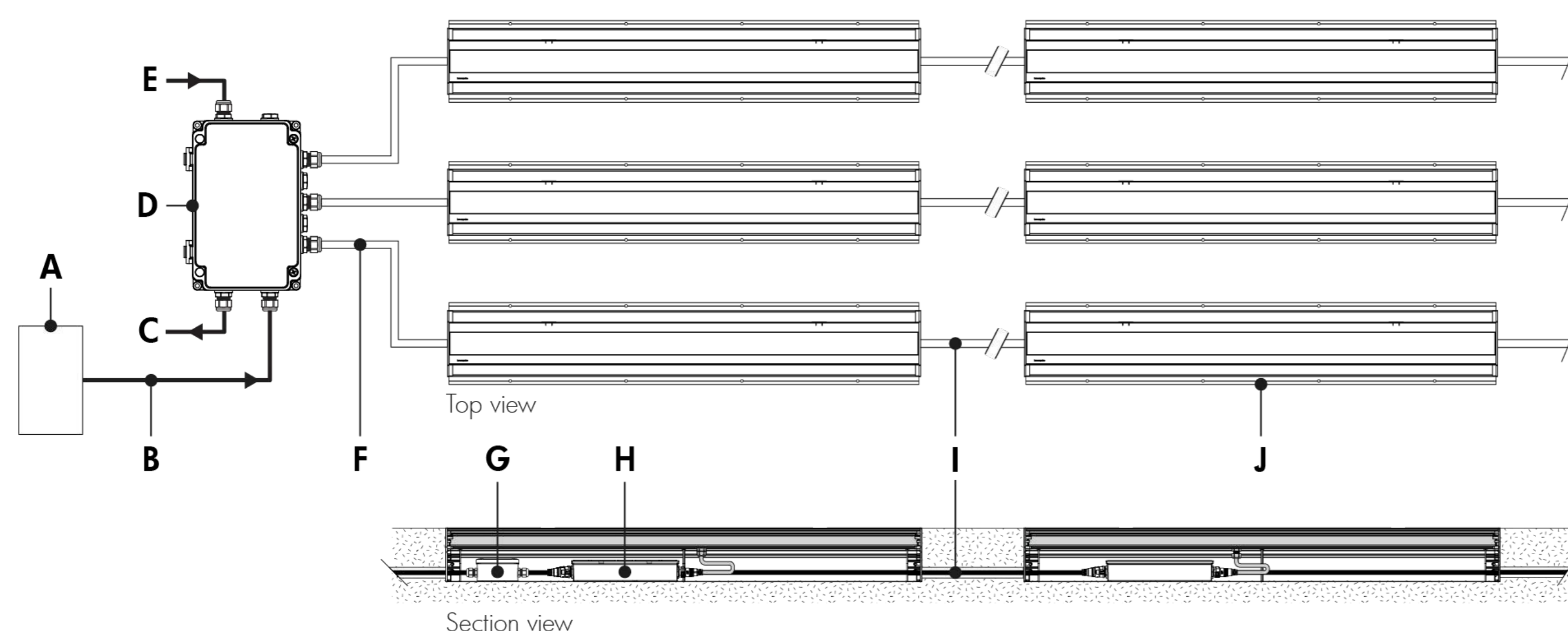
Lutron® EcoSystem® Enabled dimming (ES)



- A** - Lutron® EcoSystem® controller (by others)
- B** - Power input (120-277V, wiring by others)
- C** - Data wiring (by others)
- D** - IP68 LOI-JBOX (optional)
- E** - PACBOX
- F** - Jumper cable (LOIJC)
- G** - Lumenfacade Inground

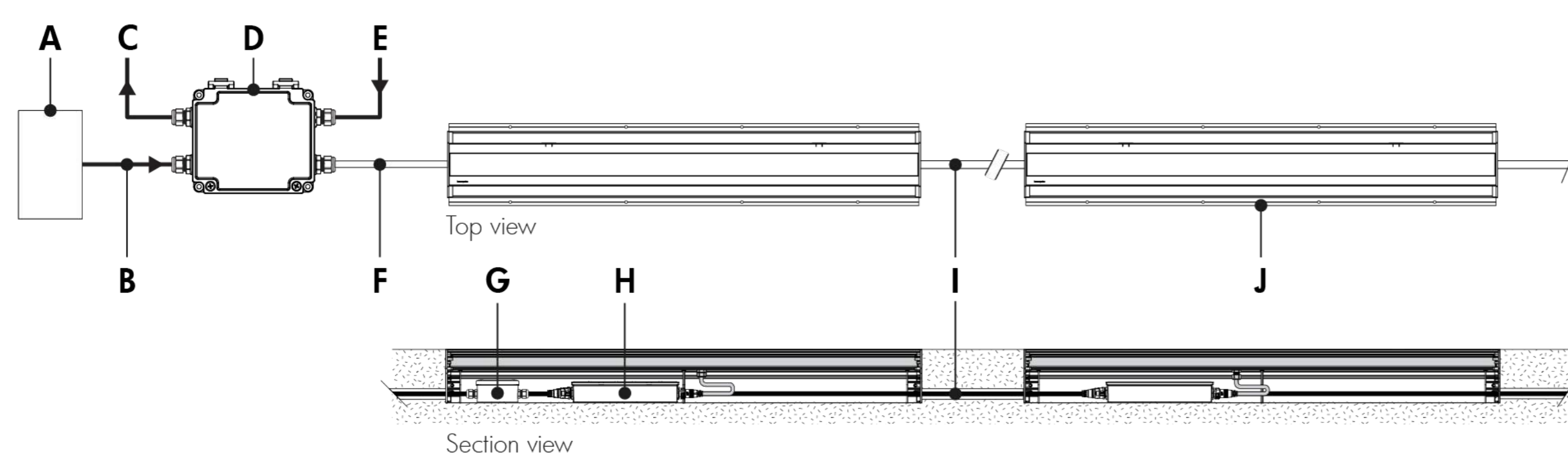
- Consult the installation instructions for additional wiring details.
- Consult factory for specific applications and maximum fixture count/cable length recommendations.
- Each Lutron® EcoSystem® enabled fixture has its own address; for the example shown, there are a total of 2 EcoSystem® addresses.
- 1% minimum dimming value.
- ASHRAE version (not available for 12 in fixture lengths): 5 W/ft; Regular Output version: 8.5 W/ft; High Output version: 15.25 W/ft.

Star Layout (DMX/RDM)



- A** - DMX/RDM controller (order separately from Lumenpulse, or by others)
- B** - Data input (Belden 9841 or equivalent, by others)
- C** - Data output to next CBX (optional, not isolated/not boosted)
- D** - CBX-ST
- E** - Power input (120-277V, wiring by others)
- F** - Leader cable (LOILC)
- G** - IP68 LOI-JBOX (optional)
- H** - PACBOX
- I** - Jumper cable (LOIJC)
- J** - Lumenfacade Inground

Daisy Chain Layout (DMX/RDM)



- A** - DMX/RDM controller (order separately from Lumenpulse, or by others)
- B** - Data input (Belden 9841 or equivalent, by others)
- C** - Data output to next CBX (optional, not isolated/not boosted)
- D** - CBX-DS
- E** - Power input (120-277V, wiring by others)
- F** - Leader cable (LOILC)
- G** - IP68 LOI-JBOX (optional)
- H** - PACBOX
- I** - Jumper cable (LOIJC)
- J** - Lumenfacade Inground

- Consult the installation instructions for additional wiring details.
- Consult factory for specific applications and maximum fixture count/cable length recommendations. Maximum run length calculations are typically based on 48 in fixtures.
- The DMX/RDM protocol states a maximum of 32 DMX/RDM enabled fixtures on any single run.
- Maximum of 4 DMX/RDM repeaters/CBX cascading in line.
- Maximum of 6 outputs per CBX-ST; maximum of 1 output per CBX-DS.
- Each fixture requires 1 DMX address.
- 1% minimum dimming value.
- ASHRAE version (not available for 12 in fixture lengths): 5 W/ft; Regular Output version: 8.5 W/ft; High Output version: 15.25 W/ft.

How to order

1	2	3	4	5	6	7	8
9							

1 . Housing ⁽¹⁾ ⁽²⁾ ⁽³⁾

LOI ASHRAE	Lumenfacade™ Inground, 5 W/ft ASHRAE compliant ⁽⁴⁾
LOI RO	Lumenfacade™ Inground, Regular Output, 8.5 W/ft
LOI HO	Lumenfacade™ Inground, High Output, 15.25 W/ft

⁽¹⁾ A Lumenfacade Inground fixture includes one optical chamber (LOIC), one power and control box (PACBOX) and one recessed blackout (RBO). The LOIC, PACBOX and RBO are provided according to the output/color, length and control configuration.

⁽²⁾ Consult the installation instructions to plan all aspects of the fixture installation. A completed Certificate of Installation must be returned to Lumenpulse to activate the warranty.

⁽³⁾ Power consumption is typically 20% higher for 12 in fixture lengths.

⁽⁴⁾ ASHRAE version not available for 12 in fixture lengths.

2 . Voltage

120/277	120-277 volts
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3 . Length

12	13 1/16 in (7.5 lbs) ⁽¹⁾
24	25 1/16 in (15.3 lbs)
36	37 1/16 in (21.4 lbs)
48	49 1/16 in (27 lbs)

⁽¹⁾ Power consumption is typically 20% higher for 12 in fixture lengths.

4 . Color and Color Temperature ⁽¹⁾

22K	2200K
27K	2700K
30K	3000K
35K	3500K
40K	4000K
RD	Red ⁽²⁾
GR	Green ⁽²⁾
BL	Blue ⁽²⁾

⁽¹⁾ Consult factory for availability of static Royal Blue, 6500K and 90+ CRI.

⁽²⁾ Static colors made to order 8-10 weeks.

5 . Optics

WW	Asymmetric Wallwash
8x8	8° x 8° ⁽¹⁾
10x10	10° x 10° ⁽¹⁾
10x30	10° x 30°
10x60	10° x 60°
10x90	10° x 90°
15x25	15° x 25°
30x30	30° x 30°
30x60	30° x 60°
35x35	35° x 35°
50x80	50° x 80°
60x60	60° x 60°
80x80	80° x 80°
90x90	90° x 90°

⁽¹⁾ For best results use with HO fixtures at a 6 in setback from surface. Contact factory for application support.

9 . Options

ASL	Anti-slip lens
CE	CE (certification covers European Economic Area) ⁽¹⁾

⁽¹⁾ Consult European specification sheet and installation instructions for CE wiring information.

6 . Tilt Setting ⁽¹⁾ ⁽²⁾

TS0	0 degrees
TS2.5	2.5 degrees
TS5	5 degrees
TS20	20 degrees

⁽¹⁾ Do not specify a tilt setting for the asymmetric wallwash option. The asymmetric wallwash optic is factory set with a 2.5 degree tilt.

⁽²⁾ Tilt setting is factory set and cannot be adjusted in the field.

7 . Optical Option

INTL	Internal louver ⁽¹⁾
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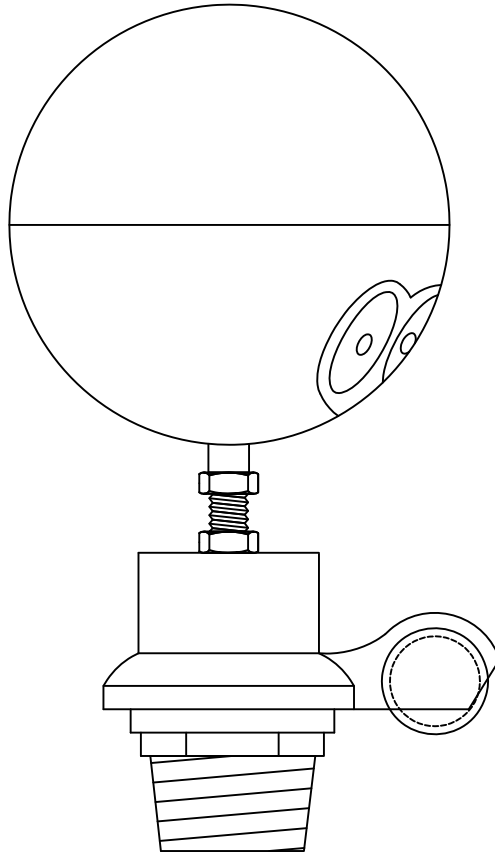
⁽¹⁾ The addition of an internal louver will affect beam distribution. Consult factory for application support.

8 . Control

NO	On/Off control
LT	Lumentalk ⁽¹⁾
DIM	0-10V dimming
DALI	DALI dimming
ES	Lutron® EcoSystem® Enabled dimming
DMX/RDM	DMX/RDM enabled ⁽²⁾

⁽¹⁾ A Lumentranslator and LumentalkID (LIDLT) must be specified for Lumentalk applications. Consult Lumentranslator and Lumentalk pages and specification sheets for details.

⁽²⁾ A control box (CBX) and LumenID (LID) must be specified.



<i>P/N</i>	<i>Voltage</i>	<i>Color</i>	<i>Item Number</i>	<i>Bulb Type</i>	<i>Wire Length</i>	<i>Pole Length</i>	<i>Notes</i>
95866-005G	12 V.	Gold	ORN FPB-8-359-D-12V	6 Watt L.E.D.	50 FEET	40 FEET	
95866-005S	12 V.	Silver	ORN FPB-8-359-D-12V	6 Watt L.E.D.	50 FEET	40 FEET	
95866-006G	120 V.	Gold	ORN FPB-8-359-D-120V	6 Watt L.E.D.	50 FEET	40 FEET	
95866-006S	120 V.	Silver	ORN FPB-8-359-D-120V	6 Watt L.E.D.	50 FEET	40 FEET	
95866-007G	12 V.	Gold	ORN FPB-8-359-D-12V	6 Watt L.E.D.	40 FEET	40 FEET	Solar Option Only
95866-007S	12 V.	Silver	ORN FPB-8-359-D-12V	6 Watt L.E.D.	40 FEET	40 FEET	Solar Option Only

American Beacon – External Revolving

26252 Hillman Highway • Abingdon, VA 24210 • Phone: 276-525-4078 • Fax: 276-676-3090 • Toll Free: 855-530-4078



ArcPad Xtreme tm



Client: _____

Project: Canton Centennial Park

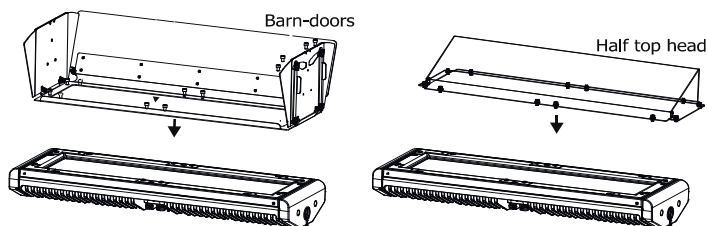
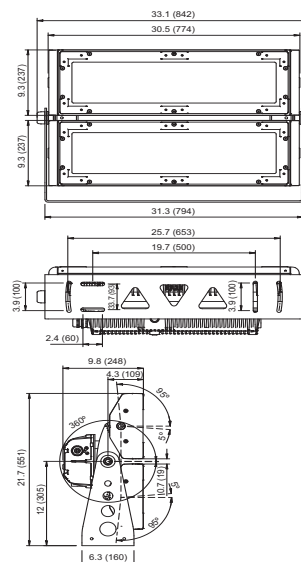
Specifier: Tec Studio

Type: Type N Qty: _____

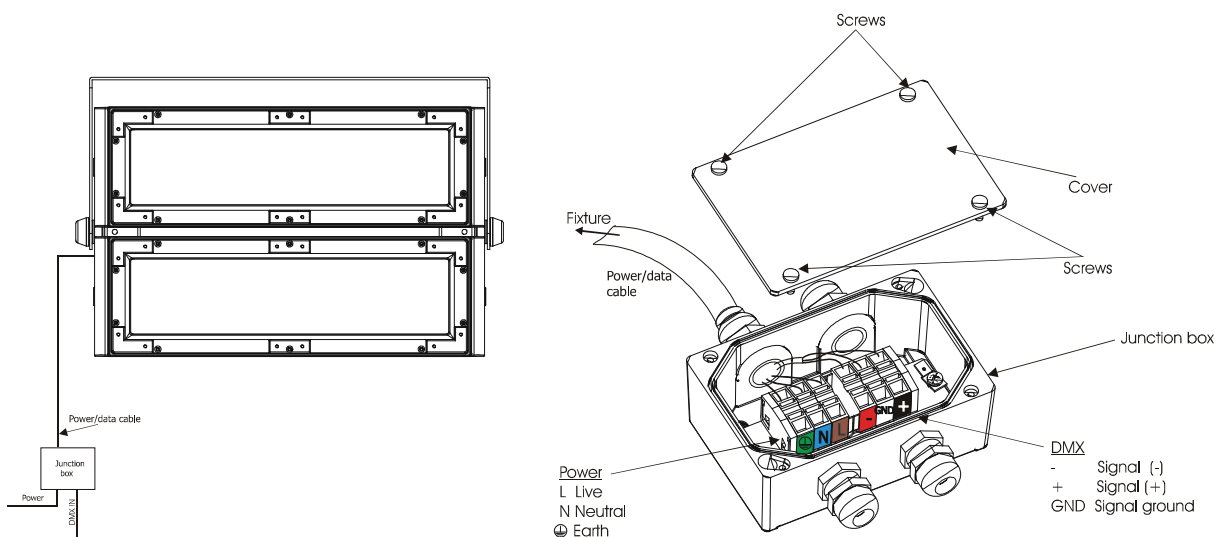


FEATURES:

- Input Voltage: 100-240VAC 50/60Hz (Optional 277V)
- Power consumption: 580W
- Light Source: 188 x High Power LED's
- Delivered Lumen: 26866lm CW 44°
- Projected LED Life: 77,000 Hrs
- Control: DMX Controller
- Housing: Cast Aluminium - Glass cover
- Fixing Method: Stirrup
- IP Rating: IP67 (IP66 Junction Box)
- Operating Ambient Temp: -20°C/+40°C [-4°F/+104°F]
- Certification: ETL / cETL, CE, RoHS
- 5 Year Warranty



Connection Scheme:



Accessories:



Barn Door Module (2pcs in 1 Box)



Top Hat Module (2pcs in 1 Box)



Half Top Hat Module (2pcs in 1 Box)

Product Specification:

Electrical	Input Voltage		100-240V AC 50/60 Hz (Optional 277V)
	Power Consumption		580W +/- 10%
	In Rush Current		46Amp Peak Max @ 1/2 Cycle 264V
Optical	Light Source		188 x High Power LED's
		RGBW	W = WW-3200K or CW-6500K
		PW	3200K, 4300K, 6500K
		SW	3200K - 6500K
	LED Channels		Red / Green / Blue / White, Pure White, Smart White
	Beam Angle		10°, 23°, 44°, 14°x26°
Projected Lumen Maintenance		77,000 hrs (L70@ 25°C / 77°F)	
Control	Interface Protocol		DMX512
	Wireless DMX (Optional Accessory)		Lumen Radio CRMX Technology
	Control System		Anolis Lighting Controls or any Third Party DMX512 Controller
	Power Supply		Integral (Standard) Remote (Optional)
	Stand Alone Control		Yes
Physical	Width x Height x Depth	Inches	33.15 x 21.65 x 10.63
		mm	842 x 550 x 270
	Weight	lbs	125.7
		kg	57
	Housing		High Pressure Die-Cast Aluminium Body Tempered Glass
	Fixture Cable and Connections		Li9YCHY - 3xAWG16+1 (2xAWG24) + Junction Box
	Fixing Method		Stirrup
	Adjustability		+95°/ -5°, Both LED Modules +/-180°
	IP Rating		IP67 (IP66 Junction Box)
	IK Rating		IK**
	Cooling System		Convection
	Operating Ambient Temperature		-20°C / +40°C (-4°F / +104°F)
	Operating Temperature		+85°C @ Ambient +40°C (+185°F @ Ambient +104°F)
Certification	Listings		ETL / cETL, CE, RoHS

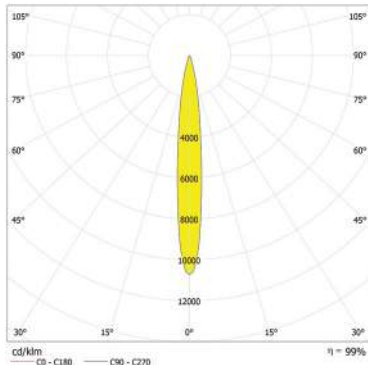
Subject to change without notice - please contact Anolis for clarification

Accessories	Description
	Junction Box (Included)
	Gasket Cable Grommet M20 (Included)
	Barn Doors
	Top Hat
	Half Top Hat



Photometric Data:

ArcPad Xtreme WW - 10°

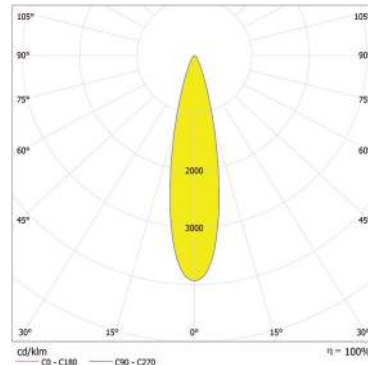


Distance [m]	Cone Diameter [m]	Beam Diameter [m]	Beam Angle [°]	Illuminance [lx]
0.5	0.11	0.11	6.3°	117083
1.0	0.22	0.22	6.3°	29266
1.5	0.33	0.33	6.3°	13007
2.0	0.44	0.44	6.3°	7316
2.5	0.55	0.55	6.3°	4683
3.0	0.66	0.66	6.3°	3252

Distance [m] Cone Diameter [m] Illuminance [lx]
 CD - C180 (Half-value Angle: 12.6°)

Total Luminous Flux: 29354lm

ArcPad Xtreme WW - 23°



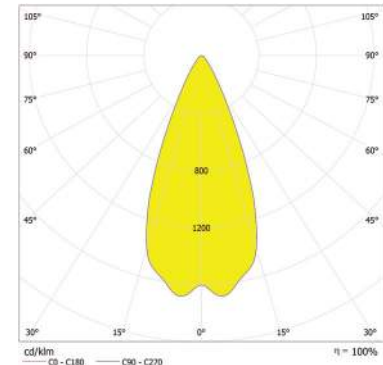
Distance [m]	Cone Diameter [m]	Beam Diameter [m]	Beam Angle [°]	Illuminance [lx]
0.5	0.21	0.21	12.0°	36247
1.0	0.43	0.43	12.0°	9012
1.5	0.64	0.64	12.0°	4361
2.0	0.85	0.85	12.0°	2453
2.5	1.06	1.06	12.0°	1570
3.0	1.28	1.28	12.0°	1090

Distance [m] Cone Diameter [m] Illuminance [lx]
 CD - C180 (Half-value Angle: 24.0°)

Total Luminous Flux: 26832lm

For foot Candles divide lux by 10.7

ArcPad Xtreme WW - 44°



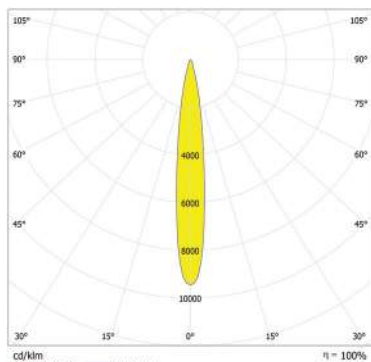
Distance [m]	Cone Diameter [m]	Beam Diameter [m]	Beam Angle [°]	Illuminance [lx]
0.5	0.40	0.40	22.0°	15735
1.0	0.81	0.81	22.0°	3924
1.5	1.21	1.21	22.0°	1748
2.0	1.62	1.62	22.0°	983
2.5	2.02	2.02	22.0°	629
3.0	2.42	2.42	22.0°	437

Distance [m] Cone Diameter [m] Illuminance [lx]
 CD - C180 (Half-value Angle: 44.0°)

Total Luminous Flux: 26418lm

Photometric Data:

ArcPad Xtreme CW - 14°

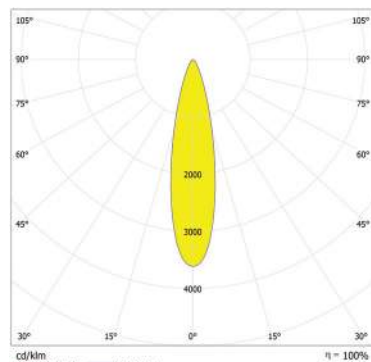


Distance [m]	Cone Diameter [m]	η(0°)	η(C0)	η(C90)	η(C270)	Illuminance [lx]
0.5	0.12	81(0°)	1349390	81(C0)	6.9° 689980	
1.0	0.24	81(0°)	337346	81(C0)	6.9° 167495	
1.5	0.36	81(0°)	149932	81(C0)	6.9° 74442	
2.0	0.48	81(0°)	84337	81(C0)	6.9° 41874	
2.5	0.61	81(0°)	53076	81(C0)	6.9° 26799	
3.0	0.73	81(0°)	37483	81(C0)	6.9° 18611	

Distance [m] Cone Diameter [m]
C0 - C180 (Half-value Angle: 13.8°)

Total Luminous Flux: 35674lm

ArcPad Xtreme CW - 24°



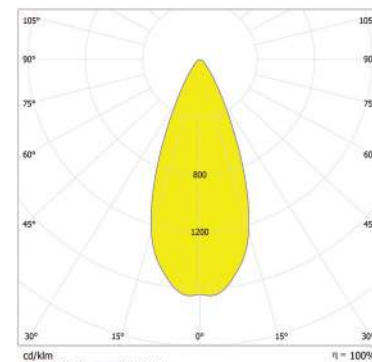
Distance [m]	Cone Diameter [m]	η(0°)	η(C0)	η(C90)	η(C270)	Illuminance [lx]
0.5	0.21	81(0°)	463672	81(C0)	12.0° 227369	
1.0	0.43	81(0°)	116668	81(C0)	12.0° 58662	
1.5	0.64	81(0°)	53630	81(C0)	12.0° 25263	
2.0	0.85	81(0°)	30167	81(C0)	12.0° 14211	
2.5	1.06	81(0°)	19307	81(C0)	12.0° 9695	
3.0	1.28	81(0°)	13408	81(C0)	12.0° 6716	

Distance [m] Cone Diameter [m]
C0 - C180 (Half-value Angle: 24.0°)

Total Luminous Flux: 33354lm

For foot Candles divide lux by 10.7

ArcPad Xtreme CW - 43°

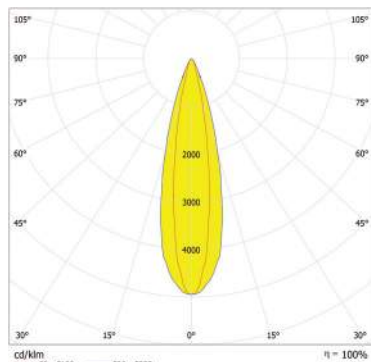


Distance [m]	Cone Diameter [m]	η(0°)	η(C0)	η(C90)	η(C270)	Illuminance [lx]
0.5	0.39	81(0°)	218913	81(C0)	21.5° 85223	
1.0	0.79	81(0°)	54726	81(C0)	21.5° 22306	
1.5	1.18	81(0°)	24323	81(C0)	21.5° 9914	
2.0	1.58	81(0°)	13682	81(C0)	21.5° 5076	
2.5	1.97	81(0°)	8759	81(C0)	21.5° 3959	
3.0	2.36	81(0°)	6681	81(C0)	21.5° 2478	

Distance [m] Cone Diameter [m]
C0 - C180 (Half-value Angle: 43.0°)

Total Luminous Flux: 33338lm

ArcPad Xtreme CW - 17°x28°



Distance [m]	Cone Diameter [m]	η(0°)	η(C0)	η(C90)	η(C270)	Illuminance [lx]
0.5	0.25 0.15	81(0°)	895138	81(C90)	14.1° 318708	81(C0) 6.9° 340711
1.0	0.50 0.30	81(0°)	173785	81(C90)	14.1° 79677	81(C0) 8.9° 85176
1.5	0.75 0.45	81(0°)	77238	81(C90)	14.1° 35412	81(C0) 8.9° 37857
2.0	1.00 0.60	81(0°)	43446	81(C90)	14.1° 19919	81(C0) 8.9° 21204
2.5	1.25 0.75	81(0°)	27806	81(C90)	14.1° 12748	81(C0) 8.9° 13608
3.0	1.51 0.90	81(0°)	19309	81(C90)	14.1° 8863	81(C0) 8.9° 9464

Distance [m] Cone Diameter [m]
C0 - C180 (Half-value Angle: 17.0°)
C90 - C270 (Half-value Angle: 28.2°)

Total Luminous Flux: 35108lm

PROJECT:	FIXTURE TYPE: Type P, P1	CATALOG #:
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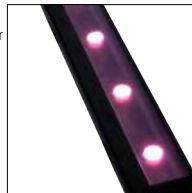
LINE VOLTAGE LED, HIGH PERFORMANCE FACADE AND FLOOD LIGHTING

- Ideal for lighting facades, structures, bridges
- Integral power (line voltage 120V – 277V)
- IP67, 3G vibration rating, suitable for use on bridges
- Wireless DMX capability
- Field installable accessories



LED ARRAY OPTIONS

Quad-Chromatic Board (RGBWq): Integrates multiple colors (ie; red, green, blue, white) into a single location for immediate and superior color saturation. This is ideal for direct line of sight applications where the face of the fixture is visible, creating color consistency between the luminaire and the illuminated surface. LED color combinations may be customized to suit any application (ex: royal blue, cyan, lime and white). Please contact factory for special branding requirements.



Discreet (RGBd, RGBWd): The Discreet LED array utilizes individual secondary optics per led color (ie; red, green, blue, amber). This array increases optical performance from 4° to 60° allowing for superior beam control and increased efficiency. The increased optical control allows for maximum peak candela, allowing longer throws.



Tri-Chromatic Board (RGBt): Integrates multiple colors (ie; red, green, blue) into a single location for immediate and superior color saturation. This is ideal for direct line of sight applications where the face of the fixture is visible, creating color consistency between the luminaire and the illuminated surface.



Tri-Chromatic (RGB+Wt): The Tri-Chromatic LED Board integrates one row of Tri-Chromatic RGB and one row of Discreet White, allowing for high lumen output and RGB color changing.



COLORS	RGB TRI-CHROMATIC, RGB DISCREET, RGBW DISCREET, RGBW QUAD-CHROMATIC, RGBWWA, RGB+W					
OPTICS	6W RGBt - Tri-Chromatic: 100° X 100° 9W RGBt - Tri-Chromatic: 12° X 60°, 20° X 60°, 45° X 60°, 100° X 100° 12W RGB+Wt - Tri-Chromatic: 100° X 100° 15W RGBWWAd - Discreet: 18° X 60°, 42° X 60°, 100° X 100° 17W RGBd - Discreet: 7° X 60°, 15° X 60°, 30° X 60°, 45° X 60°, 60° X 60°, 100° X 100°, SYMMETRIC, ASYMMETRIC 17W RGBWd - Discreet: 7° X 60°, 15° X 60°, 30° X 60°, 45° X 60°, 60° X 60°, 100° X 100°, SYMMETRIC ASYMMETRIC 17W RGBWq - Quad-Chromatic: 10° X 60°, 30° X 60°, 100° X 100°					
PERFORMANCE RGB COLOR CHANGING 48" FIXTURE		FIXTURE WATTAGE (TOTAL WATTAGE)	OPTICS	LUMENS	EFFICACY	MAX CANDELA
		9 (12.1W/FT) 17 (17.6W/FT)	12° X 60° 7° X 60°	1044 2247	22 LM/W 32 LM/W	5104 25313
LUMEN MAINTENANCE	75,000 hrs L70	75,000 hrs L70				
ELECTRICAL	AC LINE VOLTAGE	120V OR 277V				
	POWER SUPPLY	Integral to the luminaire				
CONTROL	DMX READY					
PHYSICAL	HOUSING	Aluminum extrusion with cast aluminum end caps, powder-coated finish. Optional Corrosion Resistant Finish is available. See Accessories & Options.				
	DIMENSIONS	H X W X L: 3" X 2-5/8 X (24" / 36" / 48")				
	LENS	Tempered glass				
	OPERATING TEMPERATURE	-20° C to 50° C				
CERTIFICATION	ETL & cETL approved for wet locations, IP 67					
	Meets 3G ANSI C136.31 Vibration standard for bridge applications IK07 Impact Rating					
WARRANTY	5 YEAR LIMITED					



All MEDLEY® products are tested to IES LM-79, LM-80 and ANSI C78.377A standards

PROJECT:	FIXTURE TYPE:	CATALOG #:
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ORDERING INFORMATION

MVWII/

PREFIX	WATTAGE W / FT	LED COLORS	OPTICS	MOUNTING	FIXTURE LENGTH	VOLTAGE	CONTROL OPTIONS	FINISH	ACCESSORIES	
MVWII MEDLEY VIEW II	ACTIVE WHITE (TUNABLE)			PLUG & PLAY CONNECTION		24" 36" 48"	120 = 120V 277 = 277V DMXFX = DMX Fixture Resolution ² DMXFT = DMX Foot x Foot Resolution ² Not available with 6W RGBi or 12W RGB+Wt DMXSY = DMX System Resolution ²	TW = Textured White TBL = Textured Black TBR = Textured Bronze TLB = Textured Light Bronze TN = Textured Natural TS = Textured Sandstone CC = Custom Color ³	VS = Visor LV = Louver SN = Snoot WL = White Diffuse Lens ⁴ DV = Direct View Lens ⁴ CRF = Corrosion Resistant Finish ⁵	
	17	AWH Kelvin Tunable from 2700K - 6500K	7° = 7° X 60° 15° = 15° X 60° 30° = 30° X 60° 45° = 45° X 60° 60° = 60° X 60° 100° = 100° X 100° SYM = 10° X 10° ASYU = Asymmetric Uplight ASYD = Asymmetric Downlight	SMS = Surface, Plug & Play SMSS = Surface Side Mount, Plug & Play FMS = Fixed, Plug & Play FMSS = Fixed Side Mount, Plug & Play						
	COLOR CHANGING			CONCEALED WIRE						Contact factory for Concealed Wire mounting options
	6	RGBt Red, Green, Blue Tri-Chromatic Chip	100° = 100° X 100°	EAS-X = Extended Arm, ¹ Plug & Play						
	9	RGBt Red, Green, Blue Tri-Chromatic Chip	12° = 12° X 60° 20° = 20° X 60° 45° = 45° X 60° 100° = 100° X 100°	EXAS-X = Extended Arm ¹ Side Mount, Plug & Play CDS = Conduit, Plug & Play						
	12	RGB+Wt Red, Green, Blue, 40K Tri-Chromatic Chip	100° = 100° X 100°							
	15	RGBWWAd Red, Green, Blue, 40K, 62K, Amber Discreet Chip	18° = 18° X 60° 42° = 42° X 60° 100° = 100° X 100°							
	17	RGBd Red, Green, Blue Discreet Chip RGBWd Red, Green, Blue, 40K Discreet Chip	7° = 7° X 60° 15° = 15° X 60° 30° = 30° X 60° 45° = 45° X 60° 60° = 60° X 60° 100° = 100° X 100° SYM = 10° X 10° ASYU = Asymmetric Uplight ASYD = Asymmetric Downlight							
17	RGBWq Red, Green, Blue, 40K Quad Chip	10° = 10° X 60° 30° = 30° X 60° 100° = 100° X 100°								

NOTES

All Color Changing and Active White Installations require a DMX Programming and Distribution kit. See below for details.	See cable requirements below for Plug & Play fixtures. ¹ X = Arm Length. Specify 6", 12" or 18". Contact factory for additional arm lengths.	Contact factory 12" fixture	Load not to exceed 16 amps.	² DMX controls are required. Must order separately. All Color Changing and Active White Installations require a DMX Programming and Distribution kit. See below for details. Contact factory for Insight's wireless option.	³ Contact factory for custom colors. Additional charges will apply.	⁴ WL & DV lens options are available with 100° optics only. Not available with RGBWWAd. ⁵ CRF is recommended for coastal or extreme exterior environments
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CATALOG NUMBER EXAMPLE: MVWII / 17 / RGBWd / 15° / SMS / 24" / 277 / DMXSY / TW / VS, CRF

STEP 2 - ORDER DMX DISTRIBUTION & PROGRAMMING KIT
REQUIRED FOR COLOR CHANGING AND ACTIVE WHITE INSTALLATIONS

CATALOG NUMBER	DESCRIPTION
LPT	DMX PROGRAMMING TOOL: One LPT is required for field re-addressing of factory DMX settings.
CDS-A	DMX DISTRIBUTION KIT ONLY (4 OUTPUTS): CDS-A consists of four outputs. Each output accommodates up to 32 fixtures per data feed. Four terminators are included for use as required. ** RGBWWAd accommodates up to 24 fixtures per data feed.

EXTERIOR - LEADER CABLES FOR PLUG AND PLAY CONNECTION

Plug & Play Fixtures require a Leader Cable with each fixture run for connection from first fixture to the j-box.

CATALOG NUMBER	DESCRIPTION
ACLM-5-B	5' BLACK LEADER CABLE - For line voltage only, REQUIRED for connection at the start of each run.

EXTERIOR - JUMPER CABLES

Plug & Play Fixtures allow for end-to-end fixture connection without additional AC jumpers. If fixtures are not mounted in an end-to-end continuous manner, Jumper Cables are required.

CATALOG NUMBER	DESCRIPTION	CATALOG NUMBER	DESCRIPTION
ACJM-2-B	2' BLACK JUMPER CABLE - For line voltage only	ACJM-10-B	10' BLACK JUMPER CABLE - For line voltage only
ACJM-5-B	5' BLACK JUMPER CABLE - For line voltage only	ACJM-25-B	25' BLACK JUMPER CABLE - For line voltage only

PROJECT:	FIXTURE TYPE:	CATALOG #:
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SMS - SURFACE, BOTTOM MOUNT - PLUG & PLAY CONNECTION

LEADER CABLE IS REQUIRED ORDER SEPARATELY

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	7" / 10"	12" / 22"	18" / 34"

MOUNT BRACKET DETAILS

SMSS - SURFACE, SIDE MOUNT - PLUG & PLAY CONNECTION

LEADER CABLE IS REQUIRED ORDER SEPARATELY

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	5-1/2" / 7-1/2"	9-1/2" / 19-1/2"	15-1/2" / 31-1/2"

MOUNT BRACKET DETAILS

FMS - FIXED, BOTTOM MOUNT - PLUG & PLAY CONNECTION

LEADER CABLE IS REQUIRED ORDER SEPARATELY

1.25 THRU HOLE RECOMMENDED

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	5" / 8"	10" / 20"	16" / 32"

MOUNT BRACKET DETAILS

FMSS - FIXED, SIDE MOUNT - PLUG & PLAY CONNECTION

LEADER CABLE IS REQUIRED ORDER SEPARATELY

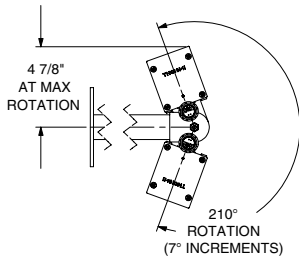
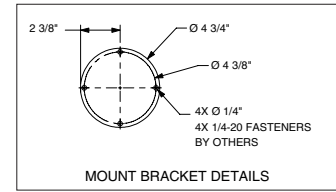
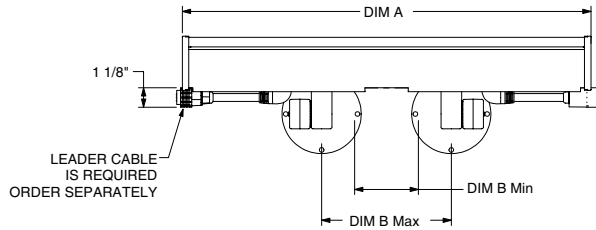
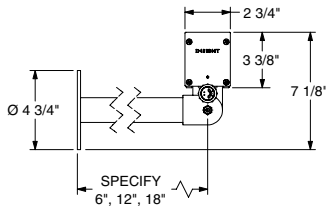
1.25 THRU HOLE RECOMMENDED

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	5-1/2" / 7-1/2"	9-1/2" / 19-1/2"	15-1/2" / 31-1/2"

MOUNT BRACKET DETAILS

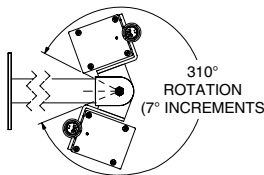
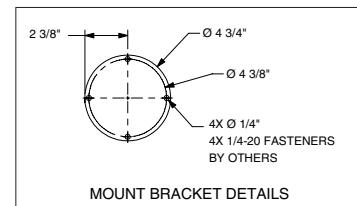
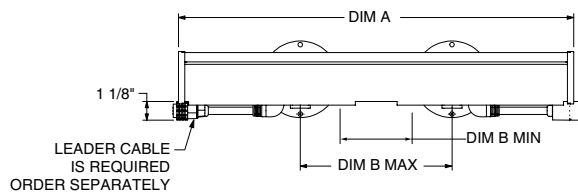
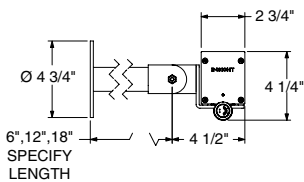
PROJECT:	FIXTURE TYPE:	CATALOG #:
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EAS - EXTENDED ARM, BOTTOM MOUNT - PLUG & PLAY CONNECTION



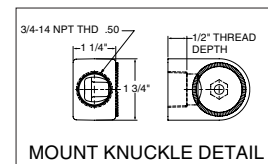
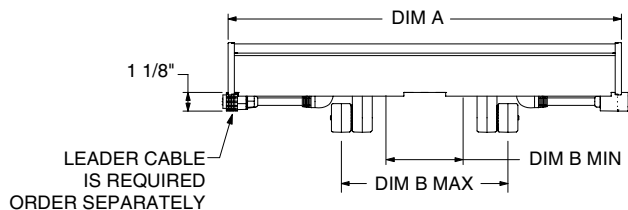
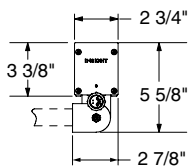
FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	5-1/2" / 7-1/2"	9-1/2" / 19-1/2"	15-1/2" / 31-1/2"

EXA-S - EXTENDED ARM, SIDE MOUNT - PLUG & PLAY CONNECTION



FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	5-1/2" / 7-1/2"	9-1/2" / 19-1/2"	15-1/2" / 31-1/2"

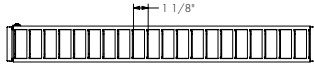
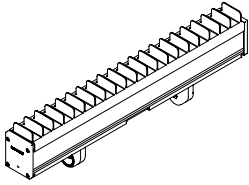
CDS - CONDUIT - PLUG & PLAY CONNECTION



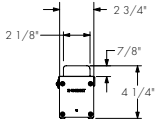
FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DIM B MIN / MAX	5-1/2" / 7-1/2"	9-1/2" / 19-1/2"	15-1/2" / 31-1/2"

PROJECT:	FIXTURE TYPE:	CATALOG #:
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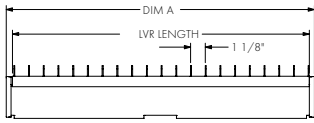
LOUVER DIMENSIONS



TOP VIEW



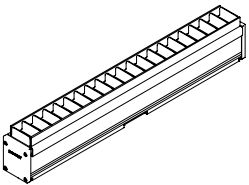
SIDE VIEW



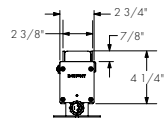
FRONT VIEW

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
LOUVER	24"	36"	48"

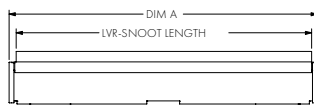
SNOOT DIMENSIONS



TOP VIEW



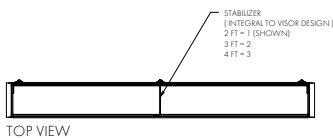
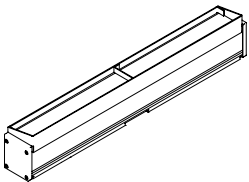
SIDE VIEW



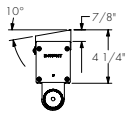
FRONT VIEW

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
LOUVER	24"	36"	48"

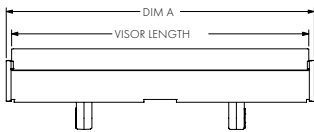
VISOR DIMENSIONS



TOP VIEW



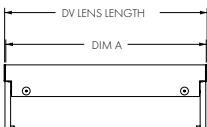
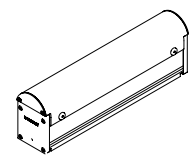
SIDE VIEW



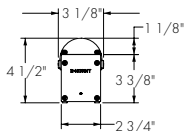
FRONT VIEW

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
VISOR	23-7/8"	35-7/8"	47-7/8"

DIRECT VIEW LENS DIMENSIONS



FRONT VIEW



SIDE VIEW

FIXTURE LENGTH	24"	36"	48"
DIM A	24-3/4"	36-3/4"	48-3/4"
DV LENS	24-7/8"	36-7/8"	48-7/8"

LS-TDB1-300 300VA Transformer for Landscape Lighting Applications**Specifications**

Input	120V, 60Hz
Output	300VA, 12.5V
ETL Approved	Yes
Protection	Circuit Breaker
Housing	NEMA 12, High Temp Fiberglass box and cover.

**Fixture Compatibility**

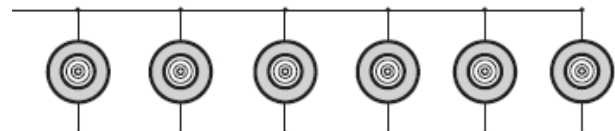
In order to determine the maximum number of fixtures a transformer or power supply will operate, please refer to the compatibility tables. These tables can be found in the back of the LED catalog and online.

Indicative Dimensions

	In. (mm)
Case width	9 (229)
Case Height	9 (229)
Case Depth	7 (178)
Weight (approx)	12 lb (5.5 kg)

Indicative Circuit Diagram

Connections to be made in parallel, in accordance with NEC and local wiring regulations.



LS782LED Astelia

At Grade



The Astelia is an excellent option for LED landscape lighting, featuring aim and tilt adjustability, a choice of finishes and long service life. The Astelia features new Lumascope d5 driver technology as a standard inclusion, providing a high level of control: When high output is required, it can be deployed in its full output, 6 W configuration; If a lower level of light is required, it can be set as low as 0.6 W, (either by the factory or in the field).

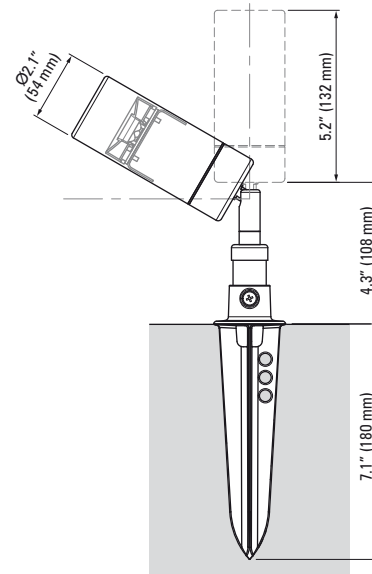
Specifications

Lamp Source	6 W LED <input type="checkbox"/> White (4 300 K typical) <input type="checkbox"/> Warm white (3 000 K typical) <input type="checkbox"/> Blue (470 nm)
Approved Use	Suitable for wet locations
Control Options	0-10 V (current sourcing) PWM On-site or factory-programmable brightness
IP Rating	IP65
Construction	Powder coated aluminum <input type="checkbox"/> Black <input type="checkbox"/> Silver Polished copper
Installation Type	Spike mount
Remote Transformers / Power Supplies	Refer to Technical Data section for application specific options <i>Order separately</i>
Ambient Operating Temperature	-4 °F to 104 °F (-20 °C to 40 °C)
Photometrics	Refer to www.lumascap.com

Any luminaire can become hot - take care with appropriate use and placement



LS782LED Astelia



LS782LED → [] → [] → 13-DIM → []

LAMP				OPTICAL SYSTEM			INPUT VOLTAGE		FINISH		
Description	Wattage	Color	Code	Beam		Code	Description	Code	Description	Material	Code
LED	6 W	White (4 300 K typical)	6W4	Narrow	14°	NR	0-10 V or PWM Dimmable Driver, 12-15 V, 60 Hz or 12-24 V DC ⁽¹⁾ Requires appropriate transformer.	13-DIM⁽¹⁾	Black, powder coated	Aluminum	CB
		Warm white (3 000 K typical)	6H6	Narrow Medium	25°	NM			Silver, powder coated	Aluminum	CS
		Blue (470 nm)	6B4	Medium	30°	ME			Polished	Copper	CU
				Wide	40°	WD					

Dimmable Wiring Diagram Reference

Input Voltage	LED Color	Control Type	Wiring Diagram
13-DIM	Single Color	PWM	2,3,4

Photometrics

Photometric data is based on test results from a NIST traceable testing lab. IES data is available at www.lumascap.com.
 Note: No depreciation factor is applied to the data shown.

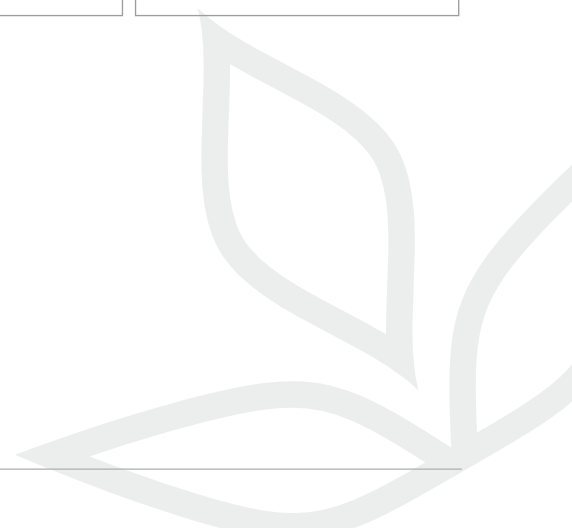
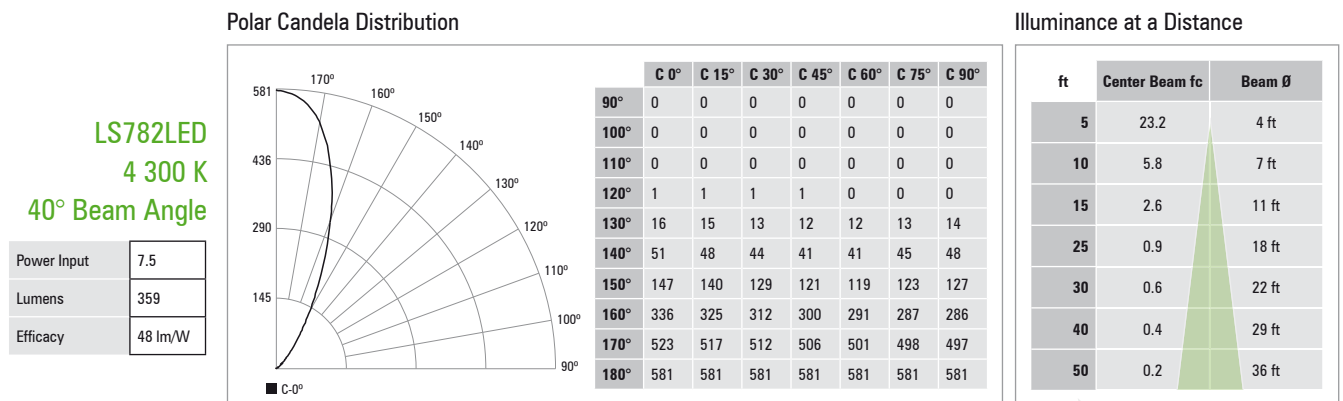
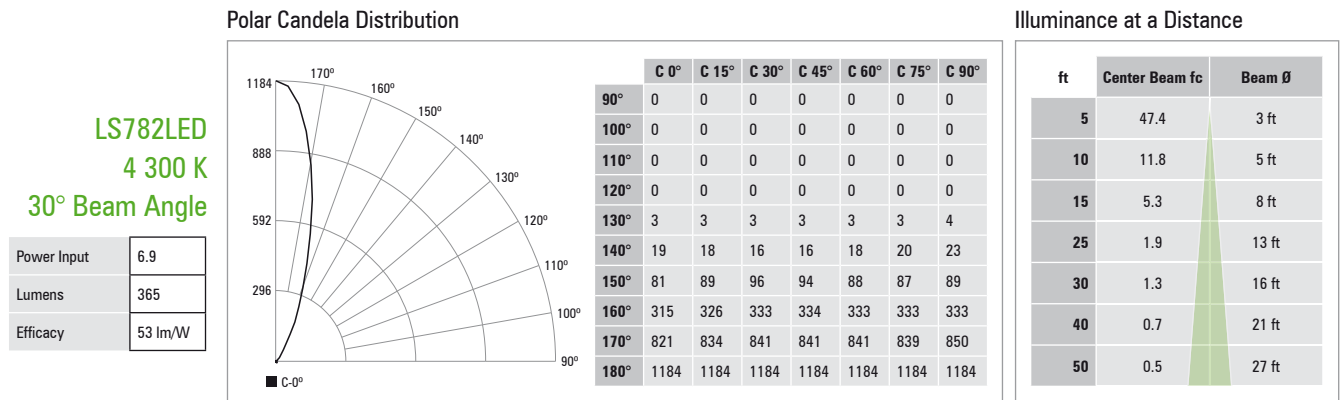
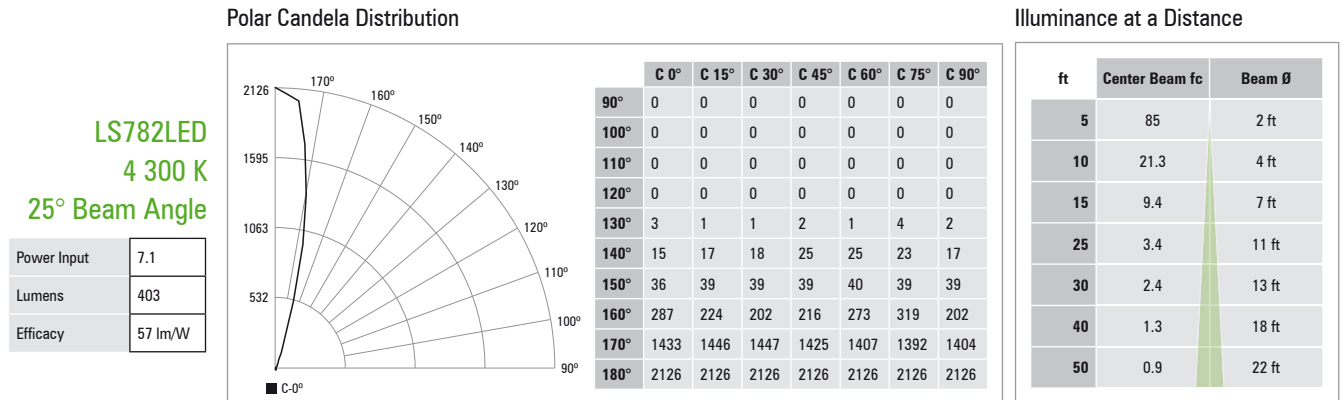
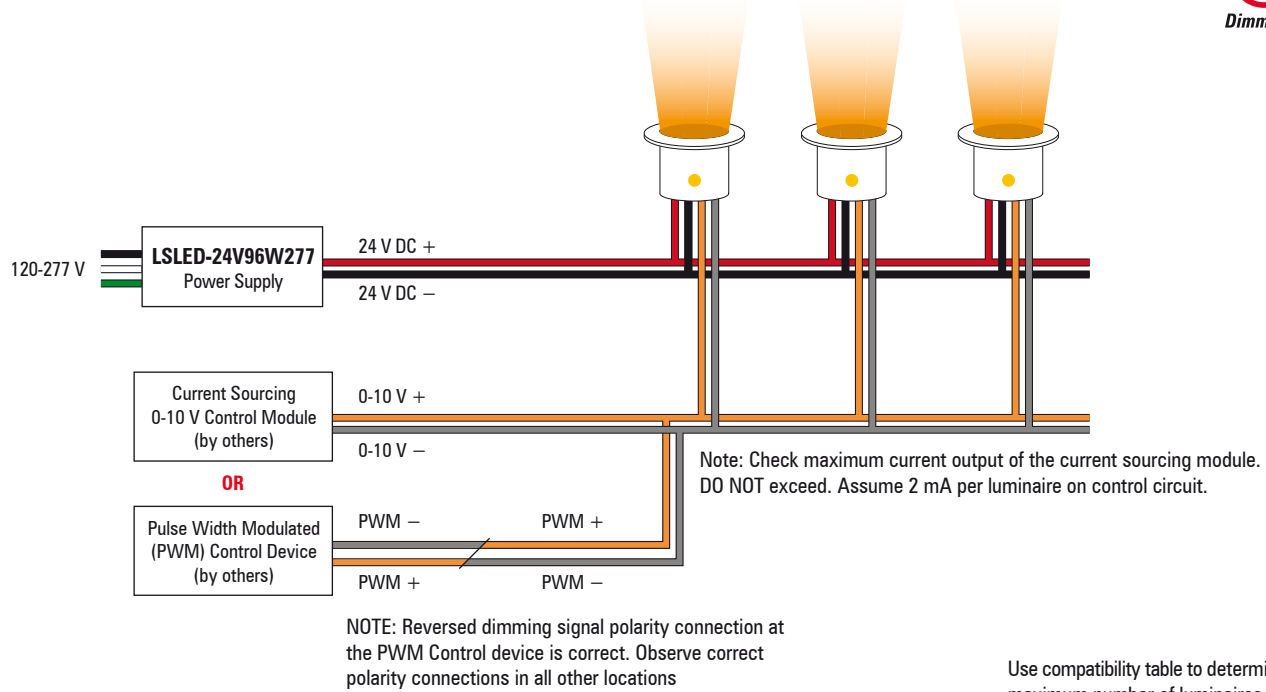
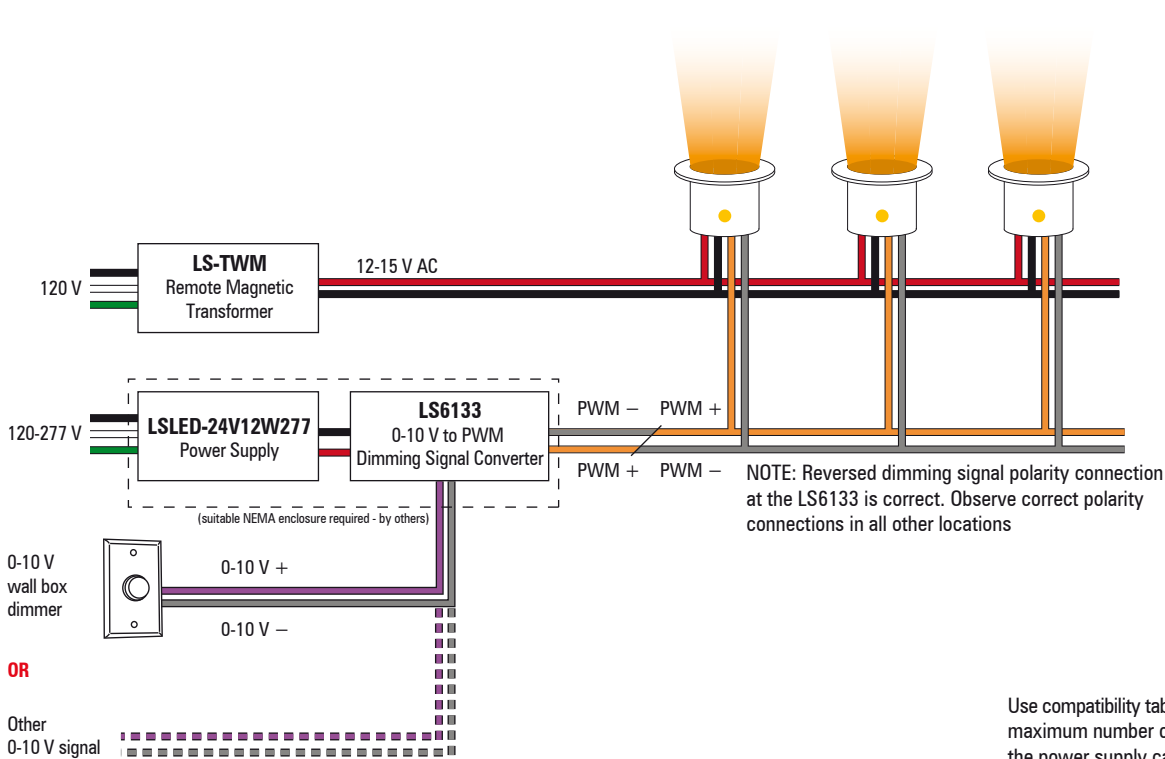


Diagram 2 - 0-10 V Dimming Via Current Sourcing Module, or Pulse Width Modulated Dimming (PWM)
 - Low Voltage LED Luminaire with d5 Driver on 24 V DC Circuit



Use compatibility table to determine maximum number of luminaires the power supply can support.

Diagram 3 - 0-10 V Dimming - Low Voltage LED Luminaire with d5 Driver on 12-15 V AC Circuit



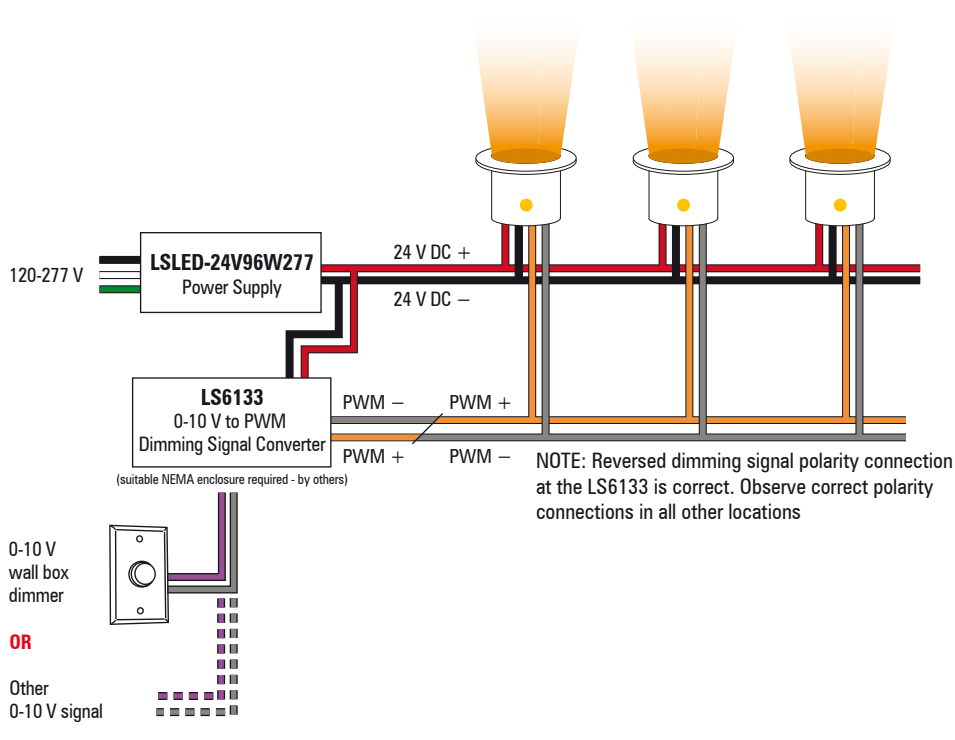
Use compatibility table to determine maximum number of luminaires the power supply can support.

NOTE: The above diagrams are intended to show electrical pathways between luminaires and ancillary devices. These diagrams are not intended to show type or color of cord/wire, wire gauge or approved use of the cord/wire supplied with luminaires.

Consult the luminaire-specific cutsheet or the factory for detailed specifications.



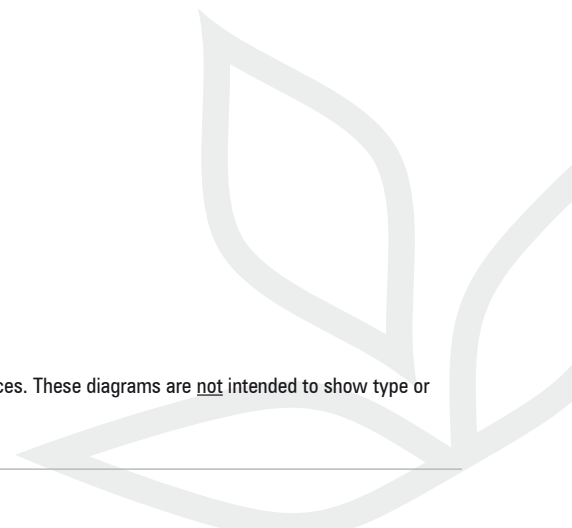
Diagram 4 - 0-10 V Dimming - Low Voltage LED Luminaire with d5 Driver on 24 V DC Circuit



Use compatibility table to determine maximum number of luminaires the power supply can support.

NOTE: The above diagrams are intended to show electrical pathways between luminaires and ancillary devices. These diagrams are not intended to show type or color of cord/wire, wire gauge or approved use of the cord/wire supplied with luminaires.

Consult the luminaire-specific cutsheet or the factory for detailed specifications.



Transformers and Power Supplies for Low Voltage LED Luminaires

The following list of transformers and power supplies are for use with luminaires specifically described as being compatible with either 12 V AC (wirewound only) transformers or with 12-24 V DC power supplies. Compatibility will be noted in the ordering code of the luminaire concerned, and will typically be referenced by Voltage Code '13' or '13-DIM'. In the case of '13-DIM' additional components may be required. Refer to the applicable wiring diagram/s.

Compatibility with each transformer or power supply is indicated by the value mentioned, representing the maximum number of luminaires that may be powered from each transformer or power supply. Please note, this does not take into consideration voltage drop or ampacity limits of the branch circuit. For assistance, please contact factory.

	Wall Mounted Landscape Lighting Transformers			Wall Mounted Transformers				Class 2 Power Supply	Direct Burial Transformer
	LS-TWM-1-300	LS-TWM-2-600	LS-TWM-3-900	LS-TWM-50	LS-TWM-100	LS-TWM-150	LS-TWM-250	LSLED-24V96W277	LS-TDB1-300
Input Voltage	120 V, 60 Hz	120 V, 60 Hz	120 V, 60 Hz	120 V, 60 Hz	120 V, 60 Hz	120 V, 60 Hz	120 V, 60 Hz	120-277 V, 50/60 Hz	120 V, 60 Hz
Output Voltage	12/13/14/15 V 60 Hz	12/13/14/15 V 60 Hz	12/13/14/15 V 60 Hz	12 V, 60 Hz	12 V, 60 Hz	12 V, 60 Hz	12 V, 60 Hz	24 V DC	12.5 V, 60 Hz
Wattage	1 x 300 W circuit	2 x 300 W circuits	3 x 300 W circuits	50 W	100 W	150 W	250 W	96 W	300 W
LS782LED	23	46	69						23

Transformers for Landscape Lighting Applications

LS-TWM-1-300

Magnetic transformer - wall mounted

Input	120 V
Rating	300 W
Output	12/13/14/15 V
Output Circuits	1
Protection	Electrostatic shield, magnetic breaker
Approvals	UL, CUL
NEMA Rating	3R
Construction	Stainless steel
Dimensions	H 17.6" (447 mm) W 6.8" (173 mm) D 6.19" (157 mm)
Weight	27 lb (12.3 kg)

LS-TWM-3-900

Magnetic transformer - wall mounted

Input	120 V
Rating	900 W
Output	12/13/14/15 V
Output Circuits	3
Protection	Electrostatic shield, magnetic breaker
Approvals	UL, CUL
NEMA Rating	3R
Construction	Stainless steel
Dimensions	H 18.6" (472 mm) W 7.8" (198 mm) D 6.19" (157 mm)
Weight	34 lb (15.5 kg)

LS-TWM-2-600

Magnetic transformer - wall mounted

Input	120 V
Rating	600 W
Output	12/13/14/15 V
Output Circuits	2
Protection	Electrostatic shield, magnetic breaker
Approvals	UL, CUL
NEMA Rating	3R
Construction	Stainless steel
Dimensions	H 17.6" (447 mm) W 6.8" (173 mm) D 6.19" (157 mm)
Weight	29 lb (13.2 kg)

LS-TDB1-300

Magnetic transformer - direct burial

Input	120 V
Rating	300 W
Output	12.5 V
Output Circuits	1
Protection	Circuit breaker
Approvals	ETL (US and Canada)
NEMA Rating	12
Construction	Reinforced composite
Dimensions	H 9" (229 mm) W 9" (229 mm) D 7" (178 mm)
Weight	8 lb (3.6 kg)

Control Related Equipment

LS6133

0-10 V to PWM translator - NEMA enclosure required (by others)

Input	24 V DC
Rating	96 W max
Output	4 A max
Output Circuits	1
Approvals	UL, CUL Recognized, Class 2
IP Rating	IP66
Dimensions	H 5.2" (132 mm) W 1.3" (33 mm) D 1" (25 mm)
Weight	0.2 lb (0.1 kg)

LS67100

DMX to PWM translator - dry location only

Input	24 V DC
Rating	4 x 60 W max
Output	4 x 2.5 A max
Output Circuits	4
Approvals	UL, CUL
IP Rating	N/A
Dimensions	H 11.25" (286 mm) W 4.6" (117 mm) D 3.2" (82 mm)
Weight	0.5 lb (0.2 kg)



**SECTION 26 51 00 - LIGHTING FIXTURES
(Café Building Only)**

- A. LED light fixtures:
1. Recessed Fixtures: Comply with NEMA LE 4.
 2. Bulb shape complying with ANSI C79.1.
 3. Lamp base complying with ANSI C81.61.
 4. CRI of minimum 80. CCT as indicated on the fixture schedule.
 5. Rated lamp life of 50,000 hours, minimum at 70 percent lumen maintenance.
 6. Lamps dimmable from 100 percent to 10 percent of maximum light output.
 7. Integral driver. Driver power factor shall be 40 percent or greater. Harmonic distortion shall be less than 10 THD. Drivers shall be equipped with automatic thermal protection and 20 KA surge protection with end of life LED indicator.
 8. Nominal Operating Voltage: as indicated on plans and schedules. Efficiency minimum of 80 lumens per watt.
- B. Linear fluorescent lamps for new light fixtures shall be TB, 3500K of the following manufacturers:
1. General Electric "Starcoat" SP35 Series
 2. Osram/Sylvania "Octron" 735 Series
 3. Phillips TL735 Series
- C. Compact fluorescent lamps for new light fixtures shall be 3500K of the following manufacturers:
1. General Electric "Biax" SPX35 Series (4 pin base)
 2. Osram/Sylvania "Dulux" 835 Series (4 pin base)
 3. Phillips "PL" or "PL-T" 3500K Series (4 pin base)
- D. All lighting fixtures shall be furnished and installed by electrical contractor as indicated on the lighting fixture schedule, including lamps. Lamps shall be of the same manufacturer for all types.
- E. All fixtures shall bear the underwriter's laboratories label and shall be installed according to manufacturer's
- F. Ballasts for linear fluorescent lamps shall be electronic, parallel, instant-start, normal output type, less than 10% THD, CBM and ETL certified, as manufactured by Magnetek, Motorola or Advance.
- G. Ballasts for "T5" compact fluorescent lamps shall be electronic, parallel, instant-start, normal output type, less than 10% THD, CBM and ETL certified, as manufactured by Magnetek, Motorola or Advance.
- H. Ballasts for "T4" compact fluorescent lamps shall be electronic, parallel, rapid-start, normal output type, less than 10% THD, CBM and ETL certified, as manufactured by Magnetek, Advance, Energy Savings, Inc. or Robertson.
- I. Existing fluorescent fixtures noted to be reused shall be cleaned and relamped as indicated on the fixture schedule.
- J. High intensity discharge ballasts shall be constant wattage type.
- K. This contractor shall provide and install all necessary support media for all lighting fixtures including structural steel, angle, rods, etc. in general, fluorescent and high

intensity discharge fixtures shall be supported in a manner acceptable to the local inspection authorities. All fixtures shall be firmly supported from beams or joists.

1. Provide all necessary backing, blocking and supports for wall mounted fixtures.
 2. Fixtures shall not be supported from roof deck.
- L. All fixtures shall be UL listed and approved for the purpose intended.
- M. If required by code, light fixtures shall be Chicago Plenum rated.
- N. Recessed fixtures in fire rated ceiling or supply air plenums shall be approved for the fire rating of the ceiling. Provide air-tight gaskets to seal around openings.
- O. All adjustable fixtures shall be aimed and adjusted during evening hours to the satisfaction of the architect.

END OF SECTION

SECTION 26 60 00 - FAULT CURRENT STUDY

- A. The fault current study shall be performed by the distribution equipment manufacturer. The study shall be submitted to the engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture. If formal completion of the study may cause delay in equipment manufacture, approval from the engineer may be obtained for a preliminary submittal of sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.
- B. The fault current study shall be performed with the aid of a "Windows 95" based computer program.
- C. The input data shall include the power company's fault current contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected and other source impedances.
- D. Short circuit momentary duty values and interrupting duty values shall be calculated on the basis of three phase bolted short circuits at each switchgear bus, switchboard, distribution panel, branch circuit panel, and other significant locations through the system. The short circuit tabulations shall include symmetrical fault currents and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.

END OF SECTION

SECTION 26 61 00 - TELEPHONE SYSTEM

- A. Electrical contractor to provide telephone service conduit or duct to telephone board as shown on plans. Service conduit size and quantity shall be as determined by local telephone company.
- B. This contractor shall provide and install all conduits with pull wires, outlet boxes, metal cabinets and pull boxes. Provide a complete conduit system with pull wire as indicated on drawings.
- C. All plates shall be standard telephone type with jack. Provide plates of same material and finish as specified for receptacles. Wall phone plates shall have mounting studs.
- D. Provide plywood terminal board as shown on drawings.
- E. A conduit run shall have not more than three (3) bends in a run between outlet boxes or between outlet box and a metal cabinet or pull box. When a run requires more than three (3) bends, a pull box of suitable size shall be placed in suitable location to meet the above conditions.

END OF SECTION

SECTION 27 05 00 - TECHNOLOGY GENERAL PROVISIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The provisions of the Instructions to Bidders, General Conditions, Supplementary Conditions, Alternates and Addenda are a part of this Specification. Contractors and Subcontractors shall examine these provisions as they may affect work under this Division.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Contractor shall examine Division I Specifications for general project requirements.
- B. Contractor shall also examine all other Division Specifications that may affect work under this Division. Contractor shall be responsible for Technology work included in these Specifications.

1.3 DESCRIPTION OF WORK

- A. Technology, Electrical, Architectural, HVAC and Structural and all other Drawings as well as the Specifications for all the Divisions shall be defined as the Contract Documents. Contractor shall review entire set of Contract Documents prior to bidding.
- B. Drawings and Specifications are to be considered as supplementing each other. Work specified but not shown, or shown but not specified, shall be performed or furnished as though mentioned in both the Specifications and the Drawings.
- C. Visit the site of the work and become familiar with the conditions affecting the installation. Submission of a proposal shall presuppose knowledge of such conditions and no additional compensation shall be allowed where extra labor or materials are required because of ignorance of these conditions.
- D. Proposal shall include any special phasing requirements related to the construction work as described in the Division I Specifications.
- E. Extra costs which might result from deviations from the Drawings, so as to avoid interferences, shall be considered a "Job Condition", and no additional compensation shall be considered applicable. In the event that such interferences occur in course of the Work, due to an error, omission, or oversight by the Contractor, no additional compensation shall be allowed.
- F. Interferences that may occur during the course of construction shall be brought to the immediate attention of the Architect and Engineer, and the Architect and Engineer's decision, confirmed in writing, shall be final.
- G. Definitions:
 - 1. "Other Technology Systems Contractors" refers to providers of other low voltage

- systems that do not fall under the responsibility of this Division.
2. The term "furnish" shall mean to supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
 3. The term "install" shall mean work which includes the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
 4. The term "provide" shall mean to furnish and install, complete and ready for the intended use.
 5. The term "Contract Documents" shall refer to the complete set of Drawings and Specifications for all Divisions included in the project.
 6. The term "continuous pathway" shall mean any hard pathway such as conduit, cable tray, cable runway and/or metallic or non-metallic raceway extending greater than five (5) feet.
 7. The term "non-continuous pathway" shall mean any pathway constructed by means of installing a device repeatedly along the run of cabling to provide support for that cabling such as J-hooks, etc.
 8. "RCDD" shall be defined as Registered Communication Distribution Designer.
 9. "BICSI" shall be defined as Building Industries Consulting Services International.
 10. One EIA rack space or panel height (denoted as I U) shall be defined as being 1.75 inches in height.
 11. The term "Mechanical" shall refer to the HV AC, Plumbing and Fire Protection Divisions as applicable.

1.4 CONTRACTOR QUALIFICATIONS

- A. The Contractor shall be fully qualified to perform installations as described on the Contract Drawings and within these Specifications. The following qualifications apply to all Low Voltage Systems, unless otherwise specified in the individual Specification Section.
- B. The Contractor shall have been active in bidding, being awarded, and performing work consistent with that which is indicated on the Contract Documents for a period not less than five (5) years.
- C. The Contractor shall possess current certifications by the manufacturer for the installation and maintenance of all systems being provided.
- D. The Contractor shall possess current BICSI certifications for the installation and maintenance of all Structured Cabling and associated equipment being provided.
- E. The Contractor shall maintain an installation staff whose sole function is the installation of Structured Cabling and associated equipment and shall not utilize additional personnel obtained by means of a temporary placement or staffing agency.
- F. The Contractor shall not utilize apprentice or trainee personnel for the pulling or termination of Structured Cabling. Furthermore, apprentices or trainees may only assist in the pulling of Structured Cabling. The primary laborer for the pulling of Structured Cabling must be a certified installer.

- G. All installation personnel assigned to the task of pulling or terminating cabling shall possess a current certification by BICSI and/or the manufacturer of the cabling products being installed.
- H. The Contractor's installation staff shall consist of 85% certified installation personnel. The remaining shall be either apprentice installation personnel or laborers under full time employment by the Contractor. Of the certified staff, 40% shall be Journeymen BICSI Installers. The remainder shall be BICSI Level I or Level II Installers. The Engineer reserves the right to wave these requirements.
- I. The Contractor shall have a dedicated RCDD assigned to the project, as Project Manager, who shall be the sole point of contact for the Engineer or Owner. The RCDD Project Manager shall provide regular project updates to the Engineer as to percentage of job completed broken down by category of work, for example, horizontal cabling, backbone copper, backbone fiber, system A, system B, etc., the status of any unforeseen circumstances, and/or changes to the project design necessitated by field conditions.
- J. The Contractor shall, with bid qualification, submit the following information for review.
 - 1. An unaltered copy of the Project Manager's RCDD Certificate.
 - 2. An unaltered copy of the Contractor's certification by the respective structured cabling manufacturer for the installation, testing and warranty of the materials being installed.
 - 3. Unaltered copies of any and all other certifications required herein, including, but not limited to data network electronics, telephone system, audio/visual systems, etc.
 - 4. Allowance pricing as described elsewhere in these Specifications.
 - 5. Alternate pricing as described elsewhere in these Specifications.
 - 6. A list of sub-contractors with key contact information and all certification information as described elsewhere in these Specifications.
 - 7. A list of assumptions and or exceptions utilized while compiling the Bid submission.

1.5 FIELD ENGINEERING AND PROJECT MANAGEMENT

- A. It shall be the responsibility of the Contractor to provide all cable path engineering required by unforeseen field conditions.
- B. The Contractor shall inform the Engineer as to changes in design required by field conditions, as soon as possible, prior to installation. Arbitrary changes in the design is unacceptable, and shall be reworked to the extent of removal and re-installation based on the original design, unless pre-approved in writing by the Engineer, or proven necessary due to the unforeseen field conditions.
- C. Other Technology Systems Contractors, whose systems will utilize the Structured Cabling System, shall certify the design of the structured cabling system according to the specifications of the equipment being installed.

Prior to installation, the Contractor shall verify this certification with the Other Technology Systems Contractors, and inform the Engineer immediately of any disparity in the design. Should the installation prove unable to support a given

system, and the system vendor has not signed off on the cabling design, the cost of any required rework of the cabling installation shall become the responsibility of the Contractor and the Vendor to resolve at no additional cost to the Owner.

- D. Additional engineering, diagrams, records, and project management shall be provided as described elsewhere in the Specifications. Diagrams and records shall be coordinated to avoid duplication of efforts and to consolidate documentation.
- E. It shall be the responsibility of the Contractor to identify and notify the Engineer immediately of any issues causing the cabling and/or equipment to be installed in such a way as to cause that part of the installation to be in violation of the accepted standards and practices governing these types of installations. Failure to do so shall place the burden of the necessary repairs on to the Contractor.

1.6 WORK INCLUDES

- A. The Contractor shall review the Electrical and Technology Contract Documents to fully understand the scope of work required. Any questions shall be submitted to the Engineer in writing prior to the bid submission. After this time, the Owner, Engineer and Architect shall not be liable for additional Work required due to the misunderstanding or misinterpretation of these requirements.
- B. Include all labor, material, equipment, services and permits necessary for the proper completion of all work shown. Items omitted, but necessary, to make the Technology Systems complete and workable shall be understood to form part of the work.
- C. Material for work required by the Contract Drawings and Specifications such as earthwork, concrete, masonry, reinforcing steel, patching and painting shall be provided as specified in other applicable Divisions covering such work.
- D. It is the purpose of the Drawings to indicate the approximate location of all equipment and devices. Ascertain exact locations, and arrange work accordingly. The right is reserved by the Engineer to effect reasonable changes in the location of devices up to the time of roughing-in, without additional cost to the Owner. Changes in location of devices, or equipment, necessitated by interference with the work of other trades shall be made only with the consent of the Architect's or Owner's Representative, and at no additional cost. Changes in location of devices resulting from the Contractor's failure to comply with Drawing or Specification requirements shall be made at no additional cost to the Owner.
- E. The Technology Design is based on the BICSI Telecommunications Distribution Methods Manual (TDMM), Customer-Owned Outside Plant Design Manual (OSP), the National Electrical Code (NEC), as well as other recognized industry standards. The Contractor shall include the cost of installing materials and equipment necessary to satisfy local, state and regional codes, as well as the requirements of good installation practices as defined in the TDMM and OSP, by BICSI and the organizations referenced therein.
- F. Include all testing, test reports, system programming, start-up reports and warranties for each system as outlined elsewhere in these Specifications. Refer to "Operating Maintenance Manuals" for additional requirements.

- G. Work includes:
1. New Horizontal Copper Cabling
 2. New Continuous/Non-Continuous Pathways
 3. New Racks and/or Related Hardware
 4. New Wall Fields
 5. Cable Runways
 6. Fire stopping
 7. Technology Grounding System Material
 8. Infrastructure for city camera Surveillance System
 9. New Speaker System

1.7 CODES, STANDARDS AND FEES

- A. Secure and pay for permits and inspections required for the technology work. Turn over certificates of approval to the Owner promptly when received, and before payment is made for the work.
- B. Give proper authorities notice as required by law relative to the work in their charge. Comply with the regulations regarding temporary enclosures, obstructions or excavations and pay all legal fees involved.
- C. Provisions of the latest revisions to the following codes and standards shall be followed where applicable:
1. Ohio Building Code, 2014 with amendments
 2. National Fire Protection Association (NFPA):
 - a. NFPA 70 -National Electrical Code, 2014
 3. ANSI -117.1 -Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped
 4. Federal Occupational Safety and Health Act (OSHA)
 5. American National Standards Institute (ANSI)
 6. National Electrical Manufacturers Association (NEMA)
 7. Institute of Electrical and Electronic Engineers (IEEE)
 8. American Society of Testing and Materials (ASTM)
 9. Underwriters Laboratories, Inc., Standards for Safety (UL)
 10. Americans with Disabilities Act (ADA)
 11. Codified Ordinances of the City of Cleveland, Title XII: Cleveland Building
 12. Code chapters 3131 HVAC, 3133 Gas Piping and Appliances, 3137 Electrical Wiring and 3139 Refrigeration, Ohio Building, Mechanical, Plumbing, Fire Codes

1.8 COORDINATION WITH OTHER TRADES

- A. Consult the drawings, product data and shop drawings covering the work for various other trades, the field layouts of the contractors for the trade and make adjustments accordingly in laying out the technology work.
- B. Keep fully informed of the progress of the general construction. Install work that is to be concealed within the building construction in sufficient time to secure proper location without delay to the work of other trades.
- C. Examine the work of other trades when it comes in contact with, or is covered by work in this Division. Do not attach to, cover up, or finish against any defective work,

- or install work in a manner that will prevent proper installation of the work of other trades.
- D. All faceplates and other outlets shall be centered with regard to paneling, trim equipment, etc., and shall line up with either bottom or top of masonry courses. Any change in the specified mounting height of any device, shall be approved by the Architect or Owner's representative before rough-in.
 - E. Take all field measurements necessary and assume responsibility for their accuracy.
 - F. Coordination Drawings:
 - 1. Before beginning construction of the Project, the Contractor shall provide to the other project Contractors (electronic drawings) (marked-up prints) indicating all technology pathways, including cable trays and conduit over 1/2". These drawings shall be used to coordinate conflicts with work of the other Contractors.
 - 2. After the coordination drawings are corrected and complete, the Contractor shall provide a set to the Engineer for review. The Engineer and Owner retain the right to require the Contractor to correct unacceptable installations due to the lack of adhering to the reviewed coordination drawings. The entirety of the financial responsibility for these corrective actions shall be born by the Contractor.
 - G. The Technology Contractor shall coordinate with the Electrical Contractor regarding the provision of continuous pathways to be utilized by the Technology Contractor. Should discrepancies arise between the Electrical and Technology Contract Documents, the Engineer shall be made aware of the discrepancies and shall determine the appropriate resolution. Should the Contractors be able to resolve the discrepancy, the Technology Contractor shall provide necessary documentation to the Technology Engineer with regards to the resolution made.

1.9 GUARANTEE AND WARRANTIES

- A. Warrant that all equipment and work is installed in accordance with good engineering and installation practices. Furthermore, warrant that all equipment will meet the requirements specified, as well as other criteria which may not be explicitly documented in these Specifications, but which are accepted as industry standards, as published by ANSI, EIA/TIA, IEEE and BICSI.
- B. Any device or equipment failing to perform or function as specified shall be replaced with complying equipment without cost to the Owner.
- C. Guarantee against defects in workmanship and materials: repair or replace any defective work, material or equipment within two (2) years from date of formal written acceptance by the Owner. An additional product warranty provided by individual equipment manufacturers shall supersede this two year workmanship and materials guarantee for installation of the appropriate equipment, as described in the individual section.
- D. The Contractor, within ten (10) business days of project completion shall fully complete and submit all documentation to the manufacturer as required to implement

the extended warranty period. Coordinate guarantee and warranty requirements with Division 1 Specifications.

PART 2 PRODUCTS

2.1 MATERIAL SUBSTITUTIONS

- A. Bids shall be based upon the specified products or listed alternatives.
- B. Substitutions are not acceptable unless otherwise indicated within these Specifications. Voluntary deduct alternates may be submitted for reference only. It is at the sole discretion of the Owner and their representative to accept any such voluntary deduct alternates. Submission of such a voluntary deduct alternates does not release the Contractor from submitting any part of the required material and equipment. Should the Contractor not choose to submit a price for a portion of the project, the submission shall be considered incomplete, and as such become disqualified.
- C. Where only one manufacturer or supplier is named in the Contract Documents, the system or equipment shall be provided as specified.
- D. Verbal requests or approvals shall not be binding on the Architect, Engineer or Owner.

2.2 EQUIPMENT AND MATERIAL

- A. Equipment and materials used on this project shall be UL Listed for the intended application.
- B. Provide materials and labor for items neither drawn nor specified, but are obviously a component part of, and necessary to complete the work, and are customarily a part of the work of similar character.
- C. Contractor is responsible to verify quantities for all technology equipment, cabling, components and materials prior to submitting a bid. The Contractor shall accept full responsibility to accurately estimate the Work and Materials based on the Specifications and Drawings.
- D. Equipment and materials for the construction shall be the responsibility of the Contractor and shall be protected by same until formally accepted by the Owner.
- E. All manufacturers of technology infrastructure and equipment shall verify to the satisfaction of the Contractor and Engineer that their equipment will function properly under the conditions of use, as shown on the Drawings and as specified herein. Dimensions, weights, operating characteristics and all other related appurtenances, shall be verified before submittal of shop drawings.

2.3 SUBMITTALS

- A. Prepare shop drawings and product data sheets for equipment with adequate details and scales as necessary to clearly show construction. Indicate operating

characteristics for each required item and design conditions, including but not limited to, worse case ETL test results for the specified connectivity solution for each. Contractor shall review each submittal prior to submission, and check for compliance with the Contract Documents. Corrections shall be noted. Mark with approval stamp prior to submission. Submittals that do not bear the Contractor's approval stamp will be returned without action.

- B. Shop drawings and product data shall include:
1. Cabling
 2. Faceplates
 3. Modular Connectors
 4. Patch Panels
 5. Punch Down Blocks
 6. Racks
 7. Speaker System Equipment
 8. Technology Grounding System Materials
- C. The submittals will be reviewed only for general compliance and not for dimensions, quantities, etc. The submittals that are returned shall be used for procurement. The responsibility of correct procurement remains solely with the Contractor. The submittal review shall not relieve the Contractor of responsibility for errors or omissions and deviations from the Contract requirements.
- D. If the submittal shows variations from the requirements of the Contract Documents for any reason, the Contractor shall fully note and explain such variations in the letter of transmittal.
- E. The Contractor shall note in red on the submittal any change in design or dimension on the items submitted including changes made by the manufacturer that may differ from catalog information.
- F. The Contractor agrees that shop drawings submittals, processed by the Engineer, are not change orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design intent of the project. His understanding is demonstrated by indicating which equipment and material is required, and by what methods of fabrication and installation will be utilized. The Contractor further agrees that if deviations, discrepancies or conflicts between the shop drawing submittals and the Contract Documents are discovered, either prior to or after shop drawings submittals are processed by the Engineer, the Contract Drawings and Specifications shall take precedence over all submittals and shall be followed.
- G. Shop drawings and product data shall be submitted as follows:
1. Conform to submittal requirements outlined in Division I Specifications. Provide the required quantity of product data submittals.
 2. Where the contents of submittal literature include data not pertinent to the submittal, clearly indicate (highlight) which portion of content is being submitted for review.

- H. Where additional wiring diagrams or other drawings are required, they shall be submitted at the same time with shop drawings and product data. Partial submittals are not acceptable.
- I. Submittals not required under this Division shall be returned to the Contractor. Incomplete or inappropriate submittals shall be returned to the Contractor without review.

2.4 RECORD DRAWINGS

- A. The Contractor shall keep one complete set of the Contract Working Drawings on the project site on which shall be recorded any deviations or changes from such Contract Drawings made during construction. The updated Contract Drawings shall become "Record Drawings" of the completed construction. Record Drawings shall show changes including:
 - 1. Size, type, capacity, etc. of any material, device or equipment.
 - 2. Location of equipment.
 - 3. Location of any outlet or device and associated wiring.
 - 4. Routing of any pathway and/or cabling.
 - 5. Equipment, device or cabling nomenclature.
 - 6. Port number assignments.
- B. Record Drawings shall indicate the location of all concealed Telecommunications and Network Service conduits. Record Drawings shall include any additional information required by TIA/EIA 606 and related standards.
- C. After the project is completed, the Record Drawings shall be delivered to the Architect in good condition, as a permanent record of the installation as constructed.
- D. Refer to individual Specification Sections for additional Record Drawing requirements.

2.5 EQUIPMENT IDENTIFICATION

- A. Provide nameplates, identification tags and other means of administration as indicated elsewhere in these Specifications and on the Drawings. Identification shall be provided in accordance with EIA/TIA 606 standards.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. Workmanship shall be in accordance with the best practices of the trade. Technology work shall be installed by certified cable installers, under the supervision of an RCDD.

3.2 CLEANING, FINISHING AND CLOSEOUT

- A. After all tests and adjustments have been completed, clean all equipment leaving everything in working order at the completion of this work. Clean racks, patch panels,

punch down blocks, faceplates, panel cabinet interiors and exteriors, etc., of dirt, dust, debris and paint, after all other trades have completed their work.

- B. All debris created by the execution of this work shall be removed as directed by the Architect or Owner.
- C. Refer to Division I Specifications for closeout procedures.

3.3 OPERATING AND MAINTENANCE MANUALS

- A. Furnish complete bound sets of Operating / Maintenance Manuals. Refer to Division I Specifications for quantities and for additional requirements.
- B. Each Operating/Maintenance manual shall be assembled into one book.
- C. Bind the required material into a hard-backed binder where they can be accommodated into 8-1/2" x 11" size. Material shall be assembled as follow unless otherwise directed in Division I Specifications:
 - 1. First Page ---Title of Project, Owner, Address, Date of Submittal, Name of Contractor and Name of Engineer.
 - 2. Second Page ---Index.
 - 3. First Section ---Written list of items requiring service and either state the service needed or refer to the manufacturer's data in the binder that describes the proper service.
 - 4. Second Section ---A copy of each submittal drawing and catalog data sheet with an index at the beginning of the section.
 - 5. Third Section ---A copy of each manufacturer's operating and maintenance instructions with an index at the beginning of the section, and a copy of each manufacturer's start up report.
 - 6. Fourth Section ---A copy of each wiring diagram utilized in the installation.
 - 7. Fifth Section ---A copy of all test results performed by the Contractor. Provide both hard copy and electronic copy as required for certification of equipment, cabling and devices.
 - 8. Sixth Section ---Copies of all warranties, approvals, etc.
- D. Refer to individual Specification Sections for additional Operating / Maintenance Manual requirements.
- E. Submit one copy to the Engineer for approval. After approval, submit the required quantity of copies to the Architect for delivery to the Owner. Engineer shall retain one copy.
- F. Include electronic documentation as detailed elsewhere in these Specifications. At the request of the Owner, electronic documentation shall be converted to formats readable to the Owner.

3.4 PROJECT COMPLETION

- A. Project completion shall be defined at a minimum by the following requirements.
 - 1. The Contractor shall submit of all applicable test results and proof of performance results to the Engineer for review and written acceptance.

2. The Contractor shall provide demonstration of system performance to the Engineer and, as necessary, the Owner, as required elsewhere in these Specifications. Upon completion of each system demonstration, the Engineer with the approval of the Owner shall provide a written acceptance of each system.
 3. The Contractor shall submit all test results, or other requirements, necessary to commence the warranty periods for all equipment and devices as provided under the scope of this Work. The Contractor shall, upon request by the Engineer or Owner, provide proof of these submissions.
 4. The Engineer shall, as a part of their final review of the project, complete a "Final Punch List". The Contractor shall rectify all items on this list, or at the discretion of the Owner provide a credit back to the Owner based on unit pricing garnered at the time of the bid. If no such unit pricing is available, a mutually agreed upon price, based on current recognized market value shall be utilized.
- B. The Contractor shall complete any and all requirements listed elsewhere in these Specifications. Any additional effort required at the time of the final walk-through due to the lack of submittals during the construction process shall cause forfeiture of the final retainage either in part or in whole based on the degree of additional effort required. The exact nature of the magnitude of this forfeiture is at the discretion of the Engineer.

END OF SECTION 27 05 00

SECTION 27 41 00- AUDIO SYSTEMS

PART 1 -GENERAL

1.1 DESCRIPTION

- A. Provide all labor, material, equipment, tools, and services necessary for, and incidental to, the proper installation of the audio system herein specified and as shown on the Construction Documents.
- B. References
 - 1. Underwriters Laboratories (UL):
 - a. UL 508 - Industrial Control Equipment American National Standards Institute (ANSI)
 - 2. National Fire Protection Association (NFPA):
 - a. NFPA 70 - National Electric Code
 - 3. American National Standards Institute (ANSI):
- C. AV Contractor Requirements
 - 1. Must be authorized dealer for specified equipment
 - 2. Must have AVIXA APEX certification
 - 3. Qualified Companies must have full time CTS-D engineer and CTS-I installer on staff
 - 4. Install work must be provided by awarded AV contractor and not sub-contracted

1.2 RESPONSIBILITY AND RELATED WORK

- A. The systems described in this section will be called the "AV Systems" and the installer will be named "The AV Contractor." The AV Contractor will provide all labor, materials, equipment, necessary tools, test equipment, hoisting, transportation, supervision and coordination necessary to complete the installation of the "AV Systems" as described in these specifications and illustrated on the Project drawings.
- B. The Contract Documents are intended to include or imply all items required for the proper execution and completion of the work. Any item of work required by the Specifications or other portion of the Contract Documents but not shown on the drawings, or shown on the drawings but not specifically required in the
- A. The AV Contractor shall provide minor accessories, such as connectors, adapters, matching devices and equipment items needed for a complete system, even if not specifically mentioned herein or on the drawings, without claim for additional payment.
- C. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the AV Contractor to supply systems in full working order. Notify Consultant of any discrepancies in part numbers or quantities prior to bid submittal. Failing to provide such notification, the AV Contractor shall supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.

- A. If a conflict is identified between the contract documents and the appropriate codes and is reported to the Owner and confirmed prior to bid opening, Consultant will prepare the necessary clarification or revision.
- B. When a conflict is reported after contract award, the AV Contractor shall propose a resolution of the conflict and, upon approval, perform related work.
- C. The AV Contractor will be responsible for connecting ground point to all AV equipment in accordance with applicable national and local codes, standards specified.
- D. The AV Contractor shall be responsible for all audio DSP programming for all AV systems described within the Contract Documents.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be stored to protect them from damage prior to installation. Material shall not be stored directly on the ground or floor and shall be kept as clean and dry and free from damage or deteriorating elements.
- B. Deliver products to project properly identified with names, types, grades, compliance labels and similar information needed for distinct identification. Materials must be adequately packaged or protected to prevent deterioration during shipment, storage and handling.

1.4 SUBMITTALS

- A. Submittal Schedule
 - 1. Within thirty (30) days of contract award, the Contractor shall submit a complete list of products he intends on furnishing with manufacturer and catalog designations, along with currently quoted lead times for delivery of same. Should the Contractor anticipate that the delivery schedule of any specified product may adversely impact the construction schedule, he shall bring it to the attention of the Architect or Owner's Representative at this time.
- B. Shop Drawings should include:
 - 1. Manufacturer cut sheets for each component
 - 2. Bill of materials listing each component
 - 3. Cad renderings of the device with the precise dimensions
 - 4. Network diagrams
 - 5. System schematic/riser diagram
- C. Quality Assurance
 - 1. Manufacturer: Minimum 10 years of experience
 - 2. All devices are 100% factory function tested prior to delivery
 - 3. All power components UL listed for required loads
- D. Substitutions
 - 1. Voluntary product substitutions from the Contractor will not be considered.

1.5 CLOSEOUT SUBMITTALS

- A. Submit closeout manual and documentation
 - 1. Warranty
 - 2. Technical Support Contact
 - 3. Manual

PART 2 -PRODUCTS

2.1 Manufacturer

- A. Provide basis of design system by D&B Audio
 - 1. System pricing has been obtained by the Design team prior to the bid and shared with the Owner.
- B. Provide Basis of design by JBL for distributed 70v audio system

2.2 Guarantees

- A. The Contractor shall warrant new equipment to be free of defects in materials and workmanship for not less than one year after date of Substantial Completion. Defects occurring in labor or materials within one-year warranty shall be rectified by replacement or repair. Within the warranty period, provide answer to service calls and requests for information within a 24-hour period, and repair or replace any faulty item within a 72-hour period without charge, including parts and labor. This warranty period does not extend to any existing equipment which is reused in the project
- B. This warranty will not void specific warranties issued by manufacturers for greater periods of time. Nor will it void any rights guaranteed to the Owner by law.
- C. The AV Contractor shall provide Owner with exact beginning and ending dates of the warranty period. Include the name of the person to call for service and telephone number. This information to be part of Project Record Set.
- D. The AV Contractor shall provide a final site visit and verification that the system is operational and all items are functioning correctly at the end of the warranty period. The Contractor shall not be responsible for correcting items that have obviously been changed by the Owner or end user.

2.3 Products

- A. DS10
 - 1. General
 - a. The device shall act as a 16 output channel break-out box connecting the Dante audio network to the AES3 digital audio standard.
 - b. In addition, 4 x AES3 input channels shall be provided, including Sample Rate Converters (SRC).
 - c. A Bypass/Network switch shall be provided to allow the device to be used either as a AES3 distribution amplifier (Bypass) or as a normal Dante device (Network) in conjunction with Dante Controller. The device shall provide a 5-port Ethernet switch for different network

- topologies, redundancy and advanced functions, including Multicast filtering and VLAN modes.
- d. The device shall support four different switch modes which shall be accessible within Dante Controller to allow different applications and network topologies.
 - e. The device shall provide meta data (e.g. Dante channel labels) via the AES3 output streams, and these meta data shall be interpretable by d&b audiotechnik 4-channel amplifiers (10D, 30D, D20, D80).
 - f. The device shall provide Overvoltage Protection for voltages up to 400 V.
 - g. The dimensions (HxWxD) shall not exceed 1RU x 19" x 232 mm (1RU x 19" x 9.1") and shall weigh no more than 3.75 kg (8.26 lb).
- B. Loudspeaker (Yi8)
- 1. General
 - a. The 2-way dipolar, passive loudspeaker shall consist of two 8" low frequency drivers with a neodymium magnet assembly and one 1.4" exit neodymium compression driver with a 3" diaphragm mounted to a dedicated wave shaping device and a passive crossover network.
 - b. The loudspeaker shall only be operated by a dedicated, compatible controller amplifier.
 - c. The cabinet enclosure shall be made from marine plywood with an impact and weather protected PCP (Polyurea Cabinet Protection) finish.
 - d. The drivers shall be protected by a rigid metal grill backed by an acoustically transparent foam.
 - e. The cabinet shall incorporate a three point rigging system for the assembly of vertical line source arrays of up to 24 cabinets in conjunction with a dedicated flying frame.
 - f. The cabinet shall incorporate two M10 threaded inserts on the top and bottom panel for the secure attachment of dedicated mounting brackets.
 - g. The connection panel on the back shall be recessed and fitted with two speakon NL4 M sockets and a two pole screw terminal block. A cover plate for protection of the connection panel shall be included.
 - h. The loudspeaker shall have a nominal horizontal dispersion angle of 80°. The vertical dispersion angle of the assembled array shall be determined by the geometry of the splay angles between the cabinets, which shall be adjustable in a range of 0° to 14° in 1° increments.
 - i. The power handling capacity shall be 400 W RMS and 1600 W peak (10 ms). The frequency response (-5 dB) measured on axis shall be 54 Hz to 19 kHz with a maximum sound pressure of at least 139 dB.
 - j. The dimensions (WxHxD) shall not exceed 630 x 257 x 375 mm (24.8" x 10" x 14.8") and shall weigh no more than 20 kg (44 lb)
 - k. Shall weatherized and painted to customer specifications
 - l. Shall include weatherized speaker covers for 24/7/365 use
- C. Loudspeaker (Yi10P)
- 1. General
 - a. The 2-way dipolar, passive loudspeaker shall consist of two 8" low frequency drivers with a neodymium magnet assembly and one 1.4" exit neodymium compression driver mounted to a rotatable CD horn and a passive crossover network.
 - b. The loudspeaker shall only be operated by a dedicated, compatible controller amplifier.

- c. The cabinet enclosure shall be made from marine plywood with an impact resistant black paint finish.
Special colours according to RAL table and a weather resistant option shall be available upon request.
The drivers shall be protected by a rigid metal grill backed by an acoustically transparent foam.
The cabinet shall incorporate two M10 threaded inserts on the top and bottom panel for the secure attachment of dedicated mounting brackets.
 - d. The connection panel on the back shall be recessed and fitted with two speakon NL4 M sockets and a two pole screw terminal block. A cover plate for protection of the connection panel shall be included
 - e. The HF horn shall have a nominal dispersion of 110° x 40° (h x v).
 - f. The power handling capacity shall be 400 W RMS and 1600 W peak (10 ms). The frequency response (-5 dB) measured on axis shall be 59 Hz to 18 kHz with a maximum sound pressure of at least 136 dB.
 - g. The dimensions (WxHxD) shall not exceed 257 x 580 x 341 mm (10" x 22.8" x 13.4") and shall weigh no more than 18 kg (40 lb).
 - h. Shall weatherized and painted to customer specifications
 - i. Shall include weatherized speaker covers for 24/7/365 use
- D. Loudspeaker (Y112)
- 1. General
 - a. The 2-way dipolar, passive loudspeaker shall consist of two 8" low frequency drivers with a neodymium magnet assembly and one 1.4" exit neodymium compression driver with a 3" diaphragm mounted to a dedicated wave shaping device and a passive crossover network.
 - b. The loudspeaker shall only be operated by a dedicated, compatible controller amplifier.\
 - c. The cabinet enclosure shall be made from marine plywood with an impact and weather protected PCP (Polyurea Cabinet Protection) finish.
The drivers shall be protected by a rigid metal grill backed by an acoustically transparent foam
 - d. The cabinet shall incorporate a three point rigging system for the assembly of vertical line source arrays of up to 24 cabinets in conjunction with a dedicated flying frame.
The cabinet shall incorporate two M10 threaded inserts on the top and bottom panel for the secure attachment of dedicated mounting brackets.
 - e. The connection panel on the back shall be recessed and fitted with two speakon NL4 M sockets and a two pole screw terminal block. A cover plate for protection of the connection panel shall be included.
 - f. The loudspeaker shall have a nominal horizontal dispersion angle of 120°. The vertical dispersion angle of the assembled array shall be determined by the geometry of the splay angles between the cabinets, which shall be adjustable in a range of 0° to 14° in 1° increments.
 - g. The power handling capacity shall be 400 W RMS and 1600 W peak (10 ms). The frequency response (-5 dB) measured on axis shall be 54 Hz to 19 kHz with a maximum sound pressure of at least 139 dB.
 - h. The dimensions (WxHxD) shall not exceed 630 x 257 x 375 mm (24.8" x 10" x 14.8") and shall weigh no more than 20 kg (44 lb).
 - i. Shall weatherized and painted to customer specifications
 - j. Shall include weatherized speaker covers for 24/7/365 use

- E. Amplifier (D80)
1. General
 - a. The amplifier shall be four channel incorporating digital signal Dprocessors (DSP) to provide loudspeaker specific configurations and functions and dedicated protection circuits. It shall be equipped with digital and analog signal inputs as well as link outputs, remote control and monitoring capabilities via CAN-Bus or Ethernet (OCA). User interface shall be via a TFT color touch screen in conjunction with a digital rotary encoder and via remote.
 - b. Four input and input link connector shall be provided while two of the connectors shall be configurable for analog or digital (AES3) audio signals.
 - c. Analog inputs shall be electronically balanced with an input impedance of 38 kOhm while the analog link output is linked in parallel to the analog input connector.
 - d. The digital inputs shall be transformer balanced with an input impedance of 110 ohm while the digital link output shall be electronically balanced providing analog signal buffering (refresh) and power fail relay (Bypass).
 - e. Sampling shall be 48 / 96 kHz / 2 Ch/n and Word-Sync: PLL-locked to source (slave mode) synchronization.
 - f. Signal processing shall utilize 96 kHz sampling rate with 27 Bit ADC / 24 Bit DAC conversion while the latency shall not exceed 0.3 msec.
 - g. The output connector options shall be 4 x NL4 or 4 x EP5. A four channel out connector (NL8) shall be provided for loudspeaker multicore purposes.
 - h. Output configurations shall be selectable for dual channel, mixed top/sub and 2-way active modes.
 - i. It shall incorporate two user definable 16-band equalizers for independent application to each channel allowing parametric filters, notch, hi- and lo- shelf filters as well as asymmetric filters.
 - j. A signal delay capability of up to 10 sec. (3440 m / 11286 ft) shall be incorporated for independent application to each channel.
 - k. Compensation for cable length shall be incorporated to improve impulse response.
 - l. It shall contain a signal generator offering pink noise or sine wave program.
 - m. Load monitoring and system check functions shall be included to ascertain the status of the loudspeaker impedance. Load monitoring shall allow impedance monitoring to determine the status of an LF or HF driver in systems with multiple elements, even if these are crossed over passively.
 - n. Input monitoring shall be included to allow detection of incoming pilot signals.
 - o. A Fallback function shall be available to enable the definition of primary (Regular) and secondary (Fallback) signal paths for analog and digital input signals with two different modes (Manual or Auto). It shall ensure that any secondary or emergency signal fed to the Fallback inputs is transmitted when required.
 - p. The Override function shall be available to allow a dedicated analog input to be set as a major signal path with highest priority for general messages or emergency services.
 - q. An AutoStandby function shall automatically switch the amplifier to Standby mode after a predefined time when the incoming signal level at the individually specified inputs drops below a defined threshold. The function shall be independent of the mute status of the respective

channels. An AutoWakeup function shall automatically repower the amplifier, when an input signal is present and exceeds a defined threshold.

- r. A switch mode power supply shall be incorporated and allow automatic mains range selection for use with 220 - 240 V AC and 100 - 120 V AC, 50 - 60 Hz mains power supply voltages. Mains voltage monitoring, mains inrush current limiter, self-resetting overtemperature, under- and overvoltage protection shall be incorporated as well as mains current limiting
- s. Power factor compensation (PFC) shall be incorporated to provide a clean and efficient sinusoidal current draw.
- t. It shall have temperature and signal controlled fans for cooling the internal assemblies.
- u. The power amplifier channels shall have ground fault protection, output pop-noise suppression, DC offset protection, output HF voltage limitation, output current limitation/protection and self-resetting overtemperature protection.
- v. The output power shall be: 4 x 2600/2000 W into 4/8 ohms at a crest factor (CF) of 6 dB, 4 x 4000/2000 W into 4/8 ohms at a crest factor (CF) of 12 dB, all channels driven.
Damping factor (20 Hz - 200 Hz into 4 ohms) shall be >100 while the S/N ratio (unweighted, RMS) shall be >110 dBr (analog input) and >114 dBr (digital input).
- w. The dimensions (HxWxD) shall not exceed 2RU x 19" x 530.5 mm (2RU x 19" x 20.9") and shall weigh no more than 19 kg (42 lb).

F. Amplifier (30D)

1. General

- a. The amplifier shall be four channel incorporating digital signal processors (DSP) to provide loudspeaker specific configurations and functions and dedicated protection circuits. It shall be equipped with digital and analog signal inputs as well as link outputs, remote control and monitoring capabilities via Ethernet (OCA) or CAN-Bus. User interface shall be a Web Remote interface and via remote control software.
- b. Four analog input connectors shall be provided also acting as link output. Two digital input connectors shall be provided, each accepting a 2 channel digital (AES3) audio signal.
Analog inputs shall be electronically balanced with an input impedance of 38 kOhm
- c. The digital inputs shall be transformer balanced with an input impedance of 110 ohm while the digital link output shall be electronically balanced providing analog signal buffering (refresh) and power fail relay (Bypass). Sampling shall be 48 / 96 kHz / 2 Ch/n and Word-Sync: PLL-locked to source (slave mode) synchronization.
Connector type for all audio inputs and link outputs shall be 3-pin Phoenix Euroblock male (Phoenix MSTB 2,5 / 3-STZ).
- d. Signal processing shall utilize 96 kHz sampling rate with 27 Bit ADC / 24 Bit DAC conversion while the latency shall not exceed 0.3 msec.
- e. The output connectors shall be 2 x Phoenix 4-pin Euroblock female (Phoenix IPC 5/ 4-STF-7,62).
- f. Output configurations shall be selectable for dual channel, mixed top/sub and 2-way active modes.
- g. Five GPIO lines shall be provided on an Phoenix 6-pin Euroblock male (Phoenix MSTB 2,5/ 6-STZ) as digital control lines which can be

- configured either as an input or output (In/Out) and shall allow either level (Hi/Lo active) or edge (rising/falling) triggering.
- h. In addition a FAULT contact shall be provided on an 3-pin Phoenix Euroblock male (Phoenix MSTB 2,5 / 3-STZ) to allow a general device error to be remotely indicated.
 - i. It shall incorporate two user definable 16-band equalizers for independent application to each channel allowing parametric filters, notch, hi- and lo- shelf filters as well as asymmetric filters.
 - j. A signal delay capability of up to 10 sec. (3440 m / 11286 ft) shall be incorporated for independent application to each channel.
 - k. It shall contain a signal generator offering pink noise or sine wave program.
 - l. Load monitoring and System check functions shall be included to ascertain the status of the loudspeaker impedance. Load monitoring shall allow impedance monitoring to determine the status of an LF or HF driver in systems with multiple elements, even if these are crossed over passively.
Input monitoring shall be included to allow detection of incoming pilot signals.
 - m. Compensation for cable length shall be incorporated to improve impulse response.
 - n. A Fallback function shall be available to enable the definition of primary (Regular) and secondary (Fallback) signal paths for analog and digital input signals with two different modes (Manual or Auto). It shall ensure that any secondary or emergency signal fed to the Fallback inputs is transmitted when required.
 - o. The Override function shall be available to allow a dedicated analog input to be set as a major signal path with highest priority for general messages or emergency services.
 - p. An AutoStandby function shall automatically switch the amplifier to Standby mode after a predefined time when the incoming signal level at the individually specified inputs drops below a defined threshold. The function shall be independent of the mute status of the respective channels. An AutoWakeup function shall automatically repower the amplifier, when an input signal is present and exceeds a defined threshold.
 - q. A universal range switched mode power supply shall be incorporated and allow mains range of 100 to 240 V AC, 50 - 60 Hz mains power supply voltages. Mains voltage monitoring, mains inrush current limiter, self-resetting overtemperature, under- and overvoltage protection shall be incorporated.
Power factor compensation (PFC) shall be incorporated to provide a clean and efficient sinusoidal current draw.
 - r. It shall have temperature and signal controlled fans for cooling the internal assemblies.
 - s. The power amplifier channels shall have ground fault protection, output pop-noise suppression, DC offset protection, output HF voltage limitation, output current limitation/protection and self-resetting overtemperature protection.
 - t. The output power shall be 4 x 1000/800 W into 4/8 ohms at a crest factor (CF) of 6 dB, all channels driven.
Damping factor (20 Hz – 200 Hz into 4 ohms) shall be >80 while the S/N ratio (unweighted, RMS) shall be >104 dBr (analog input) and >106 dBr (digital input).

- u. The dimensions (HxWxD) shall not exceed 2RU x 19" x 435 mm (2RU x 19" x 17.1") and shall weigh no more than 10.6 kg (23.4 lb).
- G. Tisera Forte AI
- 1. General
 - a. The fixed I/O DSP shall be designed exclusively for use with Tesira® systems.
 - b. The fixed I/O DSP shall support Ethernet connection for programming and control on a RJ-45 connector.
 - c. The fixed I/O DSP shall have internal DSP processing. The fixed I/O DSP shall include 4 channels of General Purpose Input and Output connection (GPIO) for sending or receiving logic signals.
 - d. The programming of the GPIO ports shall be software configurable. The fixed I/O DSP shall include a RS-232 connection for control data transmission into or out of the fixed I/O DSP and such operation shall be software programmable.
 - e. The fixed I/O DSP shall include a Universal Serial Bus (USB) connection on a standard USB-B type connector.
 - f. The fixed I/O DSP shall be software configurable to stream up to 8 channels of digital USB Class 1 Audio transmission either into or out of the fixed I/O DSP or simultaneous input and output.
 - g. The fixed I/O DSP shall support port authentication via IEEE 802.1X. The fixed I/O DSP shall provide 12 balanced input connections for receiving of microphone or line level analog audio signals on screw-down, removable connectors. The fixed I/O DSP shall provide 8 balanced output channels for the transmission of microphone or line level analog audio signals on screw-down, removable connectors. Each individual channel shall have its own dedicated connection.
 - h. The fixed I/O DSP shall provide front panel OLED identification of device power, status, alarm, and activity as well as system-wide alarm.
 - i. The fixed I/O DSP shall be rack mountable (1RU) and feature software-configurable signal processing, including but not limited to: signal routing and mixing, equalization, filtering, dynamics, and delay, as well as control, monitoring, and diagnostic tools.
 - j. The fixed I/O DSP shall be CE marked, UL listed, and shall be compliant with the RoHS directive.
 - k. Warranty shall be five years.
 - l. The fixed I/O DSP shall be TesiraFORTÉ® AI.

PART 3

3.1 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from products.

3.2 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.3 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.
- B. Install products in accordance with manufacturer's instructions.
- C. Utilize 10 AWG solid conductor wire for the D&B Line Array system

3.3 FIELD QUALITY CONTROL

- A. Startup Services

3.3 ADJUSTING

3.3 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.3 CLOSEOUT ACTIVITIES

- A. Training:
 - 1. Include services of manufacturer's authorized Service Representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.

END OF SECTION

**SECTION 31 20 00 - EARTH MOVING
(Café Building Only)**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Sections included under Division 0 & Division 1 are included as a part of this Section as though bound herein.
- B. Bidding and Contract Requirements of the Specifications and the Drawings govern the Work of this section. Provide materials, labor, equipment and services necessary to furnish, deliver and install work of this Section as shown on Drawings, as specified or as required by job conditions
- C. Coordinate work with that of other trades affecting or affected by work of this Section and cooperate to assure the steady progress of the Work.

1.02 SUMMARY

- A. The Earthwork stated in this section is for the Café Building only. Refer to other associated professional engineers for required work out the building envelope.
- B. System Description:
 - 1. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- C. Section includes, but is not limited to:
 - 1. Topsoil Stripped & Stockpiled.
 - 2. Topsoil Placement
 - 3. General cutting, filling, compacting and grading to transform existing grades to new grades as shown on Drawings.
 - 4. Subgrade preparation for building pad, walks, courts and pavements.
 - 5. Excavating and filling required for detention basin.
 - 6. Excavation and backfilling for foundations and footings.
 - 7. Excavating for site water, sanitary sewer and storm sewer utilities.
 - 8. Compacted fill from top of utility bedding to subgrade elevations.
 - 9. Excavation and backfilling for concrete curbs.

1.03 RELATED SECTIONS

1.04 REFERENCES

- A. Reference Standards:
 - 1. The Specifications of the American Institute for Testing Materials (ASTM) and Ohio Department of Transportation Construction & Material Specifications (ODOT), latest edition, referred to below with their serial designation are included herein and made an integral part of the specifications.

1.05 SUBMITTALS

- A. In accordance with Section 01 33 00 – Submittal Procedures.
- B. Inspection & Test Reports: Inspection reports and test reports of materials and installations.

1.06 QUALITY ASSURANCE

- A. Contractor shall fully comply with all applicable laws, ordinances, safety requirements, codes and regulations of federal, state and local governing bodies having jurisdiction.
- B. Testing will be performed by the Owner's independent laboratory to determine conformance with the specifications. This testing shall be performed at the expense of the Owner.
- C. Geotechnical evaluations have been performed within these work limits. This data is not intended as representation or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner or Architect will not be responsible for interpretation or conclusions drawn therefrom by Contractor. Data is made available for the convenience of the Contractor.
 - 1. Suitable material is known to be present on site. However, Contractor shall make their own independent evaluations to determine the acceptability of various materials for use in construction. By acceptance of the construction contract, the Contractor warrants that they have examined the site and are aware of the materials present and the job requirements.
 - 2. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

1.07 PROJECT CONDITIONS

- A. Protections
 - 1. Provide temporary barricades and other forms of protection as required to protect the public and the Owner's personnel from injury due to earthwork operations.
 - 2. Provide protective measures as required to provide free and safe passage of the public and the Owner's personnel to and from occupied portions of the building.
 - 3. Protect trees, plant growth, and features designated to remain.
 - 4. Protect open trenches to prevent danger to the public and Owner's personnel.
 - 5. Tracking or spilling mud, dirt or debris upon streets, residential or commercial drives, sidewalks or bike paths is prohibited. Any such occurrence shall be cleaned up immediately by the Contractor at no cost to the Owner.
 - 6. Protect improvements on adjoining properties as well as those on the Owner's property.
 - 7. Locate, identify, and protect utilities indicated to remain, from damage.
 - 8. Protect bench marks, survey control points, and existing structures from damage or displacement.
 - 9. Restore improvements damaged by this work to their original condition, as acceptable to the Owner and other parties or authorities having jurisdiction at no additional cost to the Owner.

PART 2 - PRODUCTS / OPERATIONS

2.01 DISPOSITION OF UTILITIES

- A. Rules and regulations governing the respective utilities shall be observed in executing all work under this section. Notify all utilities existing in the area of this operation to verify locations, prior to beginning work as required by Section 15 3. 64 ORC. All known utilities are listed on the Drawings. Advise the Ohio Utility Protection Service ((330)-362-2764) and all other affected utility suppliers a minimum of 48 hours prior to beginning excavation or underground work of any kind. The Contractor shall familiarize their staff with the location of all underground and overhead utilities.
- B. Contractor shall coordinate any required shutdown (temporary and/or permanent) or removal/relocation of existing utilities (whether shown or not on the drawings) with Owner.

- C. Active utilities shown on the drawings shall be adequately protected from damage and removed or relocated only as indicated or specified.
- D. Active utilities not shown on the drawings shall be protected or relocated in accordance with written instruction from the Architect.
- E. The Contractor performing the work shall be responsible for any damages incurred from disruption of utilities.
- F. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for direction. Repair damaged utilities to satisfaction of utility owner.
- G. Coordinate with utility companies for shutoff of services if lines are relocated or taken out of service by construction activities.

2.02 TRAFFIC

- A. Traffic control shall be furnished, erected, maintained, and removed by the Contractor according to the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), current edition.
- B. Conduct earthwork operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

2.03 MATERIALS

- A. Topsoil: Any topsoil provided from off-site source shall conform to ODOT 653.02. Furnish topsoil consisting of loose, friable, loamy material without admixture of subsoil or refuse. For topsoil to be considered loamy, ensure that the fraction passing the No. 10 sieve does not contain more than 40 percent clay. Furnish topsoil consisting of not less than 4 percent and not more than 20 percent organic matter as determined by loss on ignition of samples oven dried to constant weight at 212 degrees F. Furnish topsoil that is free of grass, brush and roots.
- B. Subgrade Material: Material shall be as selected from available on-site sources. Material shall not include rocks larger than 6 inches in diameter and shall have a moisture content of plus or minus 3% of the optimum moisture content at the time of placement. Moisture conditioning may be required and is included as part of this work.
- C. Subgrade Material (Off-Site Source): Should additional material be required, it may consist of silty clay soils, crushed limestone or bankrun sand and gravel. Topsoil and/or organically contaminated soils are not considered suitable for use as engineered fill. All fill materials must be observed and approved by the Soils Engineer.
- D. Granular Backfill: Material shall meet gradation of No. 57 or No. 67 conforming to ODOT 603, Structural Backfill Type 2.
- E. Flowable CDF: Material conforming to ODOT, Item 603.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.02 TOPSOIL STRIPPED & STOCKPILED

- A. Scalp and remove objectionable materials from area in which material is to be excavated. Scalping shall consist of the removal of topsoil, vegetation, and organically contaminated materials. Topsoil shall be stripped from all areas to be disturbed and stockpiled where directed. All other materials shall be wasted.
- B. Stockpile in on-site area where directed and protect from erosion.

3.03 TOPSOIL PLACEMENT

- A. Prior to topsoil placement, substrate shall be prepared as follows:
 - 1. Eliminate uneven areas and low spots.
 - 2. Remove debris, roots, branches, stones in excess of 1 inch in size.
 - 3. Scarify surface to depth of 3 inches where topsoil is scheduled.
- B. Topsoil shall be placed in areas where shown on the Drawings to the depths indicated so that after completion of settling, the resulting grades shall match those shown on the drawings. If not shown on the Drawings, place topsoil to depths as indicated below:
 - 1. Seeded Grass: 6 inches
 - 2. Sod: 4 inches
 - 3. Shrub Beds: 12 inches
 - 4. Flower Beds: 12 inches
- C. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contours of subgrade. Top of topsoil shall be plus or minus 1/2 inch. Lightly compact placed topsoil.
- D. Prohibit construction traffic over topsoil.
- E. Areas where topsoil has been stockpiled shall be restored to existing grade and properly prepared ready to receive landscaping.

3.04 SUBSOIL EXCAVATION

- A. Excavation shall be performed so as to permit segregation and selection of materials of different character in accordance with their suitability. Existing foundations, slabs, abandoned utilities, etc. discovered during excavations shall be removed within 2 feet of finished grades. Unsuitable materials as determined by the Soils Engineer shall be disposed of off-site. Unsuitable materials will include but is not be limited to topsoil or organic material, saturated soils, clays with high plasticity and low permeability, unsuitable rubble, construction materials and rubbish and other objectionable foreign materials.
- B. In areas of cut where foundations, slabs or paving are indicated to be constructed on grade, compact and proof-roll the subgrade. Any localized zones of soft soil or otherwise unsuitable material detected, shall be brought to the attention of the Soils Engineer for review and recommended course of action.
- C. Areas to receive fill shall be proof-rolled prior to placement of fill material. Any localized zones of soft soil detected that cannot be compacted or otherwise unsuitable material, shall be brought to the attention of the Soils Engineer for review and recommended course of action.
- D. No soil, rock, debris or other material shall be dumped or placed in any areas not adequately protected by erosion control installations.

3.05 EXCAVATION FOR CURBS, SLABS, FOUNDATIONS, AND FOOTINGS

- A. Dimensions of the excavation shall be such as to provide sufficient clearances to permit work therein to be carried on safely and in accordance with the plans and specifications. All excavations shall be accomplished in a neat and workman like manner.
- B. Rocks shall be removed by machine methods only. Remove existing foundations, slabs, abandoned utilities, etc. that interfere with construction.
- C. The Contractor shall notify the Architect and the Geotechnical Consultant as soon as excavations for foundations and footings are completed in order that the bearing capacity of the finished subgrade may be inspected before concrete is poured and before formwork is erected. All subgrades shall be reviewed by the Architect and the Geotechnical Consultant before proceeding with construction.
- D. The subgrades for all foundations, footings, curbs and concrete slabs shall be thoroughly compacted using either mechanical hand tampers or vibrating rollers and inspected for stability prior to installation of base and/or concrete. Remove as directed any soft or otherwise

unsuitable subgrade material and replace with premium backfill except at building foundations where concrete is required.

- E. Cold Weather Protection: Protect excavation bottoms beneath structures against freezing when temperature is less than 35 degrees F by covering with dry insulating materials of sufficient depth to prevent frost.

3.06 TRENCH EXCAVATION

- A. Dimensions of the excavation shall be such as to provide sufficient clearances to permit work therein to be carried on safely and in accordance with the plans and specifications. Remove existing foundations, slabs, abandoned utilities, etc. that interfere with construction.
- B. Pipe Trenching: The trench shall be excavated so that the pipe can be laid to the alignment, grade and depth on undisturbed soil as shown on the drawings, and it shall be excavated only 200 feet in advance of pipe laying . Remove existing foundations, slabs, abandoned utilities, etc. that interfere with construction.
- C. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for pipe.
- D. Where trenching in an existing paved area, no open cut shall result in a remaining slab width of less than 5 feet from patch to an existing joint. The cut shall be made by sawing to a minimum depth of 2-inches.
- E. Subgrade: If any part of the bottom of the trench is excavated below the specified grade, the over-excavation shall be backfilled with horizontal layers not exceeding 6 inches in loose depth. Compact each layer at optimum moisture content of the fill material to a density equal to the original adjacent ground.

3.07 STABILIZATION OF TRENCH SIDES

- A. Slope sides of excavation to comply with local codes, ordinances, and requirements of authorities having jurisdiction
- B. Where it is necessary to support the sides of the trench, the Contractor shall be responsible for the design and installation of the entire shoring, bracing and sheeting structural system or other methods to support the side of the trench. Extend shoring and bracing as excavation progresses.
- C. Removal of support sheeting shall be at the discretion of the Contractor, except sheeting shall not be withdrawn until trench is sufficiently filled to prevent injury to banks, road surfaces, adjacent utilities, sidewalks, and other property.
- D. Sheeting and supports shall not be removed below where it could cause damage to the pipe, such as loss of side support of the bedding, or side support of the foundation where the undercut is in displaceable material.

3.08 BACKFILLING

- A. Backfilling of trenches shall not begin until tests and inspections have been made and backfilling is authorized by local authorities having jurisdiction.
- B. Backfill and compact trenches to densities as specified below. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- C. Compacted granular backfill shall be used when backfilling trenches under pavements in accordance with ODOT, Item 603.
- D. Do not leave more than 50 feet of trench open at the end of each day.
- E. Backfill behind curbs and adjacent to pavement with topsoil. Transition smoothly to areas outside the limits of work. Provide material sufficiently greater than the required depth in seeded areas and planting beds so that after settlement, finished grade shall be as shown on the Drawings.

- F. Backfill foundation trenches with granular fill to within 2-feet of subgrade elevation. Do not backfill until all below grade construction and clean-up is completed and approved.
- G. Backfilling within a 1:1 influence line of existing buildings or public infrastructures (pavement, curbs, sidewalks, bike paths, etc.) shall be compacted granular fill according to ODOT Item 603 of the Standard Specifications or Flowable CDF, according to Item 603.

3.09 PLACEMENT & COMPACTION

- A. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density as indicated below.
- B. When fill is placed on existing slopes steeper than 8:1 H:V, benching shall be performed to tie the new fill into the existing slope.
- C. Place fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand operated tampers.
- D. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place fill material on surfaces that are muddy, frozen or contain frost or ice.
- E. Compaction Requirements: Control fill material compaction for each area classification indicated below.
 - 1. Percentage of Maximum Density Requirements: Compact fill material and existing subgrades to not less than the following percentages of maximum dry density, in accordance with ASTM D-698 (Standard Proctor).
 - a. Road Beds & Parking Areas: Compact top 12 inches of subgrade and each layer of fill material at 95%.
 - b. Under non-structural slabs, with normal loading - Compact top 12 inches of subgrade and each layer of fill material at 95%.
 - c. Under special foundations, isolated pads and footing – Compact top 12 inches of subgrade and each layer of fill material at 100%.
 - d. Under paved pedestrian walks and courts – Compact top 12 inches of subgrade and each layer of fill material at 95%.
 - e. Under lawn or unpaved areas – Compact top 6 inches of subgrade and each layer of fill material at 90%.
 - f. Backfill around manholes and other underground structures – 95% if depth is less than 10 feet, 100% if depth is more than 10 feet.
 - g. Density of trench backfill shall be equal to the densities specified for all other fill and backfill.
- F. Moisture Control:
 - 1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on the surface during or subsequent to compaction operations.
 - 2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Control content of moisture to within plus or minus 3% of optimum moisture per ASTM D-698.
 - 3. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to satisfactory value.

- G. A representative of the testing laboratory shall provide continuous inspection during placement and compaction operations; tests shall be made in a quantity that will assure uniform compaction and density of each course, or lift, of fill.
- H. When directed by the Architect, any material in the embankment which the Architect may consider unsuitable shall be excavated and the excavated areas refilled with suitable materials at the Contractor's expense. If the material is unsuitable due to improper compaction, the material shall be replaced and re-compacted in accordance with the above specifications at the Contractor's expense.

3.10 DEWATERING

- A. The Contractor shall provide adequate drainage of the work areas at all times consistent with erosion control practices.
- B. Prevent surface water and subsurface ground water from flooding project site, excavations and surrounding area that would cause soil changes detrimental to stability of subgrades. Any water encountered shall be removed by pumping, well pointing, subsurface drains, or any other such suitable and approved means. Care should be taken to avoid damage to adjacent properties as a result of dewatering.
- C. All effluent from dewatering operation shall be discharged into the sediment basin unless otherwise indicated on the Drawings.

3.11 GRADING

- A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
 - 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevation.
 - 2. Walks & Courts: Shape surface of areas under walks and courts to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
 - 3. Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½ inch when tested with a 10-foot straightedge.
 - 4. Road Beds & Parking Areas: Shape surface of areas under pavements to line, grade and cross-section, with finish surface not more than ½ inch above or below required subgrade elevation when tested with a 10-foot straightedge..
- B. After grading, compact subgrade surfaces to the depth and indicated percentage of maximum density for each area classification.
- C. Subgrades shall be sloped to provide drainage away from building walls in all directions at a grade not less than ¼ inch per foot.

3.12 MAINTENANCE OF GRADES

- A. During construction, the Contractor shall maintain all grades in the areas of excavation, embankment and other such areas as may be necessary to provide effective drainage at all times. The finished grades or subgrades shall be properly maintained and protected from traffic and other construction operations. Any damaged areas, resulting from settlement, displacement or erosion due to surface or subsurface water or any other cause shall be repaired by the Contractor at no additional cost to the Owner. The responsibility of such maintenance shall rest with the Contractor until completion and acceptance of all work under this contract by the Owner.

3.13 UNSUITABLE OR SURPLACE MATERIAL & CLEANUP

- A. Fill to required subgrade elevations any areas where settlement occurs. Furnish any material necessary as directed and approved by the Architect.
- B. Contractor shall avoid spilling or tracking material onto pavements and is responsible for keeping haul routes clean.
- C. All unsuitable and surplus excavated materials shall be legally disposed of off-site. Unsuitable materials will include but is not be limited to organic material, saturated soils, clays with high plasticity and low permeability, unsuitable rubble, construction materials and rubbish and other objectionable foreign materials.
- D. Remove excess topsoil material only after all final landscape work has been completed, accepted and approved by Construction Manager.

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 and grasses and plants.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for site walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 03 30 54 "Miscellaneous Cast-in-Place Concrete" for establishing subgrades for wall foundations, walks and curbs.
2. Section 31 10 00 "Site Clearing" for salvaging existing materials, site stripping and removal of above- and below-grade improvements.
3. Section 32 13 13 "Concrete Paving", for establishing pavement edges.
4. Section 32 18 13 "Synthetic Grass Surfacing", for establishing base and subsurface drainage.
5. Section 32 14 00 "Unit Paving", for establishing pavement edges.
6. Section 32 91 00 through 32 91 40 "Planting Soils" mixes, for final grade preparation and soil mixes required for final grading.
7. Section 32 93 00 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.02 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 Landscape Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Landscape Architect. Unauthorized excavation,

as well as remedial work directed by Landscape Architect, shall be without additional compensation.

- G. Fill: Soil materials used to raise existing grades.
- H. Proof Rolling: Measure the plastic or elastic deformation of the subgrade under specified load using 15 to 20-ton tandem axle (10 wheels) dump truck in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows per 2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. 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.
- L. 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.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct pre-excavation conference at Project site.
 - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
 - a. Personnel and equipment needed to make progress and avoid delays.
 - b. Coordination of Work with utility locator service.
 - c. Extent of trenching by hand or with air spade.
 - d. Field quality control.

1.04 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. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches.
 - 2. Warning Tape: 12 inches long; of each color.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487.
 - 2. Laboratory compaction curve according to ASTM D 698.

- C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.06 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Perform earthwork in compliance with applicable requirements of governing authorities.
- C. Materials and Methods of Construction: Comply with ODOT Construction and Materials Specifications, latest edition and as specified.
- D. Contractor is required to provide and pay for soils testing and inspection services during earthwork operations. Testing, inspection service and Soils Engineer shall be acceptable to the Owner.

1.07 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. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
 - 1. Do not proceed with work on adjoining property until directed by Landscape Architect.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.
- D. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Landscape Architect and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Landscape Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Landscape Architect's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- E. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- F. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 01 50 00 "Temporary Facilities and Controls" and Section 02 41 19 "Selective Demolition" are in place.

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 D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches 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 D 2487, 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 D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- L. Topsoil: See Sections 32 91 00 through 32 91 40 for "Planting Prep" soil mixes.

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: Class 2; AASHTO M 288.
 - 2. Survivability: As follows:
 - a. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - b. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - c. Tear Strength: 56 lbf; ASTM D 4533.
 - d. Puncture Strength: 56 lbf; ASTM D 4833.
 - 3. Apparent Opening Size: No. 40 or No. 60 sieve, maximum; ASTM D 4751.
 - 4. Permittivity: 0.2 per second, minimum; ASTM D 4491.
 - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- 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: Class 2; AASHTO M 288.
 - 2. Survivability: As follows:
 - a. Grab Tensile Strength: 247 lbf; ASTM D 4632.

- b. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 - c. Tear Strength: 90 lbf; ASTM D 4533.
 - d. Puncture Strength: 90 lbf; ASTM D 4833.
3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
 1. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33/C 33M, 3/4-inch nominal maximum aggregate size.
 4. Water: ASTM C 94/C 94M.
 5. Air-Entraining Admixture: ASTM C 260/C 260M.
- B. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495/C 495M.

2.04 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 wide and 4 mils 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 deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

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. Notify utility companies to remove and relocate lines and services which are in the way of construction. Maintain and protect existing utility and service lines to remain which pass through the work area. Pay costs for this work, except as covered by the applicable utility company.
- C. Protect active utility and service lines uncovered by excavation.
- D. Remove abandoned utility and service lines from areas of excavation. Cap, plug or seal abandoned lines and identify termination points at grade level with markers.
- E. Accurately locate and record abandoned and active utility and service lines rerouted or extended on project record documents.
- F. Do not cover or enclose work before obtaining required inspections, tests, approvals and location recording.
- G. Protect and maintain erosion and sedimentation controls during earth-moving operations.

- H. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- I. Field engineering: Provide all layout work required. Establish extent of grading and excavation by area and elevation; designate and identify datum elevation and project engineering reference points. Set required lines, levels and elevations.

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 subgrades, 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. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. 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, ram hammering, or ripping of material not classified as rock excavation is earth excavation.

3.04 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 SUBGRADE INSPECTION

- A. Notify Landscape Architect when excavations have reached required subgrade.
- B. If Landscape 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 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. 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.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Landscape Architect, without additional compensation.

3.07 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Landscape Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Landscape Architect.

3.08 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.

3.09 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, 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.

3.10 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 acceptable to Landscape Architect.
 - 2. Under walks and pavements, use satisfactory soil material acceptable to Landscape Architect.
 - 3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 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.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill 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 D 698:
1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.
 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.13 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.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- D. Site Drainage: Stake and establish centerline grades of drainage swales, ditches and channels providing positive drainage to swale and to drainage structure or outlet.

1. Regrade areas where water is pooling or not flowing to outlet.

3.14 SUBSURFACE DRAINAGE

1. See Section 33 46 00 – Subdrainage.

3.15 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. Where noted and detailed on drawings, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Shape subbase course and base course to required crown elevations and cross-slope grades.
 3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Landscape Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, 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. or less of paved area or building slab but in no case fewer than three tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

-
1. Scarify or remove and replace soil material to depth as directed by Landscape 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.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes Standard Concrete Paving and Right of Way Crosswalks for the following:
 - 1. Road Crosswalks (Pavement Type: P10)
 - 2. Pedestrian Walks (Pavement Type: P9)
 - 3. Curb Ramp - Cast Iron Tactile Warning Plates
- B. Related Requirements:
 - 1. Section 03 30 53 "Miscellaneous CIP Concrete" for general foundations and subbase slabs, and architectural finish type concrete walks, curbs and walls.
 - 2. Section 32 13 73 "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 32 14 00 "Unit Paving" for concrete substrate requirements for pavers set in mortar.
 - 4. State of Ohio Department of Transportation Construction and Material Specifications 2019 edition.

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.
- B. Construction Joint: Joint produced when one pour is placed up against an existing one (cold joint)
- C. Contraction Joint: Joint produced that isolates the crack (control joint).
- D. Isolation Joint: Joint containing expansion material and/or caulking material to allow the joint to "flex" based on air temperature (expansion joint). Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- E. W/C Ratio: The ratio by weight of water to cementitious materials.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and concrete paving construction practices.
 - 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete paving Subcontractor.

1.04 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.
- C. Jointing Plan: Shop drawings indicating locations for all Construction, Contraction and Isolation/Expansion joints.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.
- B. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Curing compounds.
 - 5. Applied finish materials.
 - 6. Joint filler strips.
 - 7. Cast iron tactile warning plates.
- C. Material Test Reports: For each of the following:
 - 1. Aggregates:
- D. Field quality-control reports.
- E. Minutes of Preinstallation conference.

1.06 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- C. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
 - 1. Installer experience shall demonstrate completed concrete work sandblast finishing of concrete and of similar work in material, design and extent to that indicated for this Project whose work has resulted in construction with a record of successful in-service performance.
- D. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- F. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship and as indicated in the pre-construction meeting.
 2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Landscape Architect and not less than 96 inches by 96 inches.
 3. Notify Landscape Architect as soon as possible in advance of dates and times when mockups will be constructed.
 4. Obtain Landscape Architect's approval of mockups before starting construction.
 5. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
 6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.
 7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."
1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.08 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, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated 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 unless otherwise indicated.
- B. ODOT Standards: Comply with the following ODOT specifications as noted on the drawing unless modified and noted by the requirements in the Contract Documents:
 1. ODOT 204: Subgrade Compaction and Proof Rolling
 2. ODOT 304: Aggregate Base
 3. ODOT 305: Portland Cement Concrete Base
 4. ODOT 452: Non-Reinforced Portland Cement Concrete Base
 5. ODOT 608: Walks, Curb Ramps, And Steps
 6. ODOT 609: Curbing, Concrete Medians, And Traffic Islands
 7. ODOT 703.02: Aggregate for Portland Cement Concrete
 8. ODOT 712.09: Geotextile Fabrics

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 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 surfaces.

2.03 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60; deformed.
- B. Plain-Steel Wire: ASTM A1064, as drawn.
- C. Joint Dowel Bars: ASTM A615, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.
- D. 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:
 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.04 CONCRETE MATERIALS

- A. Concrete work within City Right-of-Way - comply with City of Canton Engineering Standard Drawing No. 41 and specifications for Roadway Brick & Crosswalk Pavement.
 1. Item 452 Plain Portland Cement Class C (Limestone) – Concrete Pavement
 2. ODOT Item 304 – Aggregate Base.
- B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150, gray portland cement Type I Type II.
 2. Fly Ash: ASTM C618, Class F.
 3. Slag Cement: ASTM C989, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide fine and coarse aggregates sand and gravel for each type of exposed finish from a single source (pit or quarry) for entire job. They shall be clean, hard, strong, durable, and inert, free of staining or deleterious material.
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.
- E. 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. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C494, Type A.
 2. Retarding Admixture: ASTM C494, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494 Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
- F. Water: Potable and complying with ASTM C94/C94M.

2.05 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.
- C. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
1. Available Products:
 - a. Axim Concrete Technologies; Cimfilm.
 - b. Burke by Edeco; BurkeFilm.
 - c. ChemMasters; Spray-Film.
 - d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
 - e. Dayton Superior Corporation; Sure Film.
 - f. Euclid Chemical Company (The); Eucobar.
 - g. Kaufman Products, Inc.; Vapor Aid.
 - h. Grace Products;
 - i. Lambert Corporation; Lambco Skin.
 - j. L&M Construction Chemicals, Inc.; E-Con.
 - k. MBT Protection and Repair, ChemRex Inc.; Confilm.
 - l. Meadows, W. R., Inc.; Sealtight Evapre.
 - m. Metalcrete Industries; Waterhold.
 - n. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
 - o. Sika Corporation, Inc.; SikaFilm.
 - p. Symons Corporation; Finishing Aid.
 - q. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- D. Clear, Waterborne, Membrane-Forming Curing Compound for standard "Broomed Finishes": ASTM C309, Type 1, Class B, dissipating.
1. Acceptable products include:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
- b. Burke by Edoko; Aqua Resin Cure.
- c. ChemMasters; Safe-Cure Clear.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
- f. Euclid Chemical Company (The); Kurez DR VOX.
- g. Lambert Corporation; Aqua Kure-Clear.
- h. L&M Construction Chemicals, Inc.; L&M Cure R.
- i. Meadows, W. R., Inc.; 1100 Clear.
- j. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
- k. Symons Corporation; Resi-Chem Clear.
- l. Tamms Industries Inc.; Horncure WB 30.
- m. Unitex; Hydro Cure 309.
- n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- o. Note: The curing compound shall not be used as the final sealer for the concrete.

2.06 SURFACE SEALANTS

- A. Penetrating Water Repellent Sealer:
1. Penetrating Water Repellent: Clear penetrating sealer consisting of 100% silane and meeting the following criteria:
 - a. Flash Point: 145 Deg F.
 - b. NCHRP No. 244 Reduction in Chloride Content
 - 1) Average 91%
 - 2) Min. Required 75%
 - c. NCHRP No. 244 Reduction in water absorption
 - 1) 1 Day in water 94%
 - 2) 3 Days in water 89%
 - d. VOC's 248 g/l
 - e. Average Depth of Penetration: 0.2"
 - f. Product:
 - 1) Euclid Chemical Company (The): Baracade Silane 100 C
www.euclidchemical.com

2.07 RELATED MATERIALS

- A. Expansion Joints: Provide with joint caps.
1. Basis of design: Products by WR Meadows.
 2. Sponge Rubber: ASTM-D1751 Type I.
 - a. Typical Thickness: 1/4 inch.
 - b. Joint Cap: Two-piece device with upper portion removable after curing period; width corresponding to joint filler.
 3. Cork: ASTM-D1752, Type II.
 - a. Typical Thickness: 1/4 inch.
 - b. Joint Cap: Two-piece device with upper portion removable after curing period; width corresponding to joint filler.
- B. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C881, 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 I and II, nonload bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Cast iron tactile warning plates.

1. Cast iron conforming to ASTM A48, Class 30B, minimum. Plates as manufactured by Neenah Foundry Co.
 - a. Catalog Number: 4984-24Q, 24" x 24" Quick Connect Plates, 2 sections per ramp unless noted otherwise.

2.08 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, 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. Follow City of Canton Engineering specifications for work within City Right-of-Ways.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. as follows:
 1. Fly Ash: 25 percent.
 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 3. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- D. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 1. Air Content: 5-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
 2. Air Content: 6 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
 3. Air Content: 6 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.
- E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- F. 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 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.
- G. Concrete Mixtures: Normal-weight concrete.
 1. Compressive Strength (28 Days): 4000 psi.
 2. Maximum W/C Ratio at Point of Placement: 0.50.
 3. Slump Limit: 5 inches, plus or minus 1 inch.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
 - 1. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
- B. Proof-roll prepared subbase surface below concrete paving 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.
 - 2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 20 00 "Earth Moving."

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 STEEL REINFORCEMENT INSTALLATION

- 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.

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 (Cold 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 (Expansion 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 as shown, unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. 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. Contraction Joints (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:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- 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. Do not re-tool edges after applying surface finishes. Eliminate tool marks on concrete surfaces. "Picture Framing" tooling anywhere is not to be done, unless noted.

3.06 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 is complete and in compliance with installation requirements and tolerances and other conditions affecting performance. Prior to the inspection, provide Landscape Architect 24-hour notice.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at 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 requirements for measuring, mixing, transporting, and placing concrete.

- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 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.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Install cast iron tactile warning plates per manufacturer's instructions and specifications.
- K. When adjoining pavements are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength. Do not drive vehicles on pavement until the full 28-day strength is attained.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- M. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
- N. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Bull float Finish: After striking off initial pour of concrete, both standard finish concrete and paver subbase concrete (mud slab) shall be bull floated.

3.08 BROOM FINISH

- A. Monolithic very light broom finish. Brush marks shall be barely noticeable after finishing and before applying sealants.
 - 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.

2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic

3.09 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 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 surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-feet-long; unlevelled straightedge not to exceed 1/2 inch.
 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 6. Vertical Alignment of Dowels: 1/4 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

3.11 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 C 172/C 172M shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide 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 C 143/C 143M; 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 C 231/C 231M, 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 C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall 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.
- D. Test results shall be reported in writing to Landscape Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete 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 Landscape Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Landscape Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- 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.

3.12 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 Landscape Architect.
- B. Drill test cores, where directed by Landscape 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 surface 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 32 13 13

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cold-applied joint sealants.
 - 2. Joint-sealant backer materials.
 - 3. Primers.
- B. Related Requirements:
 - 1. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete for construction and expansion joints.
 - 2. Section 32 13 13 - Concrete Paving" for constructing joints in concrete pavement.

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each kind and color of joint sealant required, provide one Samples with joint sealants for each joint width specified formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Paving-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.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of joint sealant and accessory.
- B. Compatibility and Adhesion Test Reports: 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 needed for adhesion.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
- C. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 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.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Landscape Architect from manufacturer's full range.

2.02 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 1. Available Products:
 - a. Crafcoc Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Equal product approved by Architect.
- B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
 1. Available Products:
 - a. Crafcoc Inc.; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Equal product approved by Architect.

- C. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.
 - 1. Available Products:
 - a. Meadows, W. R., Inc.; Sof-Seal.
- D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.
- E. Multicomponent, non-sag, polyurethane elastomeric sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:
 - 1. Urethane Formulation: Type M; Grade NS; Class 25; Uses T, NT M, and, as applicable to joint substrates indicated, O.
 - a. Available Products:
 - 1) Sika Corporation; Sikaflex – 2c NS.
 - 2) Or approved equal by Landscape Architect

2.03 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.04 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint 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 joint-sealant backings.
 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
 1. Place joint sealants so they fully contact 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.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.05 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within concrete paving.
 - 1. Joint Location:
 - a. Expansion and isolation joints in concrete paving.
 - b. Contraction joints in concrete paving.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Multicomponent, nonsag, urethane, elastomeric joint sealant Single component, pourable, urethane, elastomeric joint sealant Multicomponent, pourable, urethane, elastomeric joint sealant.
 - 3. Joint-Sealant Color: Manufacturer's standard to be determined by Landscape Architect.
- B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.
 - 1. Joint Location:
 - a. Joints between concrete and asphalt paving.
 - b. Joints between concrete curbs and asphalt paving.
 - c. Other joints as indicated.
 - 2. Joint Sealant: As required by City of Canton, Engineering Dept. Standard Drawing No. 31.

END OF SECTION 32 13 73

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. Clay brick pavers set in concrete base and aggregate setting beds.
 2. Roadway Brick pavers set on concrete base with concrete sand and mortar setting bed.
 3. Aluminum and Cast-in-Place edge restraints.
 4. Joint sand.
 5. Grout.
 6. Filter Fabric.
 7. Granite curbs.
- B. Related Requirements:
1. Section 31 20 00 "Earth Moving" for excavation and compacted subgrade.
 2. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers and for cast-in-place concrete curbs and gutters serving as edge restraints for unit pavers.
 3. Section 32 13 73 "Joint Sealants" for sealing control and expansion joints in unit pavers with elastomeric sealants.
 4. Section 32 91 40 "Planting Prep Sand Based Structural Soil" for soil subbase material under pavement.

1.02 REFERENCES AND STANDARDS

- A. 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.
- B. The following references are used herein and shall mean:
1. Ohio Department of Transportation (ODOT) Construction and Material Specifications, Latest Edition, sections:
 - a. 203 Roadway Excavation & Embankment
 - b. 204 Subgrade Compaction & Proof Rolling.
 - c. 304 Aggregate Base.
 - d. 305 Portland Cement Concrete Base.
 2. City of Canton Engineering Dept (COCED) Standard Construction Drawings and Specifications.
 3. ASTM: American Society of Testing Materials
 - a. C902 Standard Specification for Pedestrian and Light Traffic Paving Brick
 - b. C1272 Standard Specification for Heavy Vehicular Paving Brick
 - c. C67 Method of Sampling and Testing Brick and Structural Clay Tile
 - d. C-33 Standard Specification for Concrete Aggregates.
 - e. C-136 Standard Method for Sieve Analysis for Fine and Coarse Aggregates
 4. BIA: The Brick Institute of America
- C. American Disabilities Act, Part 36, Appendix A- Standards for Accessible Design.

1.03 SUBMITTALS (OR ACTION SUBMITTALS)

- A. Product Data: For materials other than water and aggregates.
- B. Product Data: For the following:
 - 1. Clay Pavers – product literature, installation instructions and material safety data sheets.
 - 2. Aggregate setting bed materials
 - 3. Mortar and grout materials.
 - 4. Edge restraints.
 - 5. Granite Curbs
- C. Samples for Initial Selection: For the following:
 - 1. Each type of unit paver indicated.
 - 2. Joint materials involving color selection.
 - 3. Exposed edge restraints involving color selection.
 - 4. Granite for stone curbs.
- D. 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.]
 - 2. Joint materials.
 - 3. Exposed edge restraints.
 - 4. Granite curbs.

1.04 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with manufacturers standards. Provide for each type and size of unit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.
 - 1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C 67.
 - 2. Submit test results from qualified independent testing laboratory indicating ASTM C 902 and ASTM C 1272 compliance, as applicable.
 - 3. Submit manufacturer's certification of conformance to ASTM standards.
- C. Cleaning and Maintenance Instructions:
 - 1. Brick Pavers.
 - 2. Joints.
- D. Shop Drawings and Details:
 - 1. Plans: Show location, laying patterns, and sizes of each type of unit paving, edge restraints, expansion and control joint locations, and drain locations.
 - 2. Details: Show detail of each type of setting assembly and interface between each type of adjoining paving.
- E. D. Bedding and Jointing Sand:
 - 1. Submit sieve analysis results in accordance with [ASTM C 136] for bedding and joint sand.
 - 2. Provide supplier name, source and type of sands used for bedding and jointing.
- F. Paving Installer: Job references from projects similar in size and design to this project.

1. Provide Owner, General Contractor names, postal address, phone, fax and email address.

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. Certificates: Provide certificates as required by law for transportation and inspections of materials. Inspection and/or approval by governmental agencies does not preclude rejection of materials at project site.
- C. Paver Manufacturer's Qualifications:
 1. The manufacturer shall demonstrate a minimum of 5 years successful experience in the manufacture of interlocking 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.
- D. Installer Qualifications:
 1. Time: Not less than 3 years successful experience with installation of work of the type required by this project (with at least 100,000 square feet of sand set brick pavers installed).
 2. 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.
 3. 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.
- E. Installer's foreman shall have at least 5-year's 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.
- F. Preconstruction Compatibility and Adhesion Testing: Submit to latex-additive manufacturer, for testing indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.
 1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.
 2. COCED Standards Drawings and details apply for all work within public right-of ways.
- G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Demonstrate the proposed range of aesthetic effects and workmanship.
 - a. Install a 10 ft by 10 ft area of pavers on a prepared substrate including edge restraint to illustrate component pattern and edge details.
 - b. Provide mock-up for each paver type and bonding pattern.
 - c. Use mock-up to determine pre-compaction bedding sand level, joint sizes, lines, laying pattern(s), and color and texture ranges.

2. Obtain Owner's Representative approval of mockups before starting unit paver installation.
 3. Document approved mock up with photographs.
 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 5. Demolish and remove mockups when directed.
 6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

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.
- B. Weather Limitations for Mortar and Grout:
 1. Cold-Weather Requirements: Protect unit paver work against freezing when ambient temperature is 40 deg F and falling. Heat materials to provide mortar and grout temperatures between 40 and 120 deg F. Provide the following protection for completed portions of work for 24 hours after installation when the mean daily air temperature is as indicated: below 40 deg F, cover with weather-resistant membrane; below 25 deg F, cover with insulating blankets; below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F. TMS 602/ACI 530.1/ASCE 6 applies.
 2. Hot-Weather Requirements: Protect unit paver work when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher. TMS 602/ACI 530.1/ASCE 6 applies.
 - a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

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 CLAY BRICK PAVERS

- A. All clay paving brick specified or shown on drawings shall be manufactured by (No substitutions permitted):

Name: The Belden Brick Company
Address: P. O. Box 20910
Canton, Ohio 44701-0910
Phone: 330-456-0031
Email: jim.piteo@beldenbrick.com

- B. Clay Brick Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I, Application PS. Provide brick without frogs or cores in surfaces exposed to view in the completed Work. Subject to compliance with requirements, provide products by the following:

1. P1 – Pedestrian
 - a. Thickness: 2-1/4 inches.
 - b. Face Size: 4 by 12 inches (nominal).
 - c. Color: 80% Carbon Black, 20% Landmark Grey.
 - d. Pattern: Herringbone
 - e. Edge: Straight
2. P3 - Promenade
 - a. Thickness: 2-1/4 inches.
 - b. Face Size: 4 by 12 inches (nominal).
 - c. Color: Carbon Black
 - d. Pattern: Stacked Bond
 - e. Edge: Straight
3. P4 – ADA Band
 - a. Thickness: 2-1/4 inches.
 - b. Face Size: 4 by 8 inches (nominal).
 - c. Color: Landmark Grey (Tumbled)
 - d. Pattern: Stacked Bond
 - e. Edge: Straight

- C. Clay Brick Pavers: Heavy vehicular paving brick; ASTM C 1272, Type R, Application PS. Provide brick without frogs or cores in surfaces exposed to view in the completed Work. Subject to compliance with requirements, provide products by the following:

1. P1.2 – Vehicular
 - a. Thickness: 2-3/4 inches.
 - b. Face Size: 4 by 12 inches (nominal).
 - c. Color: 80% Carbon Black, 20% Landmark Grey.
 - d. Pattern: Herringbone

- e. Edge: Straight
- 2. P2 – Vehicular
 - a. Thickness: 2-3/4 inches.
 - b. Face Size: 4 by 8 inches (nominal).
 - c. Color: 80% Carbon Black, 20% Landmark Grey.
 - d. Pattern: Herringbone
 - e. Edge: Chamfered
- 3. P5 – Pavement Markings (Roadway)
 - a. Thickness: 2-3/4 inches.
 - b. Face Size: 4 by 8 inches (nominal) with lugs.
 - c. Color: Ivory Bay.
 - d. Edge: Chamfered

D. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.

2.03 CURBS AND EDGE RESTRAINTS

- 1. Aluminum Angled Edge Restraints: Standard-profile extruded-aluminum edging, ASTM B 221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections.
 - a. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1) Curve-Rite, Inc.
 - 2) Permaloc Corporation.
 - 3) Sure-Loc Edging Corporation.
 - b. Thickness: 3/16 inch, 2 inch min. height, 2" min. flange.
- B. Job-Built Concrete Edge Restraints: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 4000 psi.
- C. Granite Curbs: Standard and Flush Granite Curbs complying with ASTM C 615/C 615M.
 - 1. Varieties and Sources: Subject to compliance with requirements, provide the following:
 - a. Type: W5 - Granite Curbs by Cold Spring Granite Inc.
 - 2. Granite Color and Grain: Carnelian Granite.
 - 3. Top Width: as per drawings.
 - 4. Face Height: as per drawings.
 - 5. Total Height: as per drawings.
 - 6. Finish: Thermal finish all exposed faces or surfaces unless noted otherwise on the drawings.

2.04 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

2.05 AGGREGATE SETTING-BED MATERIALS

- A. Paver - Aggregate for Leveling or Bedding Course:
 - 1. Crushed #9 limestone grits—ASTM D 448 for size

- B. W5 – Straight Granite Curb – Sub-Base:
 - 1. ODOT 703, Compacted No. 57 course aggregate.
 - 2. Solid Brick Pavers for setting and leveling curb.
 - 3. ODOT Item 499 at 2000 psi backfill material.
- C. Herbicide: Commercial chemical for weed control, registered with the EPA. Provide in granular, liquid, or wettable powder form.

2.06 MORTAR SETTING-BED MATERIALS

- A. Brick Paver Mortar Setting bed – 1 inch maximum compacted concrete ODOT 703.02 (ASTM C33) Setting Bed with mortar.
- B. Water: Potable.

2.07 SAND JOINT FILLERS

- A. Joint Sand - a polymeric sand stabilizer for granite pavers.
 - 1. Alliance Design Products: Eurostone Bond for natural stone paver joints. www.alliancegator.com
 - 2. Color of polymeric sand shall be uniform matching the paver in color, and shall be approved by the Landscape Architect.
 - 3. Sand shall be supplied by a single source. Source of supply shall not be changed during course of project without written permission of the Architect.

2.08 FILTER FABRIC

- A. Filter fabric separator shall be 12" meeting ODOT 712.09, Type E. Located at the top of each weep hole, below all setting beds.
 - 1. Aggregate backfill in hole: No. 8 stone.

PART 3 - EXECUTION

- A. Methodology: The installer's method statement shall be a detailed narrative describing all aspects of paver installation. It must include but not be limited to indicating the proposed starting points, direction of operations and progress of Works, the pattern dimensional controls to be used and the personnel and equipment to be kept on site at all times.
- B. Substrate: The Contractor shall inspect concrete base with the installer and the Construction Manager to ensure that it meets the grade requirements for proper installation and that the area is free from standing water, debris or obstructions prior to commencing paver installation. The Contractor shall rectify any deviations in the underlying surface levels greater than plus or minus ¼ inch or other deficiencies if and when they occur, and shall not permit the installer to continue paving these areas until they are rectified. The Landscape Architect will not be responsible for determining whether the substrate is ready for power operation to begin.
- C. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- D. Clean concrete substrates to remove dirt, dust, debris, and loose particles.

3.02 INSTALLATION, GENERAL

- A. CIP Concrete / Precast / Stone Curbs: Install per details on the Drawings.
- B. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.

- C. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures as recommended by the manufacturer.
- 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.
 - 1. The pavers shall be laid 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.
- E. Joint Pattern: As indicated.
- F. Cut pavers as required using table type wet saws. 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.
 - 1. Oversized pavers may be required to avoid undersized paver pieces. See details for further information.
- G. At the end of the laying period, the pavers shall be adjusted to form straight pattern lines and uniform joints. The maximum deviation from a 30 ft. string line shall be +/-1/4 inch. Minimum joint width is 1/16". The maximum joint width shall not exceed twice the manufacturer's material tolerance for length and width.
- H. 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.
- I. On recommencement of laying operations the edge two courses of existing paving shall be lifted and the sand rescreeded before further pavers are laid.
- J. 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.
- K. Spread dry jointing sand over the surface of the pavers so that it penetrates into the joints and secures the pavers. Remove all sand prior to compaction. Never apply polymeric sand to wet, moist, or damp pavers. Never allow polymeric sand to come in contact with asphalt surfaces.
- L. The pavement shall be compacted using a high frequency / low amplitude plate compactor with a plate area of not less than 2-1/2 sq. ft. capable of 3,000 lbf to 5,000 lbf transmitting at frequency of 75 – 100 Hz. The installer shall take necessary precautions to prevent damage to the paver. Compaction shall be permitted within 4 ft. of an unrestrained edge.
- M. After vibration of the pavers to finished elevations, dry jointing sand shall be brushed over the surface and the pavement shall be re-compacted until all joints are completely filled with sand. Great care shall be taken to ensure that the joints are filled; sand shall be constantly brushed over the surface and the pavement re-compacted as necessary.
- N. On completion of vibration, before and after joint filling, surface tolerances shall be within 3/16 in. under a 10 ft. straight edge and plus 1/4 in. to minus 1/8 in. from finished elevation. There shall not be a difference in elevation between adjacent units of greater than 1/16 in. Elevations should be such that no water ponds on the surface.
- O. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
 - 1. No "birdbaths" or other surface irregularities will be permitted.
 - 2. Correct irregularities to the satisfaction of the Architect.
- P. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide foam filler as backing for sealant-filled joints, unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete.

Install joint filler before setting pavers. Sealant materials and installation are specified in Division 07 Section "Joint Sealants."

- Q. Expansion and Control Joints: Provide joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.
- R. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 - 1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.
 - 2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
 - 3. Install job-built concrete edge restraints to comply with requirements in Division 03 Section "Cast-in-Place Concrete."
- S. Joint Sand Stabilizer: Install joint sand filler with sand stabilizer per manufacturer's directions.

3.03 AGGREGATE SETTING-BED APPLICATIONS (Over Concrete Base)

- A. Core drill 1" diameter holes through concrete subbase in areas specified on drawings.
 - 1. Fill hole with No. 8 drainage aggregate and place 12" square filter fabric over hole prior to placing aggregate leveling course.
- B. Place leveling course and screed to a thickness of 1 inch (or as per detail), ensuring that 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 one inch thick.
 - 2. 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 sand 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 aggregate 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.

3.04 SAND-CEMENT SETTING-BED APPLICATIONS.

- A. Conform to Canton Standard Drawing No. 41 detail and specifications.
- B. Place sand-cement setting bed where indicated by spreading material not less than 1 inch thick.
- C. Place pavers carefully by hand in straight courses, with hand tight joints maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain 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 after sufficient heat has built up in the surface from several days of hot weather.

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- D. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Use a vibrating plate compactor over the entire surface making several passes. Refill the joints and remove excess sand after joints are filled.

3.05 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.

3.06 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.

3.07 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.

3.08 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 32 14 00

SECTION 32 15 43 - STABILIZED AGGREGATE SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes material and labor requirements for construction to stabilized aggregate paving with Stabilizer binder additive for the following items:
 - 1. Stabilized decompose granite aggregate surfaces
- B. Related Sections:
 - 1. Section 32 22 00 "Earthwork"
 - 2. Section 32 14 00 "Unit Paving" (Edge treatments)

1.02 PERFORMANCE REQUIREMENTS

- A. Perform gradation of decomposed granite material or 3/8" or 1/4" minus crushed aggregate in accordance with ASTM C 136 – Method for Sieve Analysis for Fine and Course Aggregates.

1.03 SUBMITTALS

- A. For each product specified. Submit a 5 lb. sample and sieve analysis for grading of decomposed granite or crushed 3/8" or 1/4" minus aggregate to be sent to Stabilizer Solutions, Inc. prior to any construction – (allow 2 week turn around). Must be approved by Landscape Architect and Owner
- B. Product Data: Manufacturer's literature completely describing all components of stabilized aggregate surfacing system, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation methods and application procedures.
- C. Material test reports: Sieve analysis of aggregate material specified and acceptance of said material by Stabilizer Solutions, Inc. for using stabilizer product. Contractor to submit identical sample (if not already tested) to Stabilizer Solutions, Inc. for testing prior to any installation for verification of material acceptance for durability and aggregate gradation as specified below (allow min. 2 week turn around for report).
- D. Shop Drawings: Submit plan layout of all stabilized crushed aggregate surfacing and detail drawings showing the various components of the surfacing system, base and edging.

1.04 PROJECT/SITE CONDITIONS

- A. Field Measurements: Each bidder is encouraged to visit the site of the Work to verify the existing conditions. No adjustments will be made to the Contract Sum for variations in the existing conditions.
 - 1. Where surfacing is indicated to fit with other construction, verify dimensions of other construction by field measurements before proceeding with the work.
- B. Environmental Limitations: Do not install stabilized aggregate paving during rainy conditions or below 40 degrees Fahrenheit and falling.
 - 1. Adhere to all Manufacturer's specifications.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Installer to provide evidence to indicate successful experience in providing Stabilized Aggregate surface or ability to follow installation instructions.
- B. Mock-ups: Install 4 ft. wide x 10 ft. long mock-up of decomposed granite or 3/8" or 1/4" minus crushed aggregate surfacing with Stabilizer® additive at location specified by owner's representative.
- C. Compaction testing to be provided by contractor, one test per 2,000 square feet of base course.
- D. Manufacturer's technical representative shall visit the site at the start of an installation to ensure the installer understands the correct installation methods to use.
- E. Comply with Manufacturer's specifications.

1.06 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the installer agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Premature wear and tear, provide the material is maintained in accordance with manufacturer's written maintenance instructions.
 - 2. Failure of system to meet performance requirements.
- C. Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.
- D. Contractor shall provide, for a period of sixty days, unconditional maintenance and repairs as required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Aggregate Manufacturer: Provide "Stabilized Pathway Mix" decomposed granite surfacing system by the following:
 - 1. Basis of Design:
 - Kafka Granite, LLC
 - 550 East Hwy 153
 - Mosinee, WI 54455
 - Tel: (800) 852-7415 (Toll Free)
 - Tel: (715) 687-2423
 - Email: Kafka@kafkagraanite.com
 - Web: www.kafkagranite.com
 - 2. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.
- B. Stabilizer® for Stabilized Aggregate surfaces provided by the following manufacturer:
 - 1. Basis of Design:
 - Stabilizer Solutions, Inc.
 - 33 South 28th St.,
 - Phoenix, AZ 85034
 - Tel: (602) 225-5900

Tel: (800) 336-2468
Website: stabilizersolutions.com
Email: info@stabilizersolutions.com

2. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.

2.02 MATERIALS

- A. Stone screenings as follows:
 1. Crushed Aggregate: Basis of Design
 - a. Kafka – Stabilized Decomposed Granite Pathway Mix or equal.
 - 1) Color and Mix: Imperial Gray Granite
- B. Decomposed Granite or 3/8" or 1/4" crushed aggregate screenings.
 1. Sand and crushed stone shall consist of inert materials that are hard and durable, with stone free from surface coatings and deleterious materials. Gradation requirements shall be as follows:
 2. Crushed Stone Sieve Analysis Percentage of Weight Passing a Square Mesh Sieve AASHTO T11-82 and T2782

1/4" MINUS AGGREGATE GRADATION

U.S. Sieve No.	Percent Passing by Weight
# 3/8"	100
# 4	90 – 100
# 8	75 – 100
# 16	55 – 65
# 30	40 – 50
# 50	25 – 35
# 100	15 – 20
# 200	10 – 15

- C. Stabilized Binder
 1. Basis of Design: StabilizerR Binder by Stabilizer Solutions.
 - a. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.
 2. Patented, non-toxic, organic binder that is a colorless and odorless concentrated powder that binds stabilized aggregate.
 3. Product to have 64% pre-consumer recycled content.
 4. Product shall have 25 years experience at same formulation.
- D. Subbase Course Material
 1. ODOT Item 304.

2.03 ACCESSORIES

- A. Water: Clean and potable, free from contaminants that would be deleterious to the decomposed granite surfacing. Specifier

- B. Steel Edging: 3/16-inch thick x 4-inch deep with overlapping joints. 1. Stakes: 3/16-inch x 16-inch long x 1 3/4-inch wide at top tapering to point at bottom; locate at 36-inch on center maximum.
- C. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Application of the herbicide shall pose no short or long term health threats to the installer or the general public.

2.04 EXCESS MATERIALS

- 1. Provide owner's authorized rep. with the following excess materials for use in future stabilized crushed aggregate paving repair: (4) 50 lb. bags of the aggregate paving blended with proper amount of Stabilizer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions under which Work of this Section will be performed. Notify Landscape Architect of unsatisfactory preparation before proceeding.
- B. Correct conditions detrimental to timely and proper completion of Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Lay out work prior to the commencement of installation.

3.02 PREPARATION

- A. Excavation: Excavate to depth required so edges of decomposed granite surfacing will match adjacent grades and have a maximum cross-slope of 2 percent. Ensure edges and bottom of excavation are in a smooth and even line.
- B. Subbase Course Preparation: Place the subbase coarse aggregate free from ridges, depressions or hollows. Rake and compact to 95% Standard Proctor Density.
 - 1. Subbase conditions and thickness may vary. See drawings for requirements.
- C. Steel Edging: Install edging flush with the top of the decomposed granite surfacing. Provide sufficient stakes to secure edging in place during and after decomposed granite surfacing material installation.
- D. Pre-soak base material with water and compact to 95% determined by Test Method ASTM D 1557 prior to installing Stabilized Aggregate.
 - 1. Compaction testing: One test per 2,000 square feet of base.
- E. Although porous, it is recommended to have proper drainage available to ensure no standing water on surface or adjacent to Stabilized Aggregate, including downspouts when placed under roof overhang and surface drains.
- F. Before proceeding with installation, notify Owner's Representative in writing of unsuitable site/base conditions

3.03 BLENDING STABILIZER

- A. Stabilizer® shall be thoroughly pre-mixed with aggregate at the rate of 15-lbs of Stabilizer® per 1-ton of aggregate. Verify with manufacturer correct Stabilizer® rate for your project and climate. Drop spreading of Stabilizer® over pre-placed aggregate or mixing by rototilling is not acceptable. Stabilizer shall be mechanically pre-mixed per manufacturer's recommendations using an approved mechanical blending unit to adequately blend Stabilizer® with aggregate (Bucket blending is not an approved blending apparatus). Always blend Stabilizer® and aggregate DRY.

3.04 PLACEMENT

- A. After pre-blending, place Stabilized Aggregate directly on prepared sub-grade. Level to desired grade and cross section. Depth of pathways shall be 3" for heavy foot traffic and light vehicles. DO NOT place on filter fabric. Contact Stabilizer Solutions, Inc. for installation on slopes greater than 8%.

3.05 WATERING

- A. Water heavily for full-depth moisture penetration of profile. Water activates Stabilizer®. Apply 25 to 45- gallons of water per 1-ton to achieve saturation. Randomly test for depth using a probing device, which reaches full depth.
- B. Contractor shall wait a minimum of 6 – 72 hours or until such time that the Stabilized Aggregate is able to accept compaction from a 1 to 5 ton roller without separation, plowing or any other physical compromise of the aggregate.
- C. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.

3.06 COMPACTION

- A. Compact Stabilized Aggregate to 85% relative compaction by equipment such as; a 2 to 5-ton double drum roller making 3 to 4 passes. Do not begin compaction for 6 hours after placement and up to 72 hours.
 - 1. DO NOT use a vibratory plate compactor or vibration feature on roller, as vibration separates large aggregate particles. If pumping or pancaking of surface occurs, surface is still too wet to roll.
- B. Take care in compacting surface when adjacent to planting and irrigation systems, use 8" or 10" hand tamp. Installation of Stabilized Aggregate more than 3" thick shall be installed in lifts. If 4" thick compacted (2) 2" lifts. If 5" thick compacted (2) 2.5" lifts. If Stabilized Aggregate is pre-moistened before installation entire 4" or 5" lift may be installed.
- C. Lightly spray surface area following compaction. Do not disturb aggregate surface with spray action.

3.07 INSTALLATION TOLERANCES

- A. Decomposed Granite Surfacing Thickness: Allow for 20-25% compaction.
 - 1. Subbase Course: Plus or minus 1/2-inch.
 - 2. Surface Course: Plus 1/4-inch, no minus.
- B. Decomposed Granite Surfacing Smoothness: Produce a surface smoothness within 1/4-inch tolerance when measured with a 10-foot straightedge.
 - 1. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowed variance from template is 1/4-inch.

3.08 INSPECTION

- A. Finished surface of aggregate pavement shall be smooth, uniform and solid. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material shall not be present on the surface. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.09 PROTECTION

- A. Contractor shall furnish and install construction fence around new surface to prevent public access. Fencing shall be maintained in place for a minimum of 12 - 72 hours after completion of installation, or as directed by the Owner' Representative. Drying period may take longer due to weather conditions.
- B. Contractor shall notify Owner's Representative that landscape irrigation shall be restricted near Stabilized Aggregate surface until drying period is complete. Standing water on surface and adjacent to path shall be restricted at all times

3.10 MAINTENANCE

- A. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed. Any plowing program required during winter months shall involve the use of a rubber baffle on the plow blade or wheels on the plow that lifts the blade 1/4" off the paving surface.
- B. During the first year, a minor amount of loose aggregate will appear on the paving surface (1/16" to 1/4"). If this material exceeds a 1/4", redistribute the material over the entire surface. Water thoroughly to the depth of 1". Compact with power roller of no less than 1000 lbs. This process should be repeated as needed.
- C. If cracking occurs, simply sweep fines into the cracks, water thoroughly and hand tamp with an 8" – 10" hand tamp plate.

3.11 REPAIRS

- A. Excavate damaged area to the depth of the Stabilized Aggregate and square off sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. Pre-blend the dry required amount of Stabilizer® with the proper amount of aggregate in a concrete mixer.
- D. Add water to the pre-blended Stabilized Aggregate. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.
- E. Apply moistened pre-blended Stabilized Aggregate to excavated area to finish grade.
- F. Compact with an 8" to 10" hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

END OF SECTION 32 15 30

SECTION 32 18 13 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes synthetic turfgrass surfacing system.
 - 1. Furnish all labor, materials, tools and equipment necessary to install, in place, all synthetic turf as indicated on the plans and as specified herein, including all related materials not specified under another section but required for the work, whether or not specifically referred to herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's written installation instruction, and in accordance with all approved shop drawings.
- B. Related Requirements:
 - 1. Section 31 20 00 - Earth Moving.
 - 2. Section 03 30 00 – Cast-in-Place Concrete.
 - 3. Section 33 46 00 – Sub-drainage
 - 4. ODOT Construction and Material Specifications dated 2013

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.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: One (1) set of documents shall be prepared at the scale of the construction documents and contain all pertinent information regarding installation. These drawings shall be submitted to the Landscape Architect for approval prior to the manufacturing and shipment of materials.
 - 1. Submit drawings for:
 - a. Seaming plan.

- b. Installation details; edge details, methods of attachment, back stop detail, other inserts, method of cutting around backstop and others inserts, etc.
 - c. Other details on construction, especially any details that may deviate from these plans and specifications.
 2. Show layout of game lines, numbers, and letters. Indicate application method of each line and marking.
 3. Show location and layout of team logo/graphics.
 - C. Synthetic Grass Vendor must submit the following to Owner's Representative or Landscape Architect prior to commencing construction of the synthetic grass playground system:
 1. The (1) copy of material certificates and samples for materials that will be used on the project. Each material certificate must be marked as approved by the synthetic grass contractor.
 2. Submit representative samples of the following components that will be used on the synthetic grass playground system for approval by Owner's Representative or Landscape Architect:
 - a. One (1): 12 inches loose sample of synthetic grass product.
 - b. One (1): 12 inches boxed sample including infill and resilient base course representative of finished synthetic grass system.
 - c. One (1): 12 inches square sample of shock attenuation base material.
 - d. Seam Sample: 24 inches square with seam centered in sample.
 - e. One (1) copy of independent test report from a certified independent laboratory certifying the proposed synthetic grass surface system is fully compliant with:
 - I. ASTM 1292-04
 - II. ASTM D-5848 – pile height, tuft spacing, face weight and total weight
 - III. ASTM D-1335 – tuft Bind
 - IV. ASTM D-5034 – grab tear breaking strength
 - V. ASTM D-2858 – flammability (pill test)
 - VI. ASTM F-1551 – water permeability
 - f. One (1) copy of independent test report from a certified independent laboratory certifying the proposed synthetic grass surface system is fully compliant with ASTM 1951 Standardized test for ADA Compliance.
 - g. One (1) of the product warranty for proposed synthetic grass product.
 - h. One (1) copy of a signed letter from synthetic grass vendor certifying that the proposed synthetic grass product is manufactured in the USA.
 3. Source Limitations: Obtain synthetic turn surface system materials from single source from single manufacturer.
 4. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.
 5. ASTM 1292 Test Results: Critical Fall Height – impact attenuation test results shall be submitted to the requiring agency prior to installation of the surface material. The results shall be submitted on the letterhead of the independent testing lab. Impact attenuation results must comply with ASTM 1292 *Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment for the critical fall height of the equipment.*
 - D. 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.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer] [testing agency].
 - 1. Certified list of at least ten (10) existing installations, including Owner representative and telephone number, attesting compliance with quality assurance information. Five (5) of the existing installations must be within 150 miles of the project site.
 - 2. The base contractor (if different from the turf contractor employees) must provide a list of synthetic turf bases completed within the last 2 years, including an owner representative
- B. Product Test Reports: For each synthetic grass surfacing assembly.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For synthetic grass surfacing, including maintenance cleaning instructions, to include in maintenance manuals.

1.07 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 10 sq. yd. for each type indicated.
 - 2. Infill: Minimum of 5 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.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer Qualifications: The synthetic grass vendor and contractor must be experienced in the installation of synthetic grass systems and have completed a minimum of Five (5) major systems, a minimum of 10,000 sf each within the United States, Three (3) systems, within 150 miles of project site.
 - 2. The synthetic grass vendor shall employ only qualified, experienced supervisors and technicians skilled in the installation of synthetic grass systems.
 - 3. The synthetic grass vendor 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/installer shall have been in the synthetic turf installation business, under the same ownership, for at least five (5) years.
 - 5. The Contractor/installer shall have a representative on site to certify the installation and Warranty compliance.
 - 6. Synthetic Grass Surface Installer Qualifications
 - a. Installer must be IPEMA certified to install the synthetic grass surface.
 - I. Synthetic Grass Vendor must submit One (1) copy of Certification.
- B. Contractor must meet the following criteria:

1. Have proper Contractor's license, in good standing, and have never had a license revoked.
2. Have not had a Surety or Bonding company finish work on any contract within the last ten (10) years.
3. Have not been disqualified or barred from performing work for any public Owner or other contracting entity.
4. No current litigation for unacceptable work or non-completion of work.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees F (4 degrees C) and a maximum temperature of 90 degrees F (32 degrees C).

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Install surfacing system when minimum ambient temperature is 40 degrees F (1 degree C) and maximum ambient temperature is 90 degrees F (32 degrees C). Do not install in steady or heavy rain

1.11 WARRANTY

- A. 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 and turf surface material. The warranty coverage shall not be prorated nor limited to the amount of the usage.
- B. The warranty submitted must have the following characteristics:
 1. Provide full coverage of materials and workmanship for a minimum of eight (8) years from the date of substantial completion.
 2. Warrant the workmanship and materials installed meet or exceed the product specifications.
 3. Cover defects in the installation and workmanship.
 4. Repair or replace such portions of the installed materials that are no longer serviceable to maintain a useable and playable surface.
 5. Be from a single source covering workmanship and all materials.
 6. Assure the availability of exact or substantially the same replacement materials for the synthetic grass system for the full warranty period.
 7. 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.
 8. 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.
- C. When defective material or workmanship is discovered which will require repair or replacement, all such repair work or replacement work shall be done by the CONTRACTOR at its own expense after written notification is given of such required repairs. However, if the CONTRACTOR fails to comply with the requirements of the above guarantee within

reasonable time after notification is given, the Owner, Owner's Representative or Landscape Architect shall proceed to have the repairs made by others at the CONTRACTOR'S expense.

1. Any unsafe conditions that arise shall be secured and maintained by the installer until all required repairs or replacements have been completed.
2. All resurfacing will conform in kind and quality to the specifications set forth in the plans and specifications and will be free of defects in workmanship and material.

PART 2 - PRODUCTS

2.01 SYNTHETIC RESILIENT GRASS SURFACING

- A. Manufactures and Type: ForeverLawn - Fusion Elite
 1. Product:
ForeverLawn of Ohio, Inc.
5901 Ely Vista Dr.
Parma, OH 44129
Ph. 330-614-9390
<http://ohio.foreverlawn.com>
 2. No substitutions will be permitted. **Owner to provided turfgrass material only.**
Contractor bid price to include all other materials and installation:

2.02 MISCELLANEOUS

- A. Leveling base – 3/8" angular aggregate or as per Manufacturer's requirements.
- B. Aggregate base – 3/4" angular aggregate or as per Manufacturer's requirements.
- C. Nailer board – pressure treated, size varies or as per Manufacturer's requirements.
- D. Concrete anchors for nailer boards per Manufacturer's requirements.
- E. Staples – galvanize 1".
- F. Primer Adhesive – as per Manufacturer's requirements.
- G. Closed Cell Foam – Attenuation Material
 1. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
- H. Resilient infill system – as per Manufacturer's requirements.

2.03 MATERIALS

- A. Rubber Infill: Ground SBR crumb rubber mesh free of metal, nonmetal fibers, and contaminants; mesh size as recommended by synthetic grass surfacing manufacturer.
- 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. Shock-Attenuation Pad: Porous composite consisting of rubber granules bound with urethane adhesive, 1 inch thick; with drainage composite laminated to one side. Provide shock-attenuation pad with permeability sufficient to meet synthetic grass surfacing assembly permeability indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine base and other conditions, with Installer and Landscape Architect present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.
 - 1. Confirm work limits as per drawings.
 - 2. Examine exposed subgrades and sub-base surfaces for compliance with requirements for dimensional, grading, and elevation tolerances. Contractor is responsible for all work and materials necessary, but not limited to, aggregate fill, drainage and installation of turfgrass surface system to finish grade within the work limits areas. Coordination with other trades in area will be necessary.
 - 3. Confirm point of connection to storm drainage system is available within each zone area.
 - 4. Proceed with synthetic turfgrass sub-surface operations 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 and Section 31 20 00 "Earth Moving". Verify that substrates are sound and without high spots, ridges, holes, and depressions.
 - 1. Install sub-drainage system according to manufacturer's requirements.
 - 2. Install minimum aggregate base to 95% proctor. Slope the base material 1/8 inch per foot to accommodate proper drainage.
 - 3. Install aggregate leveling course to manufacturer's requirements.
 - 4. Cleaning - the entire surface shall be clean and free of any foreign material.

3.03 INSTALLATION

- A. General: Comply with synthetic grass surface system manufacturer's written installation instructions. Install synthetic turfgrass surface system over area and in thickness indicated.
 - 1. Thickness: The total depth of the surface shall be installed in strict accordance and conformity to the Manufacturer's drawings and these specification requirements. Surface thickness will vary in the impact layer. The thickness of the impact layer will be installed according to the fall height (s) of the play equipment as specified. These requirements must be verified in the field prior to starting the installation of the impact layer.
- B. 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.
- C. Closed Cell Foam Installation: Install Manufacturer's specified Foam Attenuation Material per approved shop drawings and confirmed fall height thicknesses for each play area.
- D. Synthetic Turf Installation:
 - 1. Rough cut synthetic grass rolls for installation.
 - 2. All seams shall be installed and secured with micromechanical primary bonding. Seams secured primarily with adhesive, hot weld, or stitching shall not be accepted.
 - 3. Install rubber infill to Manufacturer's recommended volume and density, using manual or machine-operated spreading equipment, distributing and embedding rubber infill throughout synthetic grass and into fiber matt

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Perform the following tests and inspections:
 - 1. Permeability: <Insert number> in./h of rainfall capacity according to ASTM F2898 or EN 15330-1.

3.05 DEMONSTRATION

- A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

3.06 PROTECTION

- A. Protect the installed synthetic turfgrass surface from damage resulting from subsequent construction activity on the site.

3.07 FINAL CLOSURE

- A. Provide owner with maintenance manuals and hold on-site meeting with owner representatives with instructions for maintaining and repair the turfgrass.
- B. Supply owner with a minimum 10 sy of material and padding for future repair or patching.

END OF SECTION 32 18 13

SECTION 32 18 16 - PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Unitary synthetic poured bonded rubber seamless surface.
- B. Related Sections:
 - 1. Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for concrete subbase preparation.
 - 2. Section 31 00 00 "Earthwork" for subgrade preparation, grading, and subbase course.

1.02 DEFINITIONS

- A. Definitions in ASTM F2223 apply to Work of this Section.
- B. Critical Height: Standard measure of shock attenuation. According to ASTM F2223, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."
- C. SBR: Styrene-butadiene rubber.
- D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.03 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: According to ASTM F 1292.
- B. Accessibility of Surface Systems: According to ASTM F 1951.
- C. CPSC No. 325

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of protective surfacing.
 - 1. Include plans, sections, placement details, and attachment to substrates.
 - 2. Include accessories and edge terminations.
 - 3. Include patterns made by varying colors of surfacing and details of graphics.
 - 4. Include fall heights and use zones for equipment and structures.
 - 5. Delete "Samples for Initial Selection" Paragraph above if colors and other characteristics are preselected and specified or scheduled. Retain first paragraph below with or without above.
- C. Samples for Verification: For each type of playground surface system indicated.
 - 1. Minimum 1-quart loose-fill surface sealed in a container.
 - 2. Minimum 6-by-6-inch Sample of synthetic rubber seamless surface.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.

- B. Product Certificates: For each type of unitary synthetic playground surface system, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each unitary synthetic playground surface system.
- D. Field quality-control reports.
- E. Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For playground surface system to include in maintenance manuals.

1.07 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. Loose Fill: Amount equal to 10 sq. feet of amount installed, but no fewer than 1 units

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain playground surface system materials, including primers and binders, from single source from single manufacturer.
- C. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for materials and execution.
 - 1. Build mockups for protective surfacing including accessories.
 - a. Size: 48 inches by 48 inches.
 - 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.

1.09 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system installation to be performed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Manufacturer and Installer agree to repair or replace components of playground surface system that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Reduction in impact attenuation.
 - b. Deterioration of surface and other materials beyond normal weathering.
 - 2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain protective surfacing materials, including loose-fill accessories, from single source from single manufacturer.
 - 1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.02 PERFORMANCE REQUIREMENTS

- A. Impact Attenuation: Critical fall height tested according to ASTM F1292.
- B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.03 UNITARY SYNTHETIC DUAL-DENSITY SEAMLESS SURFACE

- A. Surface System: Poured-in-place, two-layer system with wearing course over cushion course. Provide manufacturer's standard thickness for each layer as required for overall thickness indicated, tested for impact attenuation according to ASTM F 1292 and for accessibility according to ASTM F 1951.
 - 1. Manufactures: Basis of Design:
 - a. Manufacture: Surface America
 - 2. Wearing Course: Formulation of EPDM rubber particles, with minimum of 20 percent and maximum of 26 percent of ethylene propylene-diene-saturated polymethylene main chain along with other organic and inorganic components.
 - 3. Cushion Course: Manufacturer's standard formulation of recycled SBR particles and polyurethane, site mixed and applied.
 - 4. Binder: Weather-resistant, UV-stabilized, flexible, nonhardening, 100 percent solids polyurethane complying with requirements of authorities having jurisdiction for nontoxic and low VOC content.
 - 5. Lacquer Top Coat: Manufacturer's standard polyurethane-based formulation.
 - 6. Critical Height: 6 feet. (Confirm maximum fall height of structures within the playground zone does not exceed the noted Critical Height).
 - 7. Overall Thickness: Not less than as required for critical height indicated.
 - 8. Primer/Adhesive: Manufacturer's standard primer and weather-resistant, moisture-cured polyurethane adhesive suitable for unit, substrate, and location indicated.
 - 9. Top Surface Wearing Course Color(s): 33% Light Gray EPDM 33% Dark Gray and 33% Black EDPM,.
 - a. Color Pattern: None.
- B. Leveling and Patching Material: Portland cement-based grout or epoxy or polyurethane-based formulation suitable for exterior use and approved by playground surface system manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, and other conditions affecting performance of the Work.

- B. Hard-Surface Substrates: Verify that substrates are satisfactory for unitary playground surface system installation and that substrate surfaces are dry, cured, and uniformly level within recommended tolerances according to playground surface system manufacturer's written requirements for cross-section profile.
 - 1. Concrete Substrates: Verify that substrates are dry, free from surface defects, and free of laitance, glaze, efflorescence, curing compounds, form-release agents, hardeners, dust, dirt, loose particles, grease, oil, and other contaminants incompatible with playground surface system or that may interfere with adhesive bond. Determine adhesion, dryness, and acidity characteristics by performing procedures recommended in writing by playground surface system manufacturer.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.
- B. Concrete Substrates: Provide sound surface free of laitance, efflorescence, curing compounds, and other contaminants incompatible with playground surface system.
 - 1. Repair unsatisfactory surfaces and fill holes and depressions.
 - 2. Mechanically scarify or otherwise prepare concrete substrates to achieve recommended degree of roughness.
 - 3. Saw cut concrete for terminal edges of playground surface systems as indicated.
 - 4. Treat control joints and other nonmoving substrate cracks to prevent telegraphing through playground surface system.

3.03 INSTALLATION, GENERAL

- A. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.

3.04 INSTALLATION OF SEAMLESS PLAYGROUND SURFACE SYSTEMS

- A. Seamless Surface: Mix and apply components of playground surface system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface and impact-attenuating system of total thickness indicated.
 - 1. Substrate Primer: Apply over prepared substrate at manufacturer's standard spreading rate for type of substrate.
 - 2. Poured Cushion Course: Spread evenly over primed substrate to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation, with a minimum of cold joints.
 - 3. Intercoat Primer: Over cured cushion course, apply primer at manufacturer's standard spreading rate.
 - 4. Wearing Course: Spread over primed base course to form a uniform layer applied at manufacturer's standard spreading rate in one continuous operation and, except where color changes, with no cold joints. Finish surface to produce manufacturer's standard wearing-surface texture.
 - a. Where colored pattern is indicated, place adjacent colored material as soon as placed colored material is sufficiently cured, using primer or adhesive if required by manufacturer's written instructions.

5. Lacquer Topcoat: Spray or roller applied at manufacturer's standard coating rate in one continuous operation.
6. Edge Treatment: As indicated. Fully adhere edges to substrate with full coverage of substrate. Maintain fully cushioned thickness required to comply with safety performance requirements.

3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Perform the following tests with the assistance of a factory-authorized service representative:
 1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
 2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.
- C. Playground protective surfacing will be considered defective if it does not pass tests.
- D. Prepare test reports.

3.06 PROTECTION

- A. Seamless Systems: Prevent traffic over system for not less than 48 hours after installation.

END OF SECTION 32 18 16

SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Seating.
 - 2. Tables.
 - 3. Bicycle Racks.
 - 4. Waste and Recycling Receptacles.
 - 5. Flag Pole
 - 6. Steel Frame Fire Pits
 - 7. Skate Stops

- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for installing pipe sleeves and concrete footings.
 - 2. Section 31 20 00 "Earth Moving" for excavation for installing 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 Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish, not less than 6-inch-long linear components and 4-inch-square sheet components.
- E. 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] [Planks]: No fewer than [two] <Insert number> full-size units for each size indicated.
 - 2. Trash and Recycling Receptacle Inner Containers: Five full-size units for each size indicated.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. All site furnishings have been pre-selected by Landscape Architect and Owner. Substitution will not be permitted.

2.02 TABLE, CHAIRS and BENCHES

- A. Manufacturer: Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048. Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

1. Furnishing F1
 - a. Type: Parc Centre Table
 - b. Type: Parc Centre Chairs (No Arms)
 - c. Description: 30-inch dia. table and 2-chairs per table.
 - d. Color: 6021 RAL
 - e. Mounting: Free Standing
2. Furnishing F2
 - a. Type: Harpo Lounge Chair
 - b. Description: Steel frame with slatted seat and back.
 - c. Wood Type: Jarrah
 - d. Frame Color: Dark Grey RAL 7024
 - e. Mounting: Embedded
3. Furnishing F3:
 - a. Type: Multiplicity Table and Bench
 - b. Table Description: 29"H x 35"D x 95"W.
 - c. Bench Description: Backless, straight 18"H x 23"D x 95"W (2 benches per table)
 - d. Wood Type: Jarrah
 - e. Frame Color: Landscape Forms Onyx
 - f. Mounting: Surface Mount
 - 1) Custom bolt has 5/8-11 x 3/4" length thread, with Magni 565 coating secured to end frame with carbon steel 1/4-20 hex drive set screw with Magni 565 coating.

- B. Manufacturer: Tourensol Siteworks, 2930 Faber St., Union City CA, 94587. Phone: (800) 542-2282. Website: www.tournesolsiteworks.com.

1. Furnishing F4
 - a. Type: Pebble Bench YC01, YC02, YC03
 - b. Bench Description: Modern Style - GFRC Concrete, size and quantities vary.
 - c. Texture / Color: Natural Cement
 - d. Quantities: Contractor responsible to confirm quantities as per plans.
 - 1) YC01 (7)
 - 2) YC02 (3)
 - 3) YC03 (2)
 - e. Mounting: Permanent.

2.03 BICYCLE RACKS

- A. Manufacturer: Urban Accessories, 465 E. Fifteenth St., Tacoma, WA 98421. Phone: (877) 487-0487. Website www.urbanaccessories.com

1. Furnishing F5
 - a. Type: Curves
 - b. Description: Surface Mounted, 2 1/2" W x 1'-9 15/16" D x 2'-6" H
 - c. Metal Type and Finish: Aluminum, ASTM B26, Polyester Powdercoat.

2.04 TRASH RECEPTACLES

- A. Manufacturer: Landscape Forms, Inc., 7800 E. Michigan Ave, Kalamazoo, Michigan 49048. Phone: (800) 521-2546. Fax (269) 381-3455. Website www.landscapeforms.com
E-mail: specify@landscapeforms.com

1. Furnishing F6
 - a. Waste Receptacle Type: Central Park Conservancy
 - b. Description: 12-inch opening, 25" x 35" x 30 Gal.
 - c. Signage: With Signs, Without Ring Decals – "Landfill"
 - 1) Sign Labels: 3 Vinyl labels for the lid and 3 vinyl labels for the unit body.
 - d. Color: Landscape Forms Onyx
 - e. Mounted: Surface
2. Furnishing F7
 - a. Recycling Receptacle Type: Central Park Conservancy
 - b. Description: 8.6-inch opening, 25" x 35" x 30 Gal.
 - c. Signage: With Signs, With Ring Decals – "Recyclable"
 - d. Color: Landscape Forms Onyx
 - e. Mounted: Surface

2.05 FLAG POLES

- A. Manufacturer: American Flagpole, 26252 Hillman Highway, Abingdon, VA 24210, Phone: (800)-530-4078.

1. Furnishing Type: FP
 - a. Type: 1 qty. @ 40 ft, 2 qty @ 30 ft.
 - b. Description: Titan Series, Internal Halyard – Revolving Wire Cable Halyard with Winch with down light system.
 - c. Color: Satin Aluminum Pole and Spun Collar.
 - d. Lighting: See electrical lighting for "American Beacon Flagpole Light specification.

2.06 FIRE PIT – (DELEGATED DESIGN)

- A. General Description: Contractor to design/build/ and install steel fire pit, with waterproof emergency stop button and gas valve, custom steel plate sidewalls and burner pan with vents, electric ignition and timer, inclusive of electrical and gas hook-up compliant to all State and Local Codes.

1. Materials:
 - a. 1/4-inch thick Corten steel plate sidewalls and fire pan.
 - 1) Finish: Weathered.
 - 2) All welds and edges to be ground smooth.
 - a) See below Article: Fabrication.
 - b. Custom steel burner pan with sufficient air passages.
 - c. Custom brass firepit burner and pan w/electronic ignition with Rolled Lava Stone.
 - 1) Manufactured by: Warmingtrends.com (or approved equal)

2. Provide design for review and approval to Landscape Architect prior to shop drawing production. Proceed to shop drawings only after Landscape Architect approves the design.
3. Comply with all State and Local codes. Submit drawings as required for review and approvals.

2.07 SKATE STOPS

- A. Manufacturer: Skate Stoppers, 1547 N. Cuyamaca, El Cajon, CA 92920, www.skatestoppers.com , PH. (610) 447-6396.
 1. Model No. G0112SS,
 2. Material: 316 Stainless Steel, Brushed
 3. Description: Surface mount, drill and epoxy mounting pins into place.

2.08 DIGITAL KIOSK

- A. Digital display panel and cabinet – more information to come in Addendum No. 1.

2.09 CANTON SIGN

- A. Artistic 3-D sign, solid material with no lighting – more information to come in Addendum No. 1.

2.10 MATERIALS

- A. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.
- B. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.
- C. 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.

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.

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 (unless noted on drawings) 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 32 33 00

SECTION 32 84 00 - IRRIGATION**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Underground irrigation system for the landscape area.
 - 2. Pipe and fittings, valves, sprinkler heads, and accessories.
 - 3. Excavation and backfilling for installation of underground system components.
- B. Related Sections:
 - 1. Division 32 Section "Turf and Grasses".
 - 2. Division 32 Section "Plants".

1.02 SYSTEM DESCRIPTION

- 1. Provide flow velocities that do not exceed 5.0 ft. per second.
- 2. Only similar types of heads with matched precipitation rates may run on same zone.
- 3. System meter and backflow preventer will be located in the utility room as shown on the drawings.

1.03 SUBMITTALS: REVIEW

- A. Product Data: System components.
- B. Samples:
 - 1. Submit the following equipment samples:
 - a. Sprinkler heads, one of each type, complete with housing.
 - b. Valves and access boxes.
 - 2. Approved equipment samples shall be returned and may be incorporated in the work.

1.04 SUBMITTALS

- A. Comply with the requirements of the General Conditions.
- B. Record As-Built Drawings:
 - 1. Indicate exact location of check valves, gate valves, wire locations, head layout, automatic valves, quick couplers, all irrigation and drainage piping, etc.
- C. Operation and Maintenance Data:
 - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 - 2. Provide schedule indicating length of time each valve is required to be run to provide a determined amount of water.
 - 3. Provide a complete parts list with manufacturer's designations for each component.
- D. Submit all product warranties to Owner's Authorized Representative.
- E. Keys, Spare, Loose Equipment: Furnish loose irrigation equipment, operating keys and spare parts in quantities as follows:
 - 1. Three quick coupler keys and matching swivel hose ells.
 - 2. Two valve keys for gate valves.
 - 3. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.

4. Two cover lifting tools for valve boxes.

1.05 QUALITY ASSURANCE

- A. Installer's Qualifications:
 1. Single firm specializing in irrigation work with a minimum of 5 years experience properly installing large commercial irrigation systems of comparable size.
- B. Materials, equipment, and methods of installation shall comply with the following codes and standards:
 1. City of Canton Ohio/State of Ohio Building Codes.
 2. American Society for Testing and Materials (ASTM).
 3. National Sanitation Foundation (NSF).
 4. National Electric Code (NEC)
- C. 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 aforementioned rules and regulations, notify the Architect for instructions before proceeding with work affected.
- D. Testing:
 1. Final review and testing shall be made in conjunction with the final review of tree planting.
- E. 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. Arrange for and pay all costs in connection with any inspection and examination required by these authorities.
- F. Grounding:
 1. Per Manufacturer's recommendations

1.06 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.

1.07 MATERIALS STORAGE AND CLEAN-UP

- A. Keep the premises free from rubbish and all debris at all times. Arrange material storage so as not to interfere with the operation of the project. All unused materials, rubbish and debris shall be removed from the site.

1.08 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 other necessary Contractors.

- C. The Contractor shall verify the correctness of all finish grades within the work area to ensure the proper soil coverage of the irrigation system pipes.
- D. Space sprinkler components as indicated on the Shop Drawings; do not exceed sprinkler spacing shown on Drawings.
- E. Minor adjustments in system layout will be permitted to clear existing field obstruction. Final system layout shall be acceptable to the Architect.

1.09 WARRANTY

- A. Warranty the entire irrigation system and all related equipment and accessories for a period of one (1) year from the date of final acceptance against all defects in workmanship and/or material.
- B. The warranty period will commence upon final acceptance by the Owner's Authorized Representative for a complete system and/or any portion thereof has been put into operation and acceptable to the Owner's Authorized Representative.
- C. Insure complete coverage as specified herein of the areas to be irrigated. During the warranty period make any adjustments as necessary to maintain proper coverage.
- D. If, within one year from the date of completion, 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 if said contractor caused the damage.
- E. Should any operational difficulties in connection with the irrigation system develop within the specified guarantee period, which, in the opinion of the Owner's Authorized Representative may be due to inferior material and/or workmanship, the difficulties shall be immediately corrected by the Contractor to the satisfaction of the Owner at no additional cost to the Owner, including any and all other damages caused by such defects.

1.10 OPERATION & MAINTENANCE — IRRIGATION SYSTEM

- A. The entire irrigation system shall be under fully automatic operation for a period of three (3) days prior to any planting.
- B. It is the Irrigation Contractor's responsibility to determine water application rates and controller cycling. Provide any adjustments, repairs, etc., other than programming.

PART 2 - PRODUCTS

2.01 IRRIGATION SYSTEM MANUFACTURERS:

- A. 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.

2.02 MATERIALS

- A. General:
 - 1. Substitutions: If sprinkler heads or remote valves are requested to be substituted each zone affected by such substitution shall be recalculated for pressure loss, GPM, and shall be submitted to the Architect for review and approval.
 - 2. 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 irrigation mainline, use polyvinyl chloride (PVC) with a minimum rating of Schedule 40 unless otherwise shown on the drawings, sized to maintain a maximum flow velocity of less than 5 ft. per second (FPS). For laterals, use PVC class 200 sized to maintain a maximum flow velocity of less than 5 ft. per second. Provide separate pricing for mainline to be Class 200 in lieu of Schedule 40.
 3. Pipe shall be marked at intervals (not to exceed 5 ft.) 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.
 4. Avoid dropping and carefully handle pipe to prevent cracking or splitting.
 5. Comply with pipe sizes and types indicated on Shop Drawings. No substitution of smaller pipe will be permitted. Larger sizes may be used subject to acceptance of the Architect. Remove damaged and defective pipe from site.
 6. When connection is plastic to metal, Sch 80 TOE (Threaded One End) nipples shall be used. The nipple shall have two turns of Teflon tape, be hand tightened, plus one turn with a strap wrench. The connection to PVC shall be solvent welded.
 7. Minimum pipe size for laterals is 3/4".
- C. Piping for Sleeving
1. For sleeves under 6 inches in size, high impact type, polyvinyl chloride (PVC) 1120, minimum schedule 40.
 2. Coordinate sleeve installation for all piping passing under paved areas, through concrete or masonry walls and slabs while the same are under construction.
- D. Solvent for PVC Pipe
1. Provide purple Primer for solvent weld pipe bells and schedule 40 fittings.
 2. Provide Clear PVC cement for solvent weld pipe bells and schedule 40 fittings. Use Purple primer and Heavy-duty Gray PVC Cement for any schedule 80 fittings.
- E. Fittings
1. Fittings for Solvent -weld PVC Pipe
 - a. Schedule 40 or 80, polyvinyl chloride (PVC), Type 1 injection molded fittings
 - b. suitable for solvent weld or threaded connections, to meet ASTM D-2466-73 and D-2467-73 NSF approved. 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 remote control valve connections.
 3. Any 'T' intersections or 90-degree bends in pipe located under paved areas shall be made of ductile iron with positive restraints.
- F. Isolation Valves
1. Gate valves shall be 200 psi rated W.O.G. 200 with brass bodies. Valves shall be equipped with tee handles. As manufactured by Watts Regulator, West Andover, MA or acceptable Substitute. Locate as per Drawings.
- G. Valve Boxes
1. In grass, groundcover, and shrub areas, tapered rib reinforcement enclosure of rigid tensile strength plastic material components chemically inert and unaffected by moisture, ultra violet light, corrosion and temperature changes. Lid and base shall withstand normal loads exerted by turf equipment without collapsing. Lid to be green and lockable.
 2. Acceptable Manufacturers:

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- a. Armor Access Boxes, Sheboygan, WI 1-800-348-7558
 - b. Carson Brooks, La Verne, CA (818) 332-6225
3. For remote control valves and quick coupler valves use rectangular standard turf box, 16 inches x 11 inches.
 4. For Isolation valves use 9-inch circular turf box.
- H. Spray heads
1. Full or part circle fixed spray sprinkler.
 2. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultra-violet resistant plastic.
 3. 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 incorporate a pressure regulating device that will regulate nozzle pressure to approximately 30 psi.
 4. A built-in check valve shall prevent low-head drainage of up to 8 feet of head.
- I. Rotor heads
1. The rotor heads shall incorporate a stainless-steel riser sleeve and a built-in check valve.
 2. Although not mandatory, it is desired that rotor heads have rubber covers and an easy mechanism to stop flow to an individual head while the rest of the zone is running.
 3. A wide assortment of nozzles must be available, including Low Angle trajectories to effectively irrigate the many areas with trees.
- J. Electric Control Valve:
1. The valve bodies shall be constructed from glass-filled nylon and have a minimum pressure rating of 200 psi.
 2. All metal parts shall be stainless steel or brass (bronze)
 3. Solenoid parts shall be captive. Holding amperage to be no more than .22 amps.
 4. The diaphragm shall be fabric reinforced.
- K. Quick Coupler valves:
1. Valves shall be located as per Drawings.
 2. Valves to be standard brass construction.
- L. Irrigation Controller:
1. Acceptable Products:
 - a. Rainbird – ESP-LXD with IQ Manager Cartridge, controllable in the field with **hand-held remote**.
- M. Rain Detection:
1. Detection device to be located near the controller and wired to it for emergency system shut off in the event of a rain storm while system is running.
 2. Acceptable products: Rainbird RSD-BEx.
- N. PVC Solvent Cement:
1. Provide professional grade cement, Whitlam #PR32 or approved Substitute for PVC pipe and fittings.
- O. PVC Primer/Cleaner
1. Provide professional grade primer/cleaner, Whitlam #PP32 or approved Substitute (purple) primer.
 2. Remote Controller – Rainbird LIMR remote control. Installer to verify remote operates controller within the project limits.

PART 3 - EXECUTION**3.01 GENERAL**

- A. Carefully schedule irrigation work with landscaping work and all other site developments.
- B. Sleeves are required wherever piping or electrical wires are placed under paved surfaces.
- C. Lay out work as accurately as possible to plans. Drawings are diagrammatic to the extent that swing joints, offsets, and all fittings are not shown.
- 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. 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 sizes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of rejection.
- F. Install irrigation system after completion of site rough grading. The irrigation system shall be installed and completely operational prior to the installation of any planting operations.

3.02 POINT OF CONNECTION

- A. Provide irrigation system complete from point of connection (water room of the building). See drawings for Point of Connection (POC).
- B. Irrigation contractor shall be responsible for making the full connection and providing all piping and equipment downstream from a point 5' outside the building. Sleeving thru the exterior wall or grade beam for access out will be provided.

3.03 EXCAVATING AND BACKFILLING

- A. All piping is to be trenched. Pipe pulling method is not to be used.
- B. Comply with requirements for utilities in Earthmoving or Earthwork specifications in other contracts except as otherwise noted herein.
- C. Excavate to depths required to provide 2 inches depth of sand bedding material for piping when unsuitable bearing materials are encountered.
- D. Install lateral irrigation lines with a minimum cover of 12 inches and a maximum cover of 18-inches based on finished grades.
- E. 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.
- F. When two pipes are to be placed in the same trench, a 6-inch space is to be maintained between the pipes. Do not install two pipes with one directly above the other.
- G. The Contractor shall be held responsible for damages caused by these operations and shall immediately repair or replace damaged parts.

3.04 PIPE LINE 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.

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- B. Solvent-Welded Joints for PVC Pipe
1. Use solvents and methods approved by solvent and pipe manufacturers.
 2. Cure joints a minimum of one hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure, unless otherwise specified by the manufacturer.
 3. 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 1/4 turning motion. Hold pipe and fitting together a minimum of 30 seconds, wipe off excess with cloth.
- C. Laying of Pipe
1. Pipes shall be bedded in at least 2 inches of finely divided material with no rocks or clods over 1-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 so as to ensure 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. 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.

3.05 PVC SLEEVES

- A. It is the responsibility of the General Contractor to install sleeves for the successful completion of the irrigation system. Coordinate sleeving efforts with other Site Contractors and/or Construction Manager and Irrigation Contractor.
- B. All PVC sleeves shall be a minimum of twice (2x) 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.

3.06 ISOLATION VALVES

- A. Provide isolation valve within 10' of the point of connection and at 200' maximum spacing along the mainline.

3.07 VALVE BOXES

- A. Set valve boxes flush with grade or even with the crowns of grass roots. Boxes set too high or too low will be adjusted prior to project acceptance.
- B. Provide valve access boxes set on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the valve box. See irrigation details.

3.08 SPRAY HEADS

- A. All sprinkler heads within a zone shall have matched precipitation rates (see Drawings for selection).
- B. Install plumb to within 1/16 inch, unless otherwise noted (see detail for heads on sloped areas on detail sheet). Top of collar (not nozzle) should be flush with finish grade.
- C. Place spray heads 4 inches from edge of adjacent walks, curbs and mowing bands, or paved areas at time of installation, rotor heads 6 inches, root watering canisters 3 feet from center of tree trunks.
- D. All sprinkler nozzles shall be adjusted for the proper radius and direction of spray pattern. Make adjustments where possible to prevent over-spraying onto walks, pavement or buildings.

- E. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw as required for proper radius.
- F. Provide with approved flexible thick wall polyethylene swing pipe with spiral barb fittings. Do not install to side inlet of sprinkler head.
- F. Do not use polyethylene swing joints to extend head more than eighteen inches (18") from lateral.

3.09 FLUSHING, TESTING AND ADJUSTMENTS

- A. After piping is installed and before sprinklers and spray heads are installed, open control valves and flush out the system with full head of water.
- B. Sprinkler main line shall be tested under normal water pressure for a period of 12 hours. If leaks occur, repair and repeat the test.
- C. Testing of the system shall be performed after completion of each section or completion of the entire installation; and any necessary repairs shall be made, at the Contractor's expense, to put the system in good working order before final project close-out.
- D. Adjust all electric automatic valve control stems for system balance and optimum performance.
- E. Adjust all spray heads and risers for proper distribution of water over the pattern coverage. Adjust for the proper arc of coverage.
- F. After the system has been installed, test the entire system and demonstrate to the project team that the entire system meets coverage requirements and automatic controls function properly.
- G. Notify the Architect 24 hours prior to testing.

3.10 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. Restore and repair all disturbed or damaged areas resulting from irrigation installation operations to original condition in a manner acceptable to the Associate.
- C. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

END OF SECTION 32 84 00

**SECTION 32 91 20 – SOIL PREPARATION: MANUFACTURED
STANDARD TOPSOIL with COMPOST AMENDMENT**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS / GENERAL REQUIREMENTS

- A. Manufactured topsoil mix in this section shall hereafter be referred to as TCA (Topsoil with Compost Amendment).

1.02 SUMMARY

- A. Section Includes:
1. All labor, materials, equipment and testing requirements necessary to complete soil component selection, soil preparation, mixing and placement as shown on the drawings and specified herein, including but not necessarily limited to the following:
 - a. Soils available as 'off the shelf' products available from local vendors;
 - b. Various Topsoil with Compost Amendments (TCA) Mixes comprised of topsoil plus the organic amendment (compost) and other soil amendment materials, as needed to meet the specified criteria;
 - c. Standard and amended topsoils as noted in 2.04.A below.
 2. Test, furnish, deliver and install all soil materials, including off-site borrow soils, soil amendment materials, such as composted materials, and other soil amendments for use in the soil or per detail sections shown on the drawings.
 - a. Prepare transition zone and subgrade soils in all areas receiving TCA where shown on the plans.
 - b. Place, spread and bring to specified elevations all Soil Systems as indicated for each type.
 - c. Test installed Soil Systems to ensure compaction rates as specified.
 - d. Protect all Soil System installations by approved means until substantial completion.
- B. Related Sections: (eliminate ones that are not included)
1. Section 31 20 00 "Earth Moving" for subgrade and drainage preparation.
 2. 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. The following references are used herein and shall mean:
1. ASTM: American Society of Testing Materials
 2. USDA: United States Department of Agriculture
 3. USGA: United States Golf Association
 4. AASHTO: American Association of State Highway and Transportation Officials
 5. Standard Specifications: Regional, State or Municipal Standard Specification Documentations for the location of proposed usage
 6. AOAC: Association of Official Analytical Chemists
 7. SSSA: Soil Science of America, Methods of Soil Analysis, Part 1 & Part 3
 8. NCR221: Recommended Soil Testing Procedures for the North Central Region
 9. TMECC: Test Methods for the Examination of Composting and Compost

1.04 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of a Soil System after specified compaction and natural settling.
- B. Subgrade: Surface or elevation of subsoil remaining after completing excavation or backfill of soils or other materials immediately beneath transition mix or a TCA mix or other Soil System.
- C. Topsoil: A mineral soil from the A Horizon of a well-drained site and having a USDA soil texture classification of a Clay Loam or Loam and an organic matter content of not less than 3% by weight as specified below.
- D. Topsoil with Leaf Compost or Com-til Amendment: (hereafter referred to as TCA) equal to Kurtz Brothers 'Grower's Blend' soil or Jones Topsoil 'Supersoil'.
- E. Compost: An organic material that has been aerobically composted and stabilized from feedstocks such as green waste (yard debris), biosolids or other suitable organic materials
- F. Softscape: Landscaping items such as trees, shrubs, lawn grasses, other ornamentals plants, mulches, earth and related soils and other organic and "natural" items.
- G. Hardscape: All structural and fixed items such as concrete, cut stone, paving materials, lighting fixtures, benches and other fabricated items.
- H. 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.

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.
- C. Locations: Submit locations of material sources. Submit location of mixing site(s).
- D. Soil Mix Suppliers
 - 1. Landscape Architect shall have the right to reject any soil supplier.
 - 2. Soil mix suppliers shall have a minimum of 5 years experience at supplying custom TCA mixes.
 - 3. Submit supplier name, address, email, telephone and fax numbers and contact name.
 - 4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project and within the limitations of the Project Schedule.
- E. 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.
- F. Topsoil Submittals: Engage an independent testing agency to qualify soils, soil system components and specified soil mix. The Contractor shall submit representative samples of all component materials which are intended to be used to make mixes and all final mixes to an agricultural soil testing laboratory acceptable to the Landscape Architect. All soil tests shall be performed in accordance with the current methods provided by ASTM, USGA or NCR221, unless otherwise noted. All organic amendment tests shall be performed in accordance with the TMECC, unless otherwise noted. All reports prepared by the testing laboratory shall be sent to the Landscape Architect for approval. Samples of all soil materials to be brought to the site must be approved before delivery. Deficiencies in the topsoil, organic materials, other mix components or final soil mixes shall be corrected by the Contractor, as directed by the Landscape Architect after review of the testing agency report. Test reports shall include the following:
 - 1. Date issued.
 - 2. Project Title and names of Contractor and supplier.

3. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field inspector or laboratory contact.
 4. Date, place, and time of sampling or test, with record of temperature and weather conditions.
 5. Location of material source.
 6. Type of test.
 7. Results of tests including identification of deviations from acceptable ranges.
 8. Soil pH and Buffer pH Test.
 9. Analysis for levels of heavy metals to include arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc. Test results shall be cited in milligrams per kilogram dry weight with comparisons to USEPA 40 CFR Table 3 of § 503.13 Pollutant Concentrations.
 10. Particle size analysis shall be performed and compared to the USDA Soil Classification System per ASTM D422 (hydrometer test). The USDA sand and gravel classifications shall be determined on material retained on the #270 sieve following a wet washing procedure.
 11. Deleterious materials shall be determined by ASTM D 5286.
 12. Percent of organic matter by weight shall be determined by ASTM D 2974 Method C, loss on ignition at 440°C.
 13. Saturated hydraulic conductivity shall be determined by ASTM F1815.
 14. 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.
 15. Soluble salts shall be determined by electrical conductivity of a 1:2 soil/water slurry reported in millimhos per cm.
 16. Cation Exchange Capacity (CEC) per NCR221 using the ammonium acetate method.
 17. Soil analysis reports shall show recommendations for soil additives, including organic and inorganic soil amendments, necessary to accomplish particular mix objectives noted.
- G. Organic Amendment (Compost) Submittals
1. Reports of analyses from producers of composted organic materials are required. Testing procedures shall conform to TMECC Methods, unless otherwise noted. Reports shall include pH, salinity, total nitrogen, carbon:nitrogen ratio, phosphorus, potassium, calcium, magnesium, sodium and boron by saturated media extraction (SME per NCR-221), moisture, bulk density, particle size analysis, organic matter content and Solvita Maturity Index. Composted organic materials shall be tested for the USEPA 503 heavy metals.
 2. Biological tests for pathogens in compost:
 - a. Contact the testing laboratory to review testing and sampling requirements before sending samples.
 - b. Sampling requirements: composted organic amendments shall be sampled according to the Ohio EPA Composting Regulations 3745-24-46.
 - c. Maintain clear and concise records of testing and sampling procedures.
 - d. Compost samples shall be tested for the following:
 - 1) Fecal coliforms (MPN) TMECC 07.01
 - 2) Salmonella (MPN) TMECC 07.02
- H. Testing Agencies: The following firms are acceptable testing agencies for the various components.
1. Soil physical analysis on all components and TCA soil mixes including particle size analysis shall be determined by an A2LA Accredited Lab, such as Hummel & Co, 35 King Street, Trumansburg, NY 14886, tel. 607-387-5694, fax 607-387-9499 or other qualified laboratory approved by the Landscape Architect.

2. Soil Chemical analysis on all components and TCA soil mixes shall be performed by CLC LABS, 325 Venture Drive, Westerville, OH 43081, phone 614- 888-1663, fax 614-888-1330 or other qualified laboratory approved by the Landscape Architect.
 3. Compost testing shall be performed by CLC LABS, 325 Venture Drive, Westerville, OH 43081, phone 614-888-1663, fax 614-888-1330 or other qualified laboratory approved by the Landscape Architect.
- I. Although the report(s) may contain the laboratory's comments or recommendations to the Landscape Architect regarding amendment requirements or procedures, the report shall not be interpreted as prescribing or dictating procedures or quantities of soil materials for the work of this Contract.
 - J. Changing testing laboratories during the mix development phase or for quality assurance testing must be authorized by the Landscape Architect.
 - K. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications of the selected testing agencies.
 - L. Submit samples of all listed materials to the Landscape Architect for approval:
 1. Topsoil, each source, 2-3 lb packaged.
 2. Organic Amendment (Compost), each source, 2-3 lb. packaged
 3. Com-til biosolids mix, 2-3 lb packaged
 4. TCA or Lawn Mix, each specified type, 2-3 lb. packaged.
 - M. Equipment Data: Submit descriptive information with wheel load data for each proposed item of equipment to be used for execution of all earthwork of this Contract. Equipment data will be evaluated for conformance to site use restrictions and mix compaction potential. All equipment used in mix placement shall have a ground pressure level of 4 psi or lower.
 - N. 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. The TCA mix is comprised of approved topsoil, additional organic amendment and possibly other soil amendment materials, as determined by the testing laboratory. Each component of the TCA Mix must meet the specification herein and be verified by testing as specified herein, prior to delivery to the site.
- B. No mix component of the TCA will be accepted unless it meets all submittal, testing and certification requirements including the testing and certification reports in the format specified herein.
- C. Inspections and Testing
 1. Soils, composts, and other materials testing as well as Soil Mix 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 mixes that do not meet the requirements of the Specifications shall be removed by the Contractor at no cost to the project.
 5. Samples of individual components all Soil Systems shall be submitted by the Contractor for testing and analysis to the approved testing laboratory.

6. No component for the TCA mixes shall be used until test reports from the approved testing laboratory have been received and approved by the Landscape Architect.
7. As necessary, make any and all mix amendments to achieve the required specifications and resubmit tests reports indicating amendment changes until approved.
8. Include verification testing of on-site sub-soils for suitability to support Transition Mix and TCA Mixes to provide adequate sub-surface drainage.

D. Qualifications:

1. Installation and maintenance foreman on the job shall be competent English-speaking supervisor(s), experienced in landscape installation and maintenance. Perform work with personnel totally familiar with TCA soil preparation and lawn and TCA installations under the supervision of a foreman experienced with landscape work.
2. Testing Laboratory: Experienced person or persons 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 with regard to the specified testing. The Testing Laboratory shall be as approved by the Landscape Architect.
3. 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 or material.

- E. 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 REGULATORY REQUIREMENTS

- A. The Contractor shall comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make work comply with such requirements without additional cost to Owner.
- B. The Contractor shall procure and pay for permits and licenses required for work of this section.

1.08 PROJECT CONDITIONS

- A. The Contractor shall be responsible for pedestrian and vehicular safety and control within the work site. He/she shall provide the necessary warning devices and ground personnel needed to give safety, warning and protection to persons and vehicular traffic within the area.
- B. During site preparation, soil installation and protection, the Contractor shall be responsible for all damage to existing features above and below finished grade drainage, utility lines, paving surfaces, existing vegetation, site furnishings incurred as a result of work operations. Repairs or replacements shall be made to the satisfaction of the Owner.
- C. 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 in regard to the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary.
- D. 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 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.
- E. Environmental Requirements for Soils, Soil Components and Soil 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 placed during rain or wet weather or when near or above the point where maximum compaction will occur.
- F. 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.

1.09 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, soil mixes shall be covered with a tarpaulin until time of actual use and protected from contamination, excessive rainfall, excess water entering the site or erosion.

PART 2 - PRODUCTS

2.01 General

- A. Pulverized topsoil as meeting the specification below. Subgrade soils may not be site salvaged.
- B. Topsoil used in TCA Mixes may not be site salvaged.
- C. All TCA mix components shall fulfill the requirements as specified.

2.02 SOIL COMPONENTS

- A. Topsoil Component
- B. A loamy, friable mineral soil essentially free from heavy or stiff clay lumps, stones, cinders, concrete, brick, roots, sticks brush, litter, plastics, metals, refuse or other deleterious materials in accordance with ASTM D 5286-92. The soil shall be free of herbicides, petroleum-based materials or other substances of a hazardous or toxic nature which may inhibit plant growth. The soil shall be free of noxious weeds, seeds or vegetative parts of weedy plants that cannot be selectively controlled in the TCA.
- C. The soil shall be taken from the A Horizon of a well-drained site and have a USDA soil texture classification of a Clay Loam or Loam. The topsoil shall have the following particle size distribution:

U.S.D.A.		
<u>Particle Name</u>	<u>Size (mm)</u>	<u>Allowable Limit</u>
Gravel	2.00 – 4.75	Less than 5%
Sand	0.05 – 2.00	25 – 40 %
Silt	0.002 – 0.05	25 – 50 %
Clay	minus 0.002	20 – 35 %

- D. The topsoil component shall meet the following specifications. Perform the following tests and submit test reports showing the following criteria are met:
 1. The particle size analysis as defined above.
 2. The pH shall be approx. 5.5 to 7.8 (NCR 221)
 3. The soluble salts shall be less than 1.5 mmoh/cm (NCR 221)

- 4. The organic matter content shall be 3.0 to 6.0% (ASTM D 2974 Method C)
- E. Provide certification from the supplier that the topsoil does not contain any toxic substances harmful to plant growth.
- F. Off-site (borrow) topsoils meeting the criteria shown above can be used for TCA and their source or location communicated to the Landscape Architect.

2.03 COMPOSTED ORGANIC MIX COMPONENT

- A. Base for Design: Com-til Compost – processed biosolids, mixed and composted with wood chips and yard waste.

City of Columbus
7000 Jackson Pike (S.R. 104)
Lockbourne, OH 43137,
614-645-3153.

- B. Organic Component – non proprietary requirements:
 - 1. The organic amendment shall be stable, mature aerobically composted yard debris (green waste) compost. Leaf humus compost, manure composts, biosolids compost, peat, peat-humus and mushroom compost products are not acceptable. The compost material must meet the requirements of the Ohio EPA Composting Regulations (OAC 3745-27-46) and have the following characteristics:
 - a. The compost shall be a homogeneous material essentially free of soil clods, lumps, roots and stones.
 - b. The compost shall have a man-made foreign material (hard plastics, metal, glass, etc.) content less than 1.5% as material retained on a U.S. Std.No.5 (4 mm) sieve (TMECC 03.06)
 - c. The compost shall be screened such that a minimum of 90% passes a U.S.Std. 3/4" sieve and that no more than 10% passes a U.S. Std. No.10 sieve on a dry weight basis.
 - d. The compost shall have a pH of 7.2 to 8.0
 - e. The compost shall have a soluble salts content less than 6.0 millimhos per cm. when determined on a 1:5 compost/water slurry
 - f. The compost shall have an organic matter content of not less than 35% by weight determined by ASTM D2974-87 Method C on material passing a U.S. Std.1/4" sieve.
 - g. The compost shall have a carbon to nitrogen (C:N) ratio less than 36:1.
 - h. The compost shall have a Solvita[®] Maturity Index between 6 and 7.
 - i. The compost shall have a moisture content of 35% to 65%.
 - j. The compost shall have a dry bulk density of 0.17 to 0.35 grams per cubic centimeter (g/cc).
 - k. 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 (NCR-221)
 - l. The heavy metal content as determined by TMECC 04.06 shall not exceed the following limits:

<u>Element</u>	<u>Concentration Limits</u> <u>(mg/Kg d.w.)</u>
Arsenic	41
Cadmium	39
Chromium	1200
Copper	1500
Lead	300

Mercury	17
Molybdenum	50
Nickel	420
Selenium	36
Zinc	2800

- m. The compost shall meet all applicable state regulations based on the feedstock type.
- n. 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. TCA MIX TYPES:

2.04 TCA MIX TYPES:

- A. Provide the following TCA Mix types at the locations and depths as indicated on the Contract Drawings. Mix ratio volumes, will be established upon completion of the testing for the individual components of the TCA Mixes. The controlling factor will be the percent (%) organic matter by weight as specified for each TCA 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. Follow the recommendations on mix design provided by the soil testing laboratory to achieve the target organic matter content for TCA mix.

PART 3 - EXECUTION

3.01 VERIFICATION

- A. Prior to construction and soil placement operations at TCA areas ascertain the location of all electric cables conduits under drainage systems and utility lines. Take proper precaution so as not to disturb or damage sub-surface elements. Contractor failing to take these precautions shall be responsible for making requisite repairs to damaged utilities at Contractor's own expense.
- B. Verify that required underground utilities are available, located, and ready for use. Coordinate with other trades.
- C. Verify that all work requiring access through or adjacent to areas where TCA mixes are to be placed has been completed and no further access will be required. In the event that access will be required, this must be coordinated with the Contractor.

3.02 SITE PREPARATION FOR TCA SOIL MIXES

- A. Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the Drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.
- B. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade as shown on the drawings.
- C. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that 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. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use ½" 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. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.
 - 2. Any damage to the paving or architectural work caused by the soils installation Contractor shall be repaired by the general contractor at the soils installation contractor's expense.

- E. 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.
- F. Ripping Subgrade Soil:
 - 1. Prior to placing topsoil, rip areas to receive topsoil on the same day topsoil is placed.
 - 2. Rip subgrade twice to a depth of 6 inches. Place ripping tines at 24 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.
- G. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so topsoil material will bond with existing material.

3.03 TCA MIXES PREPARATION

- A. General:
 - 1. TCA mixes for planters and plant backfill shall be of the type(s) indicated in accordance with the planting details, and shall be pre-mixed and placed as specified.
 - 2. All amendments shall be thoroughly incorporated into the mixture to assure uniform distribution. Delay mixing of fertilizers if TCA will not follow within a few days.
 - 3. Additional amendments shall be mixed into the soil as recommended by the testing laboratory and as approved by the Landscape Architect for each plant type and condition of installation.
 - 4. Adequate quantities of TCA 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.
 - 5. Uniformly mix components using a mechanical soil blender designed for such purpose as specified for each TCA Mix Type.
 - a. Mixing of topsoil and compost: Add compost as recommended by the testing laboratory to achieve the specified organic matter content by TCA Mix type. Other amendments shall not be added to TCA Mixes unless approved by the Landscape Architect and additional tests have been conducted to verify type and quantity of amendment.
- B. Testing of TCA mix components:
 - 1. Perform and provide initial tests to confirm compliance with the TCA Mix organic matter content specifications. These test results, when approved, will establish the standard to which all other test results must conform.
- C. TCA Mix Testing:
 - 1. Take one (1) composite sample upon arrival to the site from each 500 cubic yards or as required by the Landscape Architect for testing each type of TCA Mix and test the following:
 - a. Particle size analysis: Use sieve sizes as specified for the Base Mix.
 - b. Organic matter content ASTM D2974-87 Method C on material passing a U.S. Std.1/4" sieve.
 - c. Nutrient Analysis to include phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper and boron. Request testing laboratory recommendations for fertilizer requirements for plant types being used.
 - d. Soil pH and Buffer pH
 - e. Cation Exchange Capacity
 - f. Soluble Salt Content

- D. Stockpiling:
1. Stockpiling imported soil on-site, off-site, and at the source should be restricted to no more than the needs of what can be used in a 72-hr. period. Under no circumstances shall on-site or off-site stored material exceed 500 cubic yards.
 2. Stockpiles should be no more than 6 feet 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.

3.04 PREPARATION & PLACEMENT OF TRANSITION LAYER

- A. Prior to preparation and placement the Contractor shall verify as-constructed or existing elevations and do whatever additional grading is necessary to bring the subgrades to the correct elevations as indicated on the Drawings.
1. Clean up subgrade and dispose of all debris prior to placement.
- B. Any soils polluted by gasoline, oil, plaster, construction debris, unacceptable soils, or other substances which would render the soils unsuitable for a proper plant growth shall be removed from the premises whether or not such pollution occurs or exists prior to or during the Contract period. In the event that such material is placed, this material shall be removed and replaced with approved material. All remedial operations associated with soil mixes shall be reviewed and approved by the Landscape Architect.
- C. Transition Layer: After acceptance of grades for planting areas, a "Transition" layer shall be formed by mixing the SBSS Mix with existing native subgrade material to the proper depth per the drawings.
1. Loosen subsoil to a depth as shown in the details.
 2. Place SBSS Mix in lifts not to exceed 8 inches in depth and blend with top 6" of loosened native subsoil.
 3. Lightly compact using a light-weight plate compactor.
 4. Root systems of existing plants adjacent to soil work especially soil adjoining existing trees, shall be protected from damage to the fullest extent possible and 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. Blending of Transition Mix with native soils immediately adjacent to existing roots may be carefully conducted by amending the soil by hand with hand tools.

3.05 PLACING TCA SOIL MIX

- A. Remove all large clods, lumps, brush, roots, stumps, litter, and other foreign material and stones one-half inch (1/2") in diameter or larger. Dispose of removed material legally off-site.
- B. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
- C. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- D. 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.
- E. Place and spread TCA Mix of the type specified over approved subgrade or transition zone areas to a depth sufficiently greater than the depth required for TCA areas so that after settlement as previously approved by Landscape Architect, the completed work will conform to the lines, grades, and elevations shown or otherwise indicated.
- F. For Plant Bed Areas:
1. Required Transition Layer depth per drawings.

2. Required TCA Soil depths shall be as indicated on drawings with a total of TCA Mix(es) to be a minimum per the drawings as measured in place in a settled or compacted position.
3. Place fills lightly in layers of a maximum of eight-inch (8") lifts and carefully settle soils to eliminate air pockets and to minimize future settling. Lightly scarify previously placed surfaces prior to placing subsequent lifts. Method of settlement shall be as previously approved by the Landscape Architect. Method may include, but is not limited to, light hand-tamp, light rolling or the use of a light-weight plate compactor with the number of passes approved by the Landscape Architect. Do not over compact TCA Mixes.
4. After compaction has occurred, add mix to maintain finished grades. If for any reason soil is left exposed for a long duration prior to TCA, add soil 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.

G. For Lawn Areas:

1. Required Transition Layer depth shall be per drawings.
2. Required topsoil or TCA Mix depth shall be as indicated on drawings with the total TCA Mix to be a minimum per the drawings as measured in place in a settled or compacted position.
3. Place fills lightly in layers of a maximum of eight inch (8") lifts and carefully settle soils to eliminate air pockets and to minimize future settling. Lightly scarify previously placed surfaces prior to placing subsequent lifts. 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 of time 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. Do not over compact TCA Mixes.
4. Roll the whole surface of lawn bed with a hand roller weighing approximately one hundred pounds (100 lb.) per foot (12") of roller width. During the rolling, fill all depressions caused by settlement with additional TCA soil and then re-grade. Lightly roll and rake until the surface presents a smooth, even, and uniform finish that is at required grade.
5. Allow plant mix in lawn areas to remain undisturbed until fully settled in accordance with settlement methodology submitted as approved by the Landscape Architect. After any additional settlement has occurred, restore areas to finished grade prior to seeding or sodding. Protect plant mix against construction activity with site protection fence as specified and the eroding effects of wind and rain with filter fabric as approved for the protection plan.

H. Backfilling for trees in this area shall use material specified in this section and be installed as specified in Division 32 Section "Plants". Placing, shoring or anchoring is the responsibility of the Contractor as shown on the drawings.

I. Grading Tolerances: TCA areas shall be fine graded within $\pm 1/10$ (0.10) feet of grades indicated on drawings. Maintain all flat areas and slopes to allow free flow of surface drainage without ponding.

3.06 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 32 91 20

SECTION 32 91 40 – SAND-BASED STRUCTURAL SOIL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. All labor, materials, equipment and testing requirements necessary to complete soil component selection, soil preparation, mixing and placement as shown on the drawings and specified herein, including but not necessarily limited to the following:
 - a. Construct Sand-Based Structural Soil System (hereafter referred to as 'SBSS) profiles using the specified materials and techniques as contained herein, on the drawings and by manufacturer's specifications where applicable.
 - b. Test, furnish, deliver and install all soil materials, including off-site borrow soils, soil amendment materials, such as sands, topsoils, organic amendment (compost) materials, aggregates and other soil amendments for use in the Soil Systems consisting of, but not necessarily limited to, Sand-Based Structural Soil Profile (SBSS) comprised of the specified sand and the specified organic amendment.
 - c. Prepare transition zone and subgrade soils in all planting areas.
 - d. Place, spread and bring to specified elevations all Soil Systems as indicated for each type.
 - e. Test installed Soil Systems to ensure compaction rates as specified.
 - f. Protect all Soil System installations by approved means until substantial completion.

B. Related Sections:

1. Section 03 30 53 "Misc. Cast-in-Place Concrete" for planter walls and curbs.
2. Section 31 20 00 "Earth Moving" for subgrade and drainage preparation.
3. Section 32 14 00 "Unit Paving" for pavers over structural soils.
4. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips

1.02 REFERENCES AND STANDARDS

A. The following references are used herein and shall mean:

1. ASTM: American Society of Testing Materials
2. USDA: United States Department of Agriculture
3. USGA: United States Golf Association
4. AASHTO: American Association of State Highway and Transportation Officials
5. Standard Specifications: Regional, State or Municipal Standard Specification Documentations for the location of proposed usage
6. AOAC: Association of Official Analytical Chemists
7. SSSA: Soil Science of America, Methods of Soil Analysis, Part 1 & Part 3
8. NCR221: Recommended Soil Testing Procedures for the North Central Region
9. TMECC: Test Methods for the Examination of Composting and Compost

1.03 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of a Soil System after specified compaction and natural settling.

- B. 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.
- C. Topsoil: A mineral soil from the A Horizon of a well-drained site and having a USDA soil texture classification of a Clay Loam or Loam and an organic matter content of not less than 3% by weight as specified below.
- D. Sand: A naturally occurring mineral that has been processed to remove coarse gravel, silt and clay and sized to meet the specifications.
- E. 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
- F. Soil System: A profile consisting of the native sub-grade soil or a manufactured fill material and subsequent layers, such as the Bioretention Upper or Lower Profile Mix, Transition Mix or a Planting Mix.
- G. Softscape: Landscaping items such as trees, shrubs, lawn grasses, other ornamentals plants, mulches, earth and related soils and other organic and "natural" items.
- H. Hardscape: All structural and fixed items such as concrete, cut stone, paving materials, lighting fixtures, benches and other fabricated items.
- I. 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.

1.04 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.
- C. Locations: Submit locations of material sources. Submit location of mixing site(s).
- D. Soils System Components and Soil Mix Suppliers
 - 1. Landscape Architect shall have the right to reject any soil supplier.
 - 2. Soil mix suppliers shall have a minimum of 5-years of experience at supplying custom planting mixes.
 - 3. Submit supplier name, address, email, telephone and fax numbers and contact name.
 - 4. Submit certification that accepted supplier is able to provide sufficient quantities of materials and mixes for the entire project and within the limitations of the Project Schedule.
- E. 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.
- F. Sand and Organic Material Submittals: Engage an independent testing agency to qualify SBSS components and specified soil mixes. The Contractor shall submit representative samples of all component materials which are intended to be used to make mixes and all final mixes to an agricultural soil testing laboratory acceptable to the Landscape Architect. All soil tests shall be performed in accordance with the current methods provided by ASTM, USGA or NCR221, unless otherwise noted. All organic amendment tests shall be performed in accordance with the TMECC, unless otherwise noted. All reports prepared by the testing laboratory shall be sent to the Landscape Architect for approval. Samples of all soil materials to be brought to the site must be approved before delivery. Deficiencies in the sand, or organic materials, other mix components or final soil mixes shall be corrected by the Contractor, as directed by the Landscape Architect after review of the testing agency report. Test reports shall include the following:
 - 1. Date issued.
 - 2. Project Title and names of Contractor and supplier.

3. Testing laboratory name, address and telephone number, and name(s), as applicable, of each field inspector or laboratory contact.
4. Date, place, and time of sampling or test, with record of temperature and weather conditions.
5. Location of material source.
6. Type of test.
7. Results of tests including identification of deviations from acceptable ranges.
8. Soil pH and Buffer pH Test.
9. Analysis for levels of heavy metals to include arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc. Test results shall be cited in milligrams per kilogram dry weight with comparisons to USEPA 40 CFR Table 3 of § 503.13 Pollutant Concentrations.
10. Particle size analysis shall be performed and compared to the USDA Soil Classification System per ASTM D422 (hydrometer test). The USDA sand and gravel classifications shall be determined on material retained on the #270 sieve following a wet washing procedure.
11. Deleterious materials shall be determined by ASTM D 5286.
12. Percent of organic matter by weight shall be determined by ASTM D 2974 Method C, loss on ignition at 440°C.
13. Saturated hydraulic conductivity shall be determined by ASTM F1815.
14. 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.
15. Soluble salts shall be determined by electrical conductivity of a 1:2 soil/water slurry reported in millimhos per cm.
16. Cation Exchange Capacity (CEC) per NCR221 using the ammonium acetate method.
17. Soil analysis reports shall also show recommendations for soil additives, including organic and inorganic soil amendments, necessary to accomplish particular mix objectives noted.

G. Organic Amendment (Compost) Submittals

1. Reports of analyses from producers of composted organic materials are required. Testing procedures shall conform to TMECC Methods, unless otherwise noted. Reports shall include pH, salinity, total nitrogen, carbon:nitrogen ratio, phosphorus, potassium, calcium, magnesium, sodium and boron by saturated media extraction (SME per NCR-221), moisture, bulk density, particle size analysis, organic matter content and Solvita Maturity Index. Composted organic materials shall be tested for the USEPA 503 heavy metals.
2. Biological tests for pathogens in compost:
 - a. Contact the testing laboratory to review testing and sampling requirements before sending samples.
 - b. Sampling requirements: composted organic amendments shall be sampled according to the Ohio EPA Composting Regulations 3745-24-46.
 - c. Maintain clear and concise records of testing and sampling procedures.
 - d. Compost samples shall be tested for the following:
 - 1) Fecal coliforms (MPN) TMECC 07.01
 - 2) Salmonella (MPN) TMECC 07.02

H. Testing Agencies: The following firms are acceptable testing agencies for the various components.

1. SBSS physical analysis on all components and mixes including particle size analysis shall be determined by an A2LA Accredited Lab, such as Hummel & Co, 35 King Street,

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- Trumansburg, NY 14886, tel. 607-387-5694, fax 607-387-9499 or other qualified laboratory approved by the Landscape Architect.
 2. Soil Chemical analysis on all components and planting soil mixes shall be performed by CLC LABS, 325 Venture Drive, Westerville, OH 43081, phone 614- 888-1663, fax 614-888-1330 or other qualified laboratory approved by the Landscape Architect.
 3. Compost testing shall be performed by CLC LABS, 325 Venture Drive, Westerville, OH 43081, phone 614-888-1663, fax 614-888-1330 or other qualified laboratory approved by the Landscape Architect.
- I. Although the report(s) may contain the laboratory's comments or recommendations to the Landscape Architect regarding amendment requirements or procedures, the report shall not be interpreted as prescribing or dictating procedures or indicating quantities of soil materials for the work of this Contract.
 - J. Changing testing laboratories during the mix development phase or for quality assurance testing must be authorized by the Landscape Architect.
 - K. Statement(s) of Qualifications: Submit within 45 days of notice to proceed to confirm qualifications of the selected testing agencies.
 - L. Submit samples of all listed materials to the Landscape Architect for approval:
 1. Sand, each source, 2-4 lb packaged.
 2. Organic Amendment (Compost), each source, 2-4 lb. packaged
 3. Upper- and Lower Level Mixes, each specified type, 2-4 lb. packaged.
 - M. Equipment Data: Submit descriptive information with wheel load data for each proposed item of equipment to be used for execution of all earthwork of this Contract. Equipment data will be evaluated for conformance to site use restrictions and mix compaction potential. All equipment used in mix placement shall have a ground pressure level of 4 psi or lower.
 - N. Submit for approval at least two weeks prior to installation a written plan for mixing, transporting, storing, placing and settling installed materials.

1.05 QUALITY ASSURANCE

- A. Each component of the Mixes as defined above must meet the specification herein and be verified by testing as specified herein, prior to delivery to the site.
- B. No mix component or SBSS Mix will be accepted unless it meets all submittal, testing and certification requirements including the testing and certification reports in the format specified herein.
- C. Inspections and Testing
 1. Sands, composts, and other materials testing as well as Soil System Mix 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 System Mixes that do not meet the requirements of the Specifications shall be removed by the Contractor at no cost to the project.
 5. Samples of individual components all Soil Systems shall be submitted by the Contractor for testing and analysis to the approved testing laboratory.

6. No component for the Mixes shall be used until test reports from the approved testing laboratory have been received and approved by the Landscape Architect.
7. As necessary, make any and all mix amendments to achieve the required specifications and resubmit tests reports indicating amendment changes until approved.
8. Include verification testing of on-site sub-soils for suitability to support Base Mix, Transition Mix and Planting Mixes to provide adequate sub-surface drainage.

D. Qualifications:

1. Installation and maintenance foreman on the job shall be competent English-speaking supervisor(s), experienced in landscape installation and maintenance. Perform work with personnel totally familiar with planting soil preparation and lawn and planting installations under the supervision of a foreman experienced with landscape work.
2. Testing Laboratory: Experienced person or persons 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 with regard to the specified testing. The Testing Laboratory shall be as approved by the Landscape Architect.
3. 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.

- E. 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.

1.06 REGULATORY REQUIREMENTS

- A. The Contractor shall comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make work comply with such requirements without additional cost to Owner.
- B. The Contractor shall procure and pay for permits and licenses required for work of this section.

1.07 PROJECT CONDITIONS

- A. The Contractor shall be responsible for pedestrian and vehicular safety and control within the work site. He/she shall provide the necessary warning devices and ground personnel needed to give safety, warning and protection to persons and vehicular traffic within the area.
- B. During site preparation, soil installation and protection, the Contractor shall be responsible for all damage to known existing features above and below finished grade drainage, utility lines, paving surfaces, existing vegetation, site furnishings incurred as a result of work operations. Repairs or replacements shall be made to the satisfaction of the Owner.
- C. 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 in regard to the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary.
- D. 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 Landscape Architect, it will be Contractor's duty to inform the General Contractor and/or Construction Manager immediately in writing for clarification. Work done after such discovery, unless authorized by the Landscape Architect, shall be done at the Contractor's risk.
- E. Environmental Requirements for Soils, Soil System 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. SBSS mixes shall not be handled, hauled or placed during rain or wet weather or when near or above the point where maximum compaction will occur.
- F. 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. SBSS 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, SBSS shall be covered with a tarpaulin until time of actual use and protected from contamination, excessive rainfall, excess water entering the site or erosion.

PART 2 - PRODUCTS

2.01 General

- A. All mix components shall fulfill the requirements as specified.

2.02 SBSS PROFILE MATERIALS

- A. Sand-Based Structural Soil Profile – Sand Component
 1. The sand shall be a clean, sharp, natural silica sand that has been suitably washed and classified (sieved). Suitable sands may be referred to in commerce as a uniform, ASTM-33 concrete sand (preferred) or a coarse mason’s sand. The selected sand must meet the following U.S.D.A. particle size distribution as well as the other gradation characteristics listed in Part 3 when tested in accordance with the ASTM D-422 using U.S.D.A. particle size classifications.
 2. The allowable particle size distribution is as follows:

<u>U.S.D.A. Particle Class</u>	<u>Percent Size (mm)</u>	<u>Retained</u>
Gravel	> 3.34	0 - 3
Fine Gravel	2.00 - 3.34	0 - 10
		Not more than 12% combined Gravel + Fine Gravel
Very Coarse Sand	1.00 - 2.00	10 - 25
Coarse Sand	0.50 - 1.00	20 - 40
Medium Sand	0.25 - 0.50	20 - 40
Fine Sand	0.10 - 0.25	0 - 10
Very Fine Sand	0.05 - 0.10	0 - 10
Silt + Clay	< 0.05	0 - 10
		(Combined Silt+Clay)

3. Other Gradation Characteristics must fall within the limits specified below:
 - a. Fineness Modulus (FM) - 2.5 to 3.1
 - b. Coefficient of Uniformity - 2.5 to 3.5 preferred (< 4.0 acceptable)
4. The sand shall meet the following specifications. Perform the following tests and submit test reports showing the following criteria are met:
 - a. The particle size analysis/distribution as defined above
 - b. The pH shall be 5.5 to 7.5
 - c. The soluble salts shall be less than 0.5 mmoh/cm (NCR 221)
 - d. The organic matter content shall be less than 1.0% (ASTM D 2974 Method C)
 - e. The material drainage rate shall be greater than 20 inches per hour and the total porosity shall be greater than 40% when compacted and tested according to U.S. Golf Assoc. (USGA) methods.
5. Provide certification from the supplier that the sand does not contain any toxic substances harmful to plant growth.
6. C33 Concrete Sand:
 - a. Approved supplier: Kurtz Brothers, Dublin, Ohio, 614.206.7235, meets the requirements of the specification and is an acceptable product for the sand component.

B. Sand-Based Structural Soil Profile – Organic Component

1. The organic amendment shall be stable, mature aerobically composted yard debris (green waste) compost. Leaf humus compost, manure composts, biosolids compost, peat, peat-humus and mushroom compost products are not acceptable. The compost material must meet the requirements of the Ohio EPA Composting Regulations (OAC 3745-27-46) and have the following characteristics:
 - a. The compost shall be a homogeneous material essentially free of soil clods, lumps, roots and stones.
 - b. The compost shall have a man-made foreign material (hard plastics, metal, glass, etc.) content less than 1.5% as material retained on a U.S. Std.No.5 (4 mm) sieve (TMECC 03.06)
 - c. The compost shall be screened such that a minimum of 90% passes a U.S.Std. 3/4" sieve and that no more than 10% passes a U.S. Std. No.10 sieve on a dry weight basis.
 - d. The compost shall have a pH of 7.2 to 8.0
 - e. The compost shall have a soluble salts content less than 6.0 millimhos per cm. when determined on a 1:5 compost/water slurry
 - f. The compost shall have an organic matter content of not less than 35% by weight determined by ASTM D2974-87 Method C on material passing a U.S. Std.1/4" sieve.
 - g. The compost shall have a carbon to nitrogen (C:N) ratio less than 36:1.
 - h. The compost shall have a Solvita® Maturity Index between 6 and 7.
 - i. The compost shall have a moisture content of 35% to 65%.
 - j. The compost shall have a dry bulk density of 0.17 to 0.35 grams per cubic centimeter (g/cc).
 - k. 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 (NCR-221)
 - l. The heavy metal content as determined by TMECC 04.06 shall not exceed the following limits:

<u>Element</u>	<u>Concentration Limits</u> <u>(mg/Kg d.w.)</u>
Arsenic	41

Cadmium	39
Chromium	1200
Copper	1500
Lead	300
Mercury	17
Molybdenum	50
Nickel	420
Selenium	36
Zinc	2800

- m. The compost shall meet all applicable state regulations based on the feedstock type.
- n. 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.

PART 3 - EXECUTION

3.01 VERIFICATION

- A. Prior to construction and soil placement operations at planting areas ascertain the location of all electric cables conduits under drainage systems and utility lines. Take proper precaution so as not to disturb or damage sub-surface elements. Contractor failing to take these precautions shall be responsible for making requisite repairs to damaged utilities at Contractor's own expense.
- B. Verify that required underground utilities are available, located, and ready for use. Coordinate with other trades.
- C. Verify that all work requiring access through or adjacent to areas where Planting Mixes are to be placed has been completed and no further access will be required. In the event that access will be required, this must be coordinated with the Contractor.

3.02 SITE PREPARATION FOR SBSS MIXES

- A. Excavate and compact the proposed subgrade to depths, slopes and widths as shown on the Drawings. Do not over excavate compacted subgrades of adjacent pavement or structures.
- B. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade as shown on the drawings.
- C. Clear the excavation of all construction debris, trash, rubble and any foreign material. In the event that 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. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2" 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. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.
 - 2. Any damage to the paving or architectural work caused by the soils installation Contractor shall be repaired by the general contractor at the soils installation contractor's expense.
- E. Maintain all silt and sediment control devices required by applicable regulations. Provide adequate methods to assure that trucks and other equipment do no track soil from the site onto adjacent property and the public right of way.

3.03 SBSS MIX PREPARATION

A. General:

1. Planting mixes for planters and plant backfill shall be of the type(s) indicated in accordance with the planting details, and shall be pre-mixed and placed as specified.
2. All amendments shall be thoroughly incorporated into the mixture to assure uniform distribution. Delay mixing of fertilizers if planting will not follow within a few days.
3. Additional amendments shall be mixed into the soil as recommended by the testing laboratory and as approved by the Landscape Architect for each plant type and condition of installation.
4. Adequate quantities of planting 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.
5. Uniformly mix components using a mechanical soil blender designed for such purpose as specified for each Mix Type.
 - a. Mixing of sand and compost: Add compost as recommended by the testing laboratory to achieve the specified organic matter content by Mix type. Other amendments shall not be added to Mixes unless approved by the Landscape Architect and additional tests have been conducted to verify type and quantity of amendment.

B. Testing of Mixes:

1. Perform initial tests to confirm compliance with the Mix organic matter content specifications. These test results, when approved, will establish the standard to which all other test results must conform.

C. SBSS Mix Profile Preparation:

1. SBSS Profile Mix: Thoroughly blended Sand component and Organic component to achieve 2.0 to 3.0% organic matter when tested by ASTM D2974-87 Method C on material passing a U.S. Std. 1/4" sieve.
2. Mixing shall be done using equipment designed for soil blending and screening.
3. These mixes shall be assumed to be 4 parts of the approved Sand and 1 part of the approved compost for the purpose of developing bids. Actual mix ratios to achieve the specified organic matter content or hydraulic conductivity will vary depending on the characteristics of the compost.
4. Manufacture 2 to 3 cu.yds of SBSS Profile Mix and compare to a mix meeting the specifications prepared by the soil testing laboratory.
5. Test the manufactured mixes and the laboratory test mixes for their USDA Soil Texture Analysis with Gravel/Sand Classifications using the same particle size classifications shown for the Sand component report.
6. If the manufactured mix results do not substantially match the laboratory test mix, manufacture another 2 to 3 cu.yds. following the recommendations provided by the soil testing laboratory. Repeat as necessary until the test results substantially match.
7. The saturated hydraulic conductivity of the SBSS Profile shall be 10 to 15 inches per hour. Adjust the organic amendment to achieve the desired saturated hydraulic conductivity.
8. The SBSS Mix Profile shall have a Bray 1 Phosphorus Index less than 26 ppm (52 lbs./acre).
9. These test results and criteria, when approved by the Landscape Architect, shall establish the standard to which all subsequent SBSS Mix Profile tests must conform.
10. The SBSS Mix Profile shall have one sample tested from each 500 cu. yds. of manufactured material using the organic matter test (ASTM D 2974 Method C).

D. Mix Testing:

1. Take one (1) composite sample upon arrival to the site from each 500 cubic yards or as required by the Landscape Architect for testing each type of Planting Mix and test the following:
 - a. Particle size analysis: Use sieve sizes as specified for the Mix.
 - b. Organic matter content ASTM D2974-87 Method C on material passing a U.S. Std.1/4" sieve.
 - c. Nutrient Analysis to include phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper and boron. Request testing laboratory recommendations for fertilizer requirements for plant types being used.
 - d. Soil pH and Buffer pH
 - e. Cation Exchange Capacity
 - f. Soluble Salt Content
- E. Stockpiling:
 1. Stockpiling on-site, off-site, and at the source should be restricted to no more than the needs of what can be used in a 72-hr. period. Under no circumstances shall on-site or off-site stored material exceed 500 cubic yards.
 2. Stockpiles should be no more than 6 feet 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.

3.04 PREPARATION & PLACEMENT OF TRANSITION LAYER

- A. Prior to preparation and placement the Contractor shall verify as-constructed or existing elevations and do whatever additional grading is necessary to bring the subgrades to the correct elevations as indicated on the Drawings.
 1. Clean up subgrade and dispose of all debris prior to placement.
- B. Any soils polluted by gasoline, oil, plaster, construction debris, unacceptable soils, or other substances which would render the soils unsuitable for a proper plant growth shall be removed from the premises whether or not such pollution occurs or exists prior to or during the Contract period. In the event that such material is placed, this material shall be removed and replaced with approved material. All remedial operations associated with soil mixes shall be reviewed and approved by the Landscape Architect.
- C. Transition Layer: After acceptance of grades for planting areas, a "Transition" layer shall be formed by mixing the SBSS Mix with existing native subgrade material to the proper depth per the drawings.
 1. Loosen subsoil to a depth as shown in the details.
 2. Place SBSS Mix in lifts not to exceed 8 inches in depth and blend with top 6" of loosened native subsoil.
 3. Lightly compact using a light-weight plate compactor.
 4. Root systems of existing plants adjacent to soil work especially soil adjoining existing trees, shall be protected from damage to the fullest extent possible and 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. Blending of Transition Mix with native soils immediately adjacent to existing roots may be carefully conducted by amending the soil by hand with hand tools.

3.05 PLACING SBSS MIXES

- A. Remove all large clods, lumps, brush, roots, stumps, litter, and other foreign material and stones one-half inch (1/2") in diameter or larger. Dispose of removed material legally off-site.

- B. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
- C. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
- D. 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.
- E. Place and spread SBS Mix of the type specified over approved subgrade or transition zone areas to a depth sufficiently greater than the depth required for planting areas so that after settlement as previously approved by Landscape Architect, the completed work will conform to the lines, grades, and elevations shown or otherwise indicated.
- F. For Tree Areas:
 - 1. Required Transition Layer depth per drawings.
 - 2. Required SBSS mix depths shall be as indicated on drawings with a total of Mix(es) to be a minimum per the drawings as measured in place in a settled or compacted position.
 - 3. Place fills lightly in layers of a maximum of eight inch (8") lifts and carefully settle soils to eliminate air pockets and to minimize future settling. Lightly scarify previously placed surfaces prior to placing subsequent lifts. 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 of time 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. Do not over compact Planting Mixes.
 - 4. After settlement has occurred, add mix to maintain finished grades. If for any reason soil is left exposed for a long duration prior to planting, add soil 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.

3.06 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 for 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 32 91 00

SECTION 32 93 00 – PLANTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Plants including trees, shrubs, groundcovers, bi-annuals, annuals and bulbs.
 - 2. Tree stabilization.
 - 3. Tree-watering devices.
 - 4. Landscape edgings.
 - 5. Tree grates – paver suspension system.
- B. Related Requirements:
 - 1. Section 32 91 00 through 32 91 40 - Planting Prep and Soils for soil preparation.

1.02 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 01 22 00 "Unit Prices."
- B. Unit prices apply to additions to and deletions from the Work as authorized by Change Orders.

1.03 REFERENCES

- A. 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.
- B. American Society for Testing and Materials (ASTM).
 - 1. ASTM D 1557- Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 2. ASTM D 5268-92(96) Topsoil
 - 3. ASTM C 33 Sand
- C. American Nursery & Landscape Association (ANLA).
- D. American National Standards Institute (ANSI).
 - 1. ANSI Z60.1 – American Standards for Nursery Stock.
- E. SSSA Soil Science Society of America, Inc.
 - 1. Methods of Soil Analysis Part 1 – Physical and Mineralogical Methods, 1986.
 - 2. Methods of Soil Analysis Part 3 – Chemical Methods, 1996.
- F. USDA – United States Department of Agriculture.
 - 1. Texture Triangle Classification, Handbook No. 60.

1.04 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, diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

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- 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, diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
 - E. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
 - F. 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 Z60.1 for type and size of plant required.
 - G. 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.
 - H. Excessive Compaction: Planting area soil compaction greater than 75 percent of maximum dry density as determined by ASTM D 1557.
 - I. 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 Z60.1 for type and size of plant.
 - J. Finish Grade: Elevation of finished surface of planting soil.
 - K. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or natural sand with stabilized organic soil amendments to produce topsoil or planting soil.
 - L. 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.
 - M. 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.
 - N. Planting Area: Areas to be planted.
 - O. Plant Spread: Measurement of main body diameter, not measurement from branch tip to branch tip.
 - P. 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.
 - Q. 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 329100 through 329140 – Planting Prep and Soils for soil preparation and drawing designations for planting soils.
 - R. 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.
 - S. Root Flare: Also called "trunk flare." 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.
 - T. Sand: a naturally occurring material that has been processed to remove coarse gravel, silt and clay and sized to meet the specifications.
 - U. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
 - V. 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.
 - W. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
 - X. 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.

1.05 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.

1.06 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 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 20 plants are required, include a minimum of three 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: All ornamental and shade trees are to be tagged in the field prior to digging. Tree tagging to be completed by the Landscape Architect. 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-quart 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.

1.07 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.
 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

1.08 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.09 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 Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 01 40 00 "Quality Requirements."
 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 Professional Landcare Network:
 - a. Landscape Industry Certified Technician - Exterior.
 - b. Landscape Industry Certified Interior.
 - c. Landscape Industry Certified Horticultural Technician.
 7. Pesticide Applicator: State licensed, commercial.
- C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
1. Selection of plants purchased under allowances is made by Landscape Architect, who tags plants at their place of growth before they are prepared for transplanting.
- D. Measurements: Measure according to ANSI Z60.1. 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 inches above the root flare for trees up to 4-inch caliper size, and 12 inches 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 seven days in advance of delivery to site.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Coordination."

1.10 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. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Deliver bare-root stock plants within 24 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- D. 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.
- 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.
- G. Handling Plants:
 - 1. Handle balled and burlapped 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.
- H. 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. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
 - 2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 3. Do not remove container-grown stock from containers before time of planting.
 - 4. 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.

1.11 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 Owner's Representative or the Landscape Architect prior to planting.

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- 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.
 - J. A complete list of plants, including a schedule of sizes, quantities and other requirements are shown on the drawings. In the event quantity discrepancies or material omissions occur in the plant materials list, the drawing planting plans shall govern.

1.12 ACCEPTANCE FOR SUBSTANTIAL COMPLETION

- A. The Landscape Architect shall inspect all work of this Section for Acceptance for Substantial Completion upon receipt of written notice of completion by the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
- B. Acceptance of plant material by the Landscape Architect shall be for general conformance to specified size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.
- C. Upon completion and reinspection of all repairs or renewals necessary in the judgment of the Landscape Architect, the Landscape Architect shall recommend that Acceptance for Substantial Completion of the work of this Section be given by the Owner.
- D. 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.

1.13 WARRANTY

- A. Special 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.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of [tree stabilization] [edgings] [and] [tree grates] <Insert item>.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Periods: From date of Substantial Completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
 - c. Annuals: Three months.
 3. 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.

1.14 MAINTENANCE SERVICE

- A. Maintenance of installed and accepted plantings will be performed by the Park.
- B. Trees and Shrubs: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease.
1. Maintain plantings until completion and acceptance of the entire project.
 2. All trees must be watered in thoroughly.
- C. Ground Cover and Plants: Maintain for the following maintenance period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings:
1. Maintain plantings until completion and acceptance of the entire project.

PART 2 - PRODUCTS

2.01 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; 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 similar to those of the project and within 150 miles of the project site for at least two 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 six months, but not over two 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 inch 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 that 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 Z60.1 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.
- C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 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.
- D. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- E. Labeling: Label each plant of 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.
- F. 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.
- G. Annuals and Biennials: 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.
- H. 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 Z60.1 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 feet 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 Z60.1; stem form as follows:

1. Stem Form: Single stem.
2. Provide balled and burlapped trees.
3. 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 Z60.1 for type, shape, and height of shrub.
 1. Provide balled and burlapped or container-grown shrubs.

2.04 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.05 PERENNIAL / ANNUAL PLANTS

- A. Perennials/Annuals: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

2.06 PLANTING SOIL MIX

1. Shall meet the requirements of Sections 329100 through 329140 Planting Soils Mixes as outlined per drawings and designated specifications.
 - a. Amend soils per soil test results for each soil type and application.

2.07 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: Premium Grade Shredded hardwood. .
 2. Color: Natural (Dark/Black).

2.08 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.

2.09 TREE-STABILIZATION MATERIALS

- A. Trunk-Stabilization Materials:
 1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
 2. Flexible Ties: Nylon straps of length required to reach stakes.

2.10 TREE GRATES

- A. Tree Grates: Manufacturer's standard tree grates and frames.
 - 1. Manufacturer: Tree grates to be supplied by Ironsmith, Inc. 41-701 Corporate Way, Unit 3, Palm Desert, CA 92260, ph (800) 338-4766.
 - 2. Model: Model 6220 72" Galvanized steel Paver-Grate, paver suspension systems in halves, with 12-inch tree opening.
 - 3. Suspended paver type tree grates shall be manufactured from standard steel shapes to ASTM A36 and expanded metal grating 3# to ASTM A569/569M. If required, Tubing to ASTM A500. Units shall be manufactured true to design and all components shall fit together in a satisfactory manner. Grates are to be of uniform quality, flat and free from distortion.
- B. Finish: Grates are to be supplied galvanized by hot spray and/or hot dip method.

2.11 TREE-WATERING DEVICES

- A. Slow-Release 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.
 - 1. Color: Black or dark green.

2.12 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.

2.13 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 Landscape Architect at the place of growth prior to delivery to the project site.

2. At the Landscape Architect's discretion, shrubs may or may not be reviewed, photographed, and tagged at the place of growth.
3. 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 and shrubs and outline areas for multiple plantings.
- 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 40 and as per drawing details.

1. Place soil as per specifications for each type of soil mix.
- B. 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. Excavate approximately three times as wide as ball diameter for balled and burlapped, and container-grown stock.
 3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 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 when unattended by Installer's personnel.
 8. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.
- 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-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Test fill all tree and planting pits with water, prior to planting to assure proper soil percolation. Pits which do not adequately drain shall be further excavated to a depth sufficient for drainage to occur.
1. Notify Landscape Architect and Owner should 2nd fill test fail for additional input and corrective action.
 2. No allowances shall be made for plant material loss due to improper drainage or if contractor fails to perform fill test. Contractor shall replace lost plant material with same size and species at no additional cost to the owner.
- E. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

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 degrees to root ball.
3. Use a 4-inch wide sharp blade.

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 inch to ¼ inch without damaging roots or breaking root ball.

E. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil as designated on drawings and per soil specifications.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, 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. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil as designated on drawings and per soil specifications.
2. Carefully remove root ball from container without damaging root ball or plant.
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. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

G.

H. 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 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.

3.07 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 - 1. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
 - 2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.08 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil as indicated on drawings 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.

3.09 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-inch average thickness, with 30 inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 2-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches <Insert distance> of trunks or stems.

3.10 TREE GRATE INSTALLATION

- A. Tree Grates: Install according to manufacturer's written instructions. Set grate segments per manufacturer's specifications. Maintain a 3-inch-minimum growth radius around base of tree; break away portions of casting, if necessary, according to manufacturer's written instructions.

3.11 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.

3.12 PLANT MAINTENANCE

- A. Maintain plantings by 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.

3.13 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.

3.14 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. Species of Replacement Trees: Same species being replaced.

3.15 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 final walk through with Landscape Architect, 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.

3.16 MAINTENANCE SERVICE

- A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: 12 months from date of Substantial Completion.

- B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
 - 1. Maintenance Period: Six months from date of Substantial Completion.

END OF SECTION 32 93 00