

## SECTION 00 90 20 ADDENDUM NO. 2

Project: Reunion Park  
749 Mill Street  
Little Mountain, SC 29075  
23236

Date: 5 June 2025

To: All Bid Document Holders

This Addendum forms a part of the contract documents and modifies the bidding documents with amendments and additions noted below.

Acknowledge receipt of this addendum in the space provided in the bid form. Failure to do so may render the bid unresponsive.

Manufacturers and products indicated as an “approved substitution” shall be accepted as equal for the manufacturers given in the contract documents. It is understood that the products submitted for these manufacturers must still meet the specifications of the project, and can be rejected if after review, are determined to be not equal to the product called out in the contract documents.

### GENERAL

- The sign-in sheet from the Mandatory Pre-Bid Meeting is attached.
- Pre-Bid Meeting Discussion Clarification Question 1: “Is third party testing by owner?”
  - *Response: Yes, third party testing is by owner.*
- Pre-Bid Meeting Discussion Clarification Question 2: “Will handrails for wheelchairs be necessary on Building A?”
  - *Response: No, handrails are not required on Building A. Refer to drawing sheet A1.01 for details and notes.*
- Pre-Bid Meeting Discussion Clarification Question 3: “How many days will it take to complete the project?”
  - *Response: Refer to Project Manual Section 00 41 00-2 Bid Form Section D Contract Time, “Work shall commence no earlier than August 4, 2025 or five (5) days after the receipt of the building permit, whichever is later, and the work shall be complete to the satisfaction of the owner within 145 calendar days.*
- Question 1 Received: “Project manual p. 41 notes that the cost for the preparation of Coordination Drawings is to be listed as a separate line item in the Schedule of Values, but no such line exists”

DP3 Architects, Ltd.  
15 South Main Street  
Suite 400  
Greenville, SC 29601  
864.232.8200

[www.DP3architects.com](http://www.DP3architects.com)

- *Response: Project Manual Section 01 31 50-1 Coordination Drawings, Section 1.2 Summary has been revised to delete Paragraph C.*
- Question 2 Received: "Please clarify which testing requirements (referred to as "additional samples, tests, and inspections" on project manual p. 50), other than re-testing, will be the responsibility of the contractor?"
  - *Response: Only as required in individual specification sections.*
- Question 3 Received: "Project manual p. 43 states that brush, branches, & trees can be chipped &, presumably, spread on site, whereas General Note 9 on sheet G-002 states that clearing & grubbing debris must be disposed of off-site. Please clarify."
  - *Response: Project Manual Section 01 74 19-4 Construction Waste Management, Section 3.4 Recycling Construction Waste has been revised to delete Paragraph B Site-Clearing Wastes. G-002 note is correct, clearing and grubbing debris must be disposed of off-site.*
- Question 4 Received: "Concrete Sidewalk detail on sheet C-502 references a scoring pattern on sheet C4.2. Please provide that sheet."
  - *Response: The note has been deleted; provide control joints per detail.*
- Question 5 Received: "Do keynote items #3 (Concrete Pavement), #5 (ADA Parking Bay), & # 30 (Traffic Rated Concrete Section) on sheet C-102 all correspond to the Medium Duty Concrete Paving detail on sheet C-502? If not, please clarify which item(s) do, & which detail corresponds to the remaining item(s)"
  - *Response: Keynote #3 refers to concrete sidewalk details, keynote #5 refers to medium duty concrete pavement. Revised note #5 to refer to medium duty concrete pavement. Keynotes have been updated for clarity and to clarify the add alternate as well.*
- Question 6 Received: "Please confirm that a swing gate (keynote item # 31) is required at the ramp to building D as shown on sheet C-102."
  - *Response: Keynote is mislabeled. Relabeled to keynote #32 which is a concrete ramp.*
- Question 7 Received: "Please provide material & installation details regarding the pavers & the colored concrete (keynote item # 25) shown to the east of building G on sheet C-102."
  - *Response: Landscape plans are included to clarify the paver requirements.*
- Question 8 Received: "Please confirm that the proposed asphalt walkway (sheet C-102, keynote item #7) is to be 6ft wide, while the add alternate concrete paving (keynote item #33) width is to be 8ft."
  - *Response: Keynotes number 7, 8, and 30 have been revised to clarify the widths. Due to funding, the Owner has changed all sidewalks to asphalt (including heavy duty asphalt where indicated) for the base bid. The add alternate will be concrete sidewalks (including medium duty concrete where indicated).*
- Question 9 Received: "There is a note south of building D on sheet CD-101 indicating that additional tree clearing may be required for a septic system. Please confirm that a septic system is to be provided in addition to the proposed sanitary sewer, & if so, please provide details."
  - *Response: Septic system not applicable; this note has been deleted.*



- Question 10 Received: "What is the finish on the metal handrail on the wooden ramps at buildings C & D?"
  - *Response: Drawing sheet A9.01 has been revised to change Note 5.22 to add Paint Finish. Material tag EP-4 has been added.*
- Question 11 Received: "Detail 3 on sheet A1.06 indicates a left, right, & center handrail on the proposed concrete steps to the west of building G (keynote item 35 on sheet C-102). Will the steps on the east side of the building also receive 3 handrails?"
  - *Response: Yes, it provides 3 handrails to both sides and middle of stairs. Refer to architectural drawings and stair detail.*
- Question 12 Received: "Project manual p. 88 appears to indicate that all cast-in-place concrete is to receive saw-cut joints, whereas the Concrete Sidewalk detail on sheet C-502 indicates tooled joints. Please confirm."
  - *Response: Project Manual Section 03 30 00-4 Cast-In-Place Concrete, Section 3.03 Installation has been revised to delete paragraph 11 Saw-Cut Joints. Refer to C-502 for correct details.*
- Question 13 Received: "To which area(s) does the Thickened Edge Asphalt Paving Section detail on sheet C-502 apply?"
  - *Response: Depending on the alternate chosen, this detail will be needed when asphalt abuts concrete.*
- Question 14 Received: "The following sections, referenced in project manual pp. 4-7, are absent from the project manual. Please provide these sections:"
  - 02 42 18 (Site Demolition)
  - Division 22 (Plumbing)
  - Division 23 (HVAC)
  - Division 26 (Electrical)
  - Division 32 (Exterior Improvements)
  - Division 31 (Earthwork), except for 31 31 16 (Termite Control)
  - Division 33 (Site Utilities)
  - *Response: Project Manual Sections have been added to this addendum.*
- Question 15 Received: "Detail A13 (Typical Stair Details) on sheet C-503 references a detail A/2. Please provide."
  - *Response: Changed reference to isolation joint detail instead of doweled joint and included on updated plans.*
- Question 16 Received: "Detail A13 (Typical Stair Details) on sheet C-503 indicates a 5" thick concrete landing & thickened turndown. Please provide the landing length & turndown depth. Please also indicate concrete strength."
  - *Response: Updated plans now show reference to sidewalk which is 4" with thickened edge, indicated in isolation joint detail.*
- Question 17 Received: "Please confirm that the riser height on the proposed concrete steps to the west of building G is to be 12" per note on sheet C-103."
  - *Response: Riser height mislabeled. Callouts have been updated in revised plans.*
- Question 18 Received: "Please confirm the requirement of a manhole (keynote item # 26) south of building D on sheet C-102 & provide details if so (There is no detail on C-504 per the keynote.)"

- *Response: Manhole was previously removed; keynote is not applicable and has been removed.*
- Question 19 Received: "Keynote item #21 on sheet CD-101 calls for a junction manhole to replace a drop inlet, but it does not show up on C-103. Please confirm."
  - *Response: Existing drop inlet should remain as is, keynote #21 relabeled to #19.*
- Question 20 Received: "Will HDPE be acceptable as a substitution for RCP?"
  - *Response: Appropriate HDPE pipe meeting minimum cover requirements is allowable.*
- Question 21 Received: "Please provide details for the proposed seat walls (keynote item # 24) on sheet C-102."
  - *Response: Refer to added Landscape plans for seat wall details.*
- Question 22 Received: "The Gravel Surfacing detail on sheet C-502 calls for structural geogrid & then specifies Mirafi 180N, which is non-structural. Please confirm."
  - *Response: Refer to project manual section 31 40 03 "Fabric Underlay Material" for geogrid meeting fabric underlay material specifications.*
- Question 23 Received: "Are the new wooden ramps leading up to buildings C & D to be stained &/or sealed?"
  - *Response: Refer to keynote 6.95 on Drawing Sheet A9.01, new wooden ramps leading up to Buildings C and D are to be stained. Stain will be ST-2 to match adjacent wood floor.*
- Question 24 Received: "Demo'ing the existing flagpoles & installing new ones may prove more economical than relocating the existing ones. Would you consider this alternate approach? If so, please provide new flagpole info."
  - *Response: Drawing Sheet T1.01 has been revised to include Alternate No. 2: New Flagpole. Specification sheets have been included in this addendum for basis of design. Base bid will be relocating existing flagpoles.*
- Question 25 Received: "Will the park remain open during construction?"
  - *Response: No, the park will not remain open during construction. Refer to specification section 01 50 00 Temporary Facilities and Controls, Section 1.04 for Barrier requirements.*
- Question 26 Received: "The damage to the underside of building B's roof extends back roughly 8" from the drip edge. Attaching additional plywood to the damaged material would not really resolve the wood rot issue. Would you consider cutting the overhang back approx. 8", leaving a roughly 1ft overhang remaining, & adding a new drip edge & fascia to combat the rotting problem?"
  - *Response: Yes, please refer to A1.02 revisions for updated notes.*
- Question 27 Received: "Would you consider a custom-fabricated swing gate in lieu of the one specified?"
  - *Response: Shop drawing of the substitution would be required for approval prior to the bid. Please bid per specifications.*
- Question 28 Received: "Would you accept an alternate supplier for the new metal screen (drawing note 5.50, drawing A4.01) for building A?"

- *Response: Shop drawing or cut sheet of the substitution would be required for approval prior to the bid. Please bid per specifications.*
- Question 29 Received: “Regarding note 3.36 on sheet A1.05, is it your intent to use a grinder to open up the crack, clean it out, & fill with crack filler? Would just filling with self-leveling caulk be sufficient?”
  - *Response: Self-leveling caulk is not acceptable. A grinder is needed to open up the crack, clean it out and fill with crack filler in order to actually repair the cracks and yield cleaner results. Note 3.36 has been updated.*
- Question 30 Received: “It appears that both adjacent roads (Mill St & N Ponderosa Dr) are utilized for student drop off & pick up at Little Mountain Elementary during school hours. Are there any work restrictions to be considered for the duration of the project?”
  - *Response: The park needs to be blocked off during construction; Refer to specification section 01 50 00 Temporary Facilities and Controls, Section 1.04 for Barrier requirements. The town will make repeated public announcements that no car traffic is allowed in the park during construction. The school traffic no longer goes through the park – the school has a separate entrance with three parking lots.*
- Question 31 Received: “Please confirm that no hand dryers or paper towel dispensers are to be provided in any of the bathrooms.”
  - *Response: Please refer to the Restroom Accessory Schedule on A3.01 – A recessed paper towel dispenser is to be placed in Building H. All other restrooms are to remain as-is and are not receiving paper towel dispensers or hand dryers.*
- Question 32 Received: “Please confirm that the toilets & sinks in building G are not being replaced.”
  - *Response: Toilets and sinks in building G are not being replaced. Sheet A1.06 has been updated to reflect this change.*

## PROJECT MANUAL

### Section 00 01 10 – TABLE OF CONTENTS

- Added Section 01 23 00 – Alternates.

### Section 00 11 13 – INVITATION TO BID

- Revised wording in Paragraph underneath “Due Date” to read, “Please submit one (1) sealed packet to the address below”
- Revised wording in paragraph underneath “Bidder Responsibilities and Requirements” to read, “The pre-bid meeting shall be at proposed site unless an alternate location is listed above.”

### Section 00 21 13 – INSTRUCTIONS TO BIDDERS

- Revised section 3.13 “Payment Terms” to read, “Payment will be in accordance with Section 01 20 00 Price and Payment Procedures.”
- Revised section 3.14 “Bid Bond” to add a clarifying paragraph.

- Added Section 3.14 – B
- Added Section 3.15 – C

#### **Section 00 41 00 – BID FORM**

- Added Alternate No. 1 – Concrete Sidewalks in Lieu of Asphalt Paving
- Added Alternate No. 2 – New Flagpoles in Lieu of Relocation of Existing Flagpoles
- Revised Section F “Bid Documentation” to clarify requirements
  - Deleted 1 – Non-Collusion Affidavit and moved following numbers up
  - Revised 1 – Bid *Security* to read Bid *Bond*
  - Revised 2 – to add Proof of Coverage ability
  - Revised 3 – to add Proof of Coverage ability
  - Added 4 – Certificate of Insurance showing proof of required coverages
  - Added 5 – Bidder’s Affidavit
  - Added 6 – Non-Collusion Affidavit
  - Added 7 – Newberry County requires a copy of the bidder’s W-9 to be included in the submission
- Section J - Redundant language deleted

#### **Section 01 23 00 – ALTERNATES**

- Added Section.

#### **Section 01 31 50 – COORDINATION DRAWINGS**

- Deleted Paragraph 1.2 – C.

#### **Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT**

- Deleted Paragraph 3.4 – B.

#### **Section 03 30 00 – CAST-IN-PLACE CONCRETE**

- Deleted Paragraph 3.03 – 11.

### **DRAWINGS**

#### **Drawing CD-101 – DEMOLITION & ESC PLAN**

- Updated note 19.

#### **Drawing C-102 – SITE LAYOUT & UTILITY PLAN**

- Updated notes 3, 5, 7, 8, 26, 30, 33, 35, 36, 37, and 38.

#### **Drawing C-103 – GRADING & DRAINAGE PLAN**

- Updated plans and pipe summary table.

#### **Drawing C-502 – SITE DETAILS**

- Updated heavy duty asphalt pavement section.

Drawing C-503 – SITE DETAILS

- Updated typical stair details.

Drawing L-101 PLANTING PLAN

- Sheet has been added.

Drawing L-201 – LANDSCAPE DETAILS

- Sheet has been added.

Drawing L-202 LANDSCAPE DETAILS

- Sheet has been added.

Drawing T1.01 – TITLE SHEET

- Added Alternates No. 1 and No. 2.
- Updated Drawing Index

Drawing A1.02 – BUILDING B – PLANS AND DETAILS

- Note 6.83 has been revised to read, "New 1x pressure treated wood fascia board at modified rafter ends for attachment and support of new gutter. Ensure fascia board covers rafter ends. Provide new prefinished drip edge flashing metal into new gutter. Paint."
- Note 7.67 has been revised to read, "Existing roof trusses, sheathing, and shingle roofing to remain. Protect during removal of rotten wood at eave condition."
- Note 90.59 has been added.

Drawing A1.05 – BUILDINGS E AND F – PLANS AND DETAILS

- Note 3.36 has been revised to read, "Repair cracks in exterior concrete as follows: Use a grinder to open up the crack, remove any loose pieces associated with the crack, fill with cementitious crack filler and finish smooth."
- Added note 32.01.

Drawing A1.06 – BUILDING G – PLANS AND DETAILS

- Note 32.01 has been revised to read, "Asphalt paving. Refer to Civil Drawings."
- Drawing 1 – A1.06 Building G – Demolition Floor Plan and 3 – A1.06 Building G – Floor Plan have been updated so that the toilet and lavatory are remaining instead of being demolished.
- Note 22.18 has been deleted.

Drawing A1.07 – BUILDING H – PLANS AND BUILDING SECTIONS

- Marked separation of concrete vs. asphalt.
- Note 32.01 has been added.
- Note 3.28 has been added.

Drawing A9.01 – BUILDINGS C & D – VERTICAL CIRCULATION PLANS & DETAILS

- Note 5.22 has been revised to add paint finish.

Drawing P0.01 – PLUMBING LEGEND, SCHEDULES AND DETAILS

- Approved Substitutions: Refer to attached Plumbing Fixture Submittal; Approval conditional on confirmation that fixtures are available in the specified finishes and mounting configurations.

- Substitution for Grinder Pump was not Accepted.

Drawing E0.01 – ELECTRICAL LEGEND AND LIGHTING FIXTURE SCHEDULE

- Approved Substitutions: Refer to attached Light Fixture Submittals; Approval conditional on confirmation that fixtures are available in the specified finishes and mounting configurations.

**ATTACHMENTS:**

- Section 00 01 10 – TABLE OF CONTENTS – REVISED
- Section 00 11 13 – INVITATION TO BID – REVISED
- Section 00 21 13 – INSTRUCTIONS TO BIDDERS – REVISED
- Section 00 41 00 – BID FORM – REVISED
- Section 01 21 00 – ALLOWANCES – ADDED
- Section 01 23 00 – ALTERNATES – ADDED
- Section 01 31 50 – COORDINATION DRAWINGS – REVISED
- Section 01 74 19 – CONSTRUCTION WASTE MANAGEMENT – REVISED
- Section 02 41 18 – SITE DEMOLITION – ADDED
- Section 03 30 00 – CAST-IN-PLACE CONCRETE – REVISED
- Section 03 30 02 – CONCRETE CURB & GUTTER & SIDEWALK – ADDED
- Section 22 05 17 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING – ADDED
- Section 22 05 18 – ESCUTCHEONS FOR PLUMBING PIPING – ADDED
- Section 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING – ADDED
- Section 22 05 23.12 – BALL VALVES FOR PLUMBING PIPING – ADDED
- Section 22 05 23.14 – CHECK VALVES FOR PLUMBING PIPING – ADDED
- Section 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT – ADDED
- Section 22 05 33 – HEAT TRACING FOR PLUMBING PIPING – ADDED
- Section 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT – ADDED
- Section 22 05 93 – TESTING, ADJUSTING, AND BALANCING FOR PLUMBING – ADDED
- Section 22 07 19 – PLUMBING PIPING INSULATION – ADDED
- Section 22 11 16 – DOMESTIC WATER PIPING – ADDED
- Section 22 11 19 – DOMESTIC WATER PIPING Section SPECIALTIES – ADDED
- Section 22 13 16 – SANITARY WASTE AND VENT PIPING – ADDED
- Section 22 13 19 – SANITARY WASTE PIPING SPECIALTIES – ADDED
- Section 22 13 19.13 – SANITARY DRAINS – ADDED
- Section 22 33 00 – ELECTRIC, DOMESTIC-WATER HEATERS – ADDED
- Section 22 42 13.13 – COMMERCIAL WATER CLOSETS – ADDED
- Section 22 42 16.13 – COMMERCIAL LAVATORIES – ADDED
- Section 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT – ADDED
- Section 23 05 48.13 – VIBRATION CONTROLS FOR HVAC – ADDED
- Section 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT – ADDED
- Section 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC – ADDED

- Section 23 31 13 – METAL DUCTS – ADDED
- Section 23 33 00 – AIR DUCT ACCESSORIES – ADDED
- Section 23 34 23 – HVAC POWER VENTILATORS – ADDED
- Section 23 37 23 – HVAC GRAVITY VENTILATORS – ADDED
- Section 23 82 39.19 – WALL AND CEILING UNIT HEATERS – ADDED
- Section 26 05 00 – GENERAL PROVISIONS FOR ELECTRICAL WORK – ADDED
- Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES – ADDED
- Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS – ADDED
- Section 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS – ADDED
- Section 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS – ADDED
- Section 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS – ADDED
- Section 26 09 23 – LIGHTING CONTROL DEVICES – ADDED
- Section 26 24 16 – PANELBOARDS – ADDED
- Section 26 27 26 – WIRING DEVICES – ADDED
- Section 26 51 00 – LIGHTING – ADDED
- Section 31 20 01 – SITE GRADING – ADDED
- Section 31 30 02 – TRENCHING, BACKFILLING FOR UTILITIES – ADDED
- Section 31 40 01 – EROSION AND SEDIMENT CONTROL – ADDED
- Section 31 40 03 – FABRIC UNDERLAY MATERIAL – ADDED
- Section 32 12 16 – ASPHALT PAVING – ADDED
- Section 32 12 17 – STONE BASE COURSE– ADDED
- Section 32 12 20 – MILLING, CUTTING, & REPLACING PAVEMENTS– ADDED
- Section 32 13 13 – CONCRETE PAVING – ADDED
- Section 32 17 13 – PARKING BUMPERS – ADDED
- Section 32 91 19 – LANDSCAPE GRADING – ADDED
- Section 32 92 02 – GRASSING FOR STABILIZATION – ADDED
- Section 32 93 00 – PLANTS – ADDED
- Section 33 05 01 – WATER DISTRIBUTION SYSTEM – ADDED
- Section 33 05 02 – WATER SERVICE CONNECTIONS – ADDED
- Section 33 05 03 – DISINFECTION OF POTABLE WATER – ADDED
- Section 33 10 01 – SANITARY SEWER – GRAVITY – ADDED
- Section 33 10 02 – SANITARY SEWER – PRESSURE – ADDED
- Light Fixture Substitution Submittal – FRM Lighting
- Light Fixture Substitution Submittal – SESCO Lighting
- Plumbing Substitution Submittal – HDPE Pipe
- Alternate 2 – Flagpole Basis of Design
- Drawing CD-101 Rev A
- Drawing C-102 Rev A
- Drawing C-103 Rev A
- Drawing C-502 Rev A
- Drawing C-503 Rev A
- Drawing L-101
- Drawing L-201
- Drawing L-202

- Drawing T1.01 Rev A
- Drawing A1.05 Rev A
- Drawing A1.06 Rev A
- Drawing A1.07 Rev A
- Drawing A9.01 Rev A
- Mandatory Pre-Bid Meeting Sign In Form\_2025.05.21

**END OF SECTION**



**SECTION 00 10 10  
TABLE OF CONTENTS**

**DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS**

00 01 07	SEALS PAGE
00 01 10	TABLE OF CONTENTS
00 11 13	INVITATION TO BID
00 21 13	INSTRUCTIONS TO BIDDERS
00 41 00	BID FORM
00 52 00	STANDARD FORM OF AGREEMENT
00 53 00	SUPPLEMENT TO AGREEMENT
00 70 00	GENERAL CONDITIONS

**DIVISION 01 - GENERAL REQUIREMENTS**

01 10 00	SUMMARY
01 20 00	PRICE AND PAYMENT PROCEDURES
01 23 00	ALTERNATES
01 30 00	ADMINISTRATIVE REQUIREMENTS
01 31 50	COORDINATION DRAWINGS
01 32 16	CONSTRUCTION PROGRESS SCHEDULE
01 40 00	QUALITY REQUIREMENTS
01 42 16	DEFINITIONS
01 42 50	REFERENCE STANDARDS
01 45 33	CODE-REQUIRED INSPECTIONS & PROCEDURES
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 60 00	PRODUCT REQUIREMENTS
01 70 00	EXECUTION AND CLOSEOUT REQUIREMENTS
01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 78 00	CLOSEOUT SUBMITTALS
01 79 00	DEMONSTRATION AND TRAINING

**DIVISION 02 - EXISTING CONDITIONS & SITE CONSTRUCTION**

02 41 00	DEMOLITION
02 41 18	SITE DEMOLITION

**DIVISION 03 - CONCRETE**

03 05 05	UNDERSLAB VAPOR BARRIER
03 30 00	CAST-IN-PLACE CONCRETE
03 30 02	CONCRETE CURB & GUTTER & SIDEWALK

**DIVISION 04 - MASONRY**

04 05 11	MORTAR AND MASONRY GROUT
04 20 00	UNIT MASONRY
04 26 13	MASONRY VENEER

**DIVISION 05 - METALS**

*Refer to structural drawings for additional structural steel and light-gage metal framing.*

05 52 13	PIPE AND TUBE RAILINGS
----------	------------------------

**DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES**

06 10 00	ROUGH CARPENTRY
06 16 00	SHEATHING
06 20 00	FINISH CARPENTRY

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

07 21 00	THERMAL INSULATION
07 25 00	WEATHER BARRIERS
07 31 13	ASPHALT SHINGLES
07 41 13	STANDING SEAM METAL ROOF PANELS
07 46 46	FIBER CEMENT SIDING
07 62 00	SHEET METAL FLASHING AND TRIM
07 71 00	ROOF SPECIALTIES
07 92 00	JOINT SEALERS

**DIVISION 08 - OPENINGS**

08 11 13	HOLLOW METAL DOORS AND FRAMES
08 31 00	ACCESS DOORS AND PANELS
08 71 00	DOOR HARDWARE
08 91 00	LOUVERS

**DIVISION 09 - FINISHES**

09 21 16	GYPSUM BOARD ASSEMBLIES
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING

**DIVISION 10 - SPECIALTIES**

10 14 23	PANEL SIGNAGE
10 14 23.16	ROOM IDENTIFICATION PANEL SIGNAGE
10 28 00	TOILET, BATH, AND LAUNDRY ACCESSORIES

**DIVISIONS 11 – 21 (NOT USED)****DIVISION 22 – PLUMBING**

22 05 17	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
22 05 18	ESCUTCHEONS FOR PLUMBING PIPING
22 05 19	METERS AND GAGES FOR PLUMBING PIPING
22 05 23.12	BALL VALVES FOR PLUMBING PIPING
22 05 23.14	CHECK VALVES FOR PLUMBING PIPING
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
22 05 33	HEAT TRACING FOR PLUMBING PIPING
22 05 53	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
22 05 93	TESTING, ADJUSTING, AND BALANCING FOR PLUMBING
22 07 19	PLUMBING PIPING INSULATION
22 11 16	DOMESTIC WATER PIPING
22 11 19	DOMESTIC WATER PIPING SPECIALTIES
22 13 16	SANITARY WASTE AND VENT PIPING AND SPECIALTIES
22 13 19	SANITARY WASTE PIPING SPECIALTIES
22 13 19.13	SANITARY DRAINS
22 33 00	ELECTRIC, DOMESTIC WATER HEATERS
22 42 13.13	COMMERCIAL WATER CLOSETS
22 42 16.13	COMMERCIAL LAVATORIES

**DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

23 05 29	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 05 48.13	VIBRATION CONTROLS FOR HVAC
23 05 53	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 31 13	METAL DUCTS
23 33 00	AIR DUCT ACCESSORIES
23 34 23	HVAC POWER VENTILATORS
23 37 23	HVAC GRAVITY VENTILATORS
23 82 39.19	WALL AND CEILING UNIT HEATERS

**DIVISIONS 24 – 25 (NOT USED)**

**DIVISION 26 – ELECTRICAL**

26 05 00	GENERAL PROVISIONS FOR ELECTRICAL WORK
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 33	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 09 23	LIGHTING CONTROL DEVICES
26 24 16	PANELBOARDS
26 27 26	WIRING DEVICES
26 51 00	LIGHTING

**DIVISION 27 – COMMUNICATIONS (NOT USED)**

**DIVISION 28 – ELECTRONIC SAFETY AND SECURITY (NOT USED)**

**DIVISION 30 (NOT USED)**

**DIVISION 31 – EARTHWORK**

31 20 01	SITE GRADING
31 30 02	TRENCHING, BACKFILLING AND UTILITIES
31 40 01	EROSION AND SEDIMENT CONTROL
31 40 03	FABRIC UNDERLAY MATERIAL

**DIVISION 32 – EXTERIOR IMPROVEMENTS (NOT USED)**

32 12 16	ASPHALT PAVING
32 12 17	STONE BASE COURSE
32 12 20	MILLING, CUTTING & REPLACING PAVEMENTS
32 13 13	CONCRETE PAVING
32 17 13	PARKING BUMPERS
32 91 19	LANDSCAPE GRADING
32 92 02	GRASSING FOR STABILIZATION
32 93 00	PLANTS

**DIVISION 33 – SITE UTILITIES**

33 05 01	WATER DISTRIBUTION SYSTEM
33 05 02	WATER SERVICE CONNECTIONS
33 05 03	DISINFECTION OF POTABLE WATER
33 10 01	SANITARY SEWER - GRAVITY
33 10 02	SANITARY SEWER – PRESSURE

**DIVISIONS 34 – 41 (NOT USED)**

**END OF SECTION**

**SECTION 00 11 13  
INVITATION TO BID - REVISED**

Newberry County (Agency) is soliciting sealed bids from qualified contractors for improvements to the Little Mountain Reunion Park located at 749 Mill Street in Little Mountain, SC 29075.

This solicitation is intended to promote competition. If any language, specifications, terms and conditions, or any combination thereof restricts or limits the requirements in this solicitation to a single source, it shall be the responsibility of the interested vendor to notify the Purchasing Director in writing within five (5) days prior to the opening date. The solicitation may or may not be changed but a review of such notification will be made prior to the award.

For a complete bid package, please visit:

<https://www.newberrycounty.gov/purchasing/solicitations>

**Important Dates:**

**MANDATORY PRE-BID MEETING:** **May 21, 2025 10:00 AM**

**Pre-Bid Meeting Location:**

**Derrick Center Library  
20 Depot Street  
Little Mountain, SC 29075**

**WRITTEN QUESTIONS DUE:** **June 3, 2025 5:00 PM**

**BID DUE DATE:** **June 18, 2025 3:00 PM**

**CONSTRUCTION START DATE:** **Second week of August 2025**

**Due Date:**

Please submit one (1) sealed packets to the address listed below using the following Bid Envelope Label. At the call of time, the bids will be opened and publicly read aloud. Faxed, e-mailed, or late bids will not be considered. Mail or hand-deliver to:

Newberry County  
Attn: Crystal Waldrop  
1309 College Street  
P.O. Box 156  
Newberry, SC 29108  
Phone: 803.321.2100

**BID ENVELOPE LABEL:**

**NEWBERRY COUNTY – LITTLE MOUNTAIN REUNION PARK  
IMPROVEMENTS  
GENERAL CONTRACTOR'S NAME  
GENERAL CONTRACTOR'S ADDRESS  
COUNTY BID NUMBER: 2025-9  
DATE OF SUBMISSION**

**Bidder Responsibilities and Requirements:**

All prospective bidders must participate in a Pre-Bid meeting. The Pre-Bid meeting shall be at the proposed site unless an alternate location is listed above. **Failure to attend this meeting shall be grounds for rejection of bid.**

Deadline for questions is listed in the Important Dates above.

Questions shall be sent in writing by e-mail to Laurel Getty at [lgetty@dp3architects.com](mailto:lgetty@dp3architects.com) and copied to Adam Failla at [adam@claytonconstruction.net](mailto:adam@claytonconstruction.net).

Prices submitted are valid for **60 days**.

**Project Description:**

The Project includes improvements to the Town of Little Mountain Reunion Park, including upgraded park entrance, upgraded walking trail, renovations to existing structures, upgrades to existing restrooms for accessibility compliance, and upgraded electrical at existing structures.

The project is located at 749 Mill Street in Little Mountain, SC 29075.

Construction disciplines required for the project include, but are not limited to:

Site work:	Excavation, rough and finish grading, branch utilities, paving
Concrete:	Cast in place
Masonry:	Unit masonry assemblies
Metals:	Miscellaneous steel. Standing seam roof panels and trim.
Wood & Plastics:	Rough and finish wood carpentry and trim
Thermal & Moisture Protection:	Weather barrier and insulation
Doors & Windows:	Hollow metal doors and frames.
Finishes:	Gypsum board assemblies, paint.
Specialties:	Toilet accessories
Equipment:	None
Furnishings:	None
Special Construction:	None
Conveying systems:	None
Plumbing:	Standard ADA
Mechanical:	Standard
Electrical:	Standard
Sprinkler System:	None

**SECTION 00 21 13  
INSTRUCTIONS TO BIDDERS**

**PART 1 GENERAL**

- 1.01** Only one copy of bid is required unless otherwise specified.
- 1.02** Bids, amendments thereto or withdrawal request must be received by the time advertised for bid openings to be timely filed. It is the vendor's sole responsibility to ensure that these documents are received by the purchasing office at the time indicated in the bid document.  
**PLEASE NOTE THE VENDOR IS ULTIMATELY RESPONSIBLE FOR VERIFYING THEY HAVE RECEIVED ANY/ALL ADDENDA FROM THE COUNTY WEBSITE PRIOR TO THE BID SUBMITTAL.**
- 1.03** When specifications or descriptive papers are submitted with the bid, enter bidder's name thereon.
- 1.04** Submit your signed bid on the bidder's schedule provided. Show bid number on envelope as instructed and the bid name or description. Newberry County accepts no responsibility for unmarked or improperly marked envelopes.
- 1.05** Bidders must clearly mark as "Confidential" each part of their bid which they consider to be proprietary information that could be exempt from disclosure under Section 30-4-40 Code of Laws of South Carolina, 1976, as amended, (also known as the Freedom of Information Act). The County reserves the right to determine whether this information should be exempt from disclosure and no legal action may be brought against the County or its agents for its determination in this regard.
- 1.06** By submission of a bid, you are guaranteeing that all goods and services meet the requirements of the solicitation during the contract period.
- 1.07** Tie bids will be resolved in accordance with the provisions of the Newberry County Purchasing Ordinance.
- 1.08** A copy of the bidder's W-9 shall be included in the submission.

**PART 2 GENERAL PROVISIONS**

- 2.01** The County of Newberry reserves the right to reject any and all bids, to cancel a solicitation, and to waive any technicality if deemed to be in the best interest of the County.
- 2.02** Unit prices will govern over extended prices unless otherwise stated in this bid invitation.
- 2.03** PROHIBITION OF GRATUITIES:  
A. South Carolina Law and the Newberry County Purchasing Ordinance prohibit the giving of anything of value in return for favors or other preferential treatment in the purchasing process. Bidders should govern themselves accordingly.
- 2.04** BIDDERS QUALIFICATION:  
A. Bidders must, upon request of the county, furnish satisfactory evidence of their ability to furnish products or services in accordance with the terms and conditions of these specifications. The county reserves the right to make the final determination as to the bidder's ability to provide the products or services requested herein. Bidder determined to be irresponsible bidders are not allowed to bid to provide the county goods or services.
- 2.05** BIDDERS RESPONSIBILITY:  
A. Each bidder shall fully acquaint himself with conditions relating to the scope and restrictions attending the execution of the work under the conditions of this bid. It is expected that this will sometimes require on-site observation. The failure or omission of a bidder to acquaint

himself with existing conditions shall in no way relieve him of any obligation with respect to this bid or to the contract.

**2.06 AWARD CRITERIA:**

- A. The contract shall be awarded to the lowest responsible and responsive bidder(s) whose bid meets the requirements and criteria set forth in the invitation for bid. Award may be made to one or a multiple of bidders, whichever deems to be in the best interest of the county, or unless otherwise stated on the bidder's schedule.

**2.07 WAIVER:**

- A. The county reserves the right to waive any instruction to bidders, general or special provisions, general or special conditions, or specifications deviation if deemed to be in the best interest of the county.

**2.08 COMPETITION:**

- A. This solicitation is intended to promote competition. If any language, specifications, terms and conditions, or any combination thereof restricts or limits the requirements in this solicitation to a single source, it shall be the responsibility of the interested vendor to notify the Purchasing Director in writing within five (5) days prior to the opening date. The solicitation may or may not be changed but a review of such notification will be made prior to the award.

**2.09 REJECTION:**

- A. Ambiguous bids which are uncertain as to terms, delivery, quantity, or compliance with specifications may be rejected or otherwise disregarded if such action is in the best interest of the County.

**2.10 RIGHT TO PROTEST:**

- A. Any prospective bidder, offeror, or contractor, who is aggrieved in connection with the solicitation of a contract shall protest in writing to the purchasing director within ten (10) calendar days of the date of issuance of the invitation to bid or other solicitation documents, whichever is applicable, or any amendment thereto, if the amendment is at issue. Any actual bidder, offeror, or contractor, who is aggrieved in connection with the intended award or award of a contract, shall protest in writing to the purchasing director within ten (10) calendar days of the notification of intent to award or statement of award.

**2.11 PROTEST PROCEDURE:**

- A. A protest shall be in writing, submitted to the purchasing director, and shall set forth the specific grounds of the protest with enough particularity to give notice to the issues to be decided.

**PART 3 GENERAL CONDITIONS**

**3.01 DEFAULT:**

- A. In case of default by the contractor, the County reserves the right to purchase any or all items in default in the open market, charging the contractor with any excessive costs. Should such charge be assessed, no subsequent bids of the defaulting contractor will be considered until the assessed charge has been satisfied.

**3.02 NON-APPROPRIATION**

- A. Any contract entered into by the County resulting from this bid invitation shall be subject to cancellation without damages or further obligation when funds are not appropriated or otherwise made available to support continuation of performance in a subsequent fiscal period or appropriated year.



**3.03 HOLD HARMLESS AND INSURANCE**

- A. The successful bidder shall indemnify and hold harmless the County of Newberry and all County officers, agents and employees against all suits or claims for personal injury or property damage resulting from, or arising from, the successful bidder's performance of the contract, as well as against any suits or claims of any character brought against the County or its agents or employees by reason of any claim of infringement of any patent, trade mark, trade dress, or copyright, including reimbursement to the County for all attorneys fees and court costs incurred by the County in defending itself or its agents or employees against any such claim or suit. In addition, the successful bidder will maintain a public liability policy with minimum limits of \$500,000 per occurrence, or \$1,000,000 single limit, for damages arising from acts which occur during the contract period, with the County of Newberry named as an additional insured on the policy; the successful bidder shall also maintain workers compensation and vehicle liability insurance in the amounts required by statutory law. Proof of such coverage will be provided upon demand or as otherwise provided in the bid specifications

**3.04 CONTRACT ADMINISTRATION:**

- A. Questions or problems arising after award of this contract shall be directed to the Purchasing Director, P.O. Box 156, Newberry, SC 29108, or by calling 803-321-2100.

**3.05 FORCE MAJEURE:**

- A. The Contractor shall not be liable for any excess costs if the failure to perform the contract arises out of causes beyond the control and without fault or negligence of the contractor. Such causes may include, but are not restricted to acts of God or of a public enemy, acts of Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the contractor. If the failure to perform is caused by default of a subcontractor, and if such default arises out of causes beyond the control of both the contractor and subcontractor and without excess costs for failure to perform, unless the supplies or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the contractor to meet the required delivery schedule.

**3.06 PUBLIC RELEASE:**

- A. Contractor agrees not to refer to award of this contract in commercial advertising in such a manner as to state or imply that the products or services provided are endorsed or preferred by the User.

**3.07 QUALITY OF PRODUCT:**

- A. Unless otherwise indicated in this bid it is understood and agreed that any items offered or shipped on this bid shall be new, in first class condition, and without defect that all containers shall be new and suitable for storage or shipment, and that prices include standard commercial packaging and shipping to the specified destination in Newberry County. No demonstration models shall be sold as new, without prior written permission of the County.

**3.08 S.C. LAW CLAUSE:**

- A. Upon award of a contract under this bid, the person, partnership, association or corporation to whom the award is made must comply with the Laws of South Carolina which require such person or entity to be authorized and/or licensed to do business with this State. Notwithstanding the fact that applicable statutes may exempt or exclude the successful bidder from requirements that it be authorized and/or licensed to do business in this State, by submission of this signed bid, the bidder agrees to subject himself to the jurisdiction and process of the courts of the State of South Carolina as to all matters and disputes arising or to arise under the contract and the performance thereof, including any questions as to the

liability for taxes, licenses, or fees levied by the State.

**3.09 ASSIGNMENT:**

- A. No contract or its Provisions may be assigned, sublet, or transferred without the written consent of the Purchasing Director.

**3.10 AFFIRMATIVE ACTION:**

- A. The successful bidder will take affirmative action in complying with all Federal and State requirements concerning fair employment of the handicapped, and concerning the treatment of all employees, without regard or discrimination by reason of race, color, religion, sex, national origin or physical handicap.

**3.11 DELIVERIES:**

- A. All deliveries shall be FOB Destination. It is agreed by the parties hereto that delivery by the contractor to the common carrier does not constitute delivery to the County. Any claim for loss or damage shall be between the contractor and the carrier.

**3.12 APPROPRIATE S.C. SALES TAXES, FEES, AND PERMITS:**

- A. Appropriate S.C. sales taxes, fees, and permits shall be included in the Contractor's base bid for all materials. All fees, including permits and any removal or disposal of construction debris shall be included in the contractor's bid.

**3.13 PAYMENT TERMS:**

- A. Payment will be in accordance with Section 01 20 00 Price and Payment Procedures.

**3.14 BID BOND:**

- A. For each bid in excess of \$25,000.00 each bidder will submit with their bid a bond in the amount of 5% of the total price of the bid submitted. The bid bonds will be returned to the unsuccessful bidders once the County accepts the lowest most responsive bid. If the most responsive bidder fails to perform the responsibility of the bid within 10 days of the award, then the bid bond will be forfeited to the county as liquidated damages and the next lowest bidder will be awarded the bid.
- B. Bid bonds may be in the form of a surety, a cashier's check or an unconditional letter of credit in favor of Newberry County issued by a commercial bank in South Carolina.
  - 1 Acceptable surety formats include the *Bid Bond* document included in the Bid Form, AIA Document A310-2010, or the surety companies standard bond certificate.
  - 2 Bonds executed by an Attorney-In-Fact shall have attached to each copy of the bond a certified copy of Power of Attorney properly executed and dated.

**3.15 PERFORMANCE AND PAYMENT BONDS:**

- A. The chosen vendor will be required to submit to the County both a performance bond and payment bond in the amount of 100% of the contract price as part of the Contract documents required to execute the contract prior to commencing with the work.
- B. **Both bonds will be issued from a surety company with an "A" minimum rating of performance as stated in the most current publication of Best Key Rating Guide, Property Liability. Performance Bonds are required when the project is expected to cost \$100,000.00 or more. Payment Bonds are required when the project is expected to cost more than \$50,000.00.**
- C. Proof of ability to provide both bonds is required to be submitted with their bid.
  - 1 Acceptable formats include the *Performance and Payment Bond - Proof of Coverage* document included in the Bid Form or the surety companies standard bond certificate.
  - 2 Bonds executed by an Attorney-In-Fact shall have attached to each copy of the bond a

certified copy of Power of Attorney properly executed and dated.

**3.16 COMPLIANCE WITH THE SOUTH CAROLINA ILLEGAL IMMIGRATION ACT:**

- A. By submitting an offer, Bidder certifies that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina code of Laws (originally enacted as Section 3 of The South Carolina Illegal Immigration act, 2008 S.C. Act No. 280) and agrees to provide upon request any documentation required to establish either: (a) the applicability of Title 8, Chapter 14 to Bidder and any subcontractor or sub-subcontractors; or (b) the compliance with Title 8, Chapter 14 by Bidder and any subcontractors or sub-subcontractors. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both". Bidder agrees to include in any contracts with its subcontractors language requiring the subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in any contracts with the sub-subcontractors language requiring the sub-subcontract to comply with the applicable requirements of Title 8, Chapter 14.

**END OF SECTION**

**SECTION 00 41 00  
BID FORM – REVISED**

(Failure to furnish all requested data will be cause for considering Bidder non-responsive and may render this Bid invalid on that basis.)

BID FOR:     **Bid #: 2025-9**  
                  **NEWBERRY COUNTY- LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS**  
                  749 MILL STREET  
                  LITTLE MOUNTAIN, SC 29075

SUBMITTED TO:  
NEWBERRY COUNTY  
ATTN: CRYSTAL WALDROP  
1309 COLLEGE STREET  
P.O. BOX 156  
NEWBERRY, SC 29108

SUBMITTED BY:

\_\_\_\_\_  
*Address:*  
\_\_\_\_\_  
\_\_\_\_\_  
*City, State, and Zip Code:*  
\_\_\_\_\_

This bid included addenda numbered and dated (if none, so state):

#	_____	_____
#	_____	_____
#	_____	_____
#	_____	_____
#	_____	_____

**BASE BID**

The proposed Contract Price is \_\_\_\_\_ dollars.  
(\$ \_\_\_\_\_)

**ALTERNATE NO. 1: ADD – CONCRETE SIDEWALKS IN LIEU OF ASPHALT PAVING**

The proposed Contract Price is \$ \_\_\_\_\_ dollars.  
(\$ \_\_\_\_\_)

**ALTERNATE NO. 2: [ADD] / [DEDUCT] – NEW FLAGPOLES IN LIEU OF RELOCATION OF EXISTING**

The proposed Contract Price is \$ \_\_\_\_\_ dollars.  
(\$ \_\_\_\_\_)

## GENERAL NOTES

- A. The undersigned, hereinafter called Bidder, in compliance with the "Notice to Bidders," accepting all of the terms and conditions of the "Instructions to Bidders," including without limitation those dealing with the disposition of Bid Security; proposes and agrees, if awarded the Contract, to enter into an Agreement with the Owner in the form of Agreement included in the Contract Documents, to furnish all materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the work to be performed under this Contract within the Contract Time indicated in this Bid, in full and complete accordance with the shown, noted, described and reasonably intended requirements of the Contract Documents, to the full and entire satisfaction of the Owner, for the amounts contained in the Bid Schedules.
- B. This Bid will remain open for sixty 60 days after the day of Bid opening. If awarded a contract, Bidder will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within ten (10) days after the date indicated in Owner's Notice of Award.
- C. In submitting this Bid, Bidder represents that:
  - 1 Bidder has become thoroughly familiar with the terms and conditions of the proposed Contract Documents accepting the same as sufficient to indicate and convey understanding of all the conditions and requirements under the Contract which will be executed for the Work.
  - 2 Bidder has examined the site and locality where the Work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations as Bidder deems necessary.
  - 3 This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for himself any advantage over any other Bidder or over Owner.
  - 4 That no member of the Commission or other officers or employees of said Owner is interested directly or indirectly in the Bid or in any portion of the Bid nor in the Contract or any part of the Contract which may be awarded the undersigned on the basis of such Bid.
  - 5 The description under each bid item, being briefly stated, implies, although it does not mention, all incidentals and that prices stated are intended to cover all such work, materials and incidentals as constitute Bidder's obligations as described in the Specifications, and any details not specifically mentioned, but evidently included in the Contract shall be compensated for in the item which most logically includes it.
  - 6 The Bid includes all sales taxes and other applicable taxes and fees.
- D. Contract Time: Bidder agrees that:
  - 1 CONTRACTOR will commence work with an adequate force and equipment at the time stated in the Notice to Proceed, and complete all work in the number of days stipulated from the date stated in said notice without working overtime or on Saturdays, Sundays, or legal holidays except as specifically allowed by the Contract Documents and approved by the Owner.

- 2 Work shall commence no earlier than **August 4, 2025** or five (5) days after the receipt of the building permit, whichever is later, and the work shall be complete to the satisfaction of the owner within **145 calendar days**.
- 3 The following schedule depicts working days per calendar month (non-cumulative) that shall be anticipated as normal inclement weather. Such time will not be considered justification for an extension of time. Inclement weather days in excess of normal inclement weather days listed, are justification for extension of time. Inclement weather days on Saturday, Sunday and holidays will not be allowed unless work has been scheduled and the Architect notified prior to said days. Time extensions will be granted only if the critical path has been affected. Extensions of time will be calendar days and not working days. Requests for extensions of time shall be made, in writing, within 21 days of the event(s) giving rise to the request.

Inclement weather days are defined as days, before project "dry-in", in which weather is too cold or too wet for masonry work to occur, provided the critical path is affected. For a wet weather day to occur,  $\frac{1}{4}$ " of rain must fall during that day before 12:00 noon for it to be considered. Hot weather will not be justification for an inclement weather day.

January	6 days
February	5 Days
March	5 Days
April	4 Days
May	5 Days
June	4 Days
July	6 Days
August	7 Days
September	5 Days
October	4 Days
November	4 Days
December	5 Days

- 4 Liquidated Damages. OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not substantially complete within the times specified above. They also recognize the delays, expenses and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) items e and f below shall be enforced.
- 5 CONTRACTOR shall pay OWNER **Three Hundred Dollars (\$300)** for each calendar day that expires after the time specified above for completion and readiness for final payment.
- 6 CONTRACTOR understands and hereby expressly agrees that in addition to liquidated damages specified in Section 5 above, to pay the OWNER the actual costs to OWNER for any inspector or inspectors necessarily employed by OWNER on the Work until the Work is completed and ready for final payment. Further, the CONTRACTOR agrees that the sums to be paid the OWNER may be deducted from the sum due the CONTRACTOR for work performed as provided in Article 14 of the General Conditions.

E. Execution of Contract: Bidder agrees that:

- 1 In case of failure on his part to execute the said Contract and Bonds within 15 days after the date indicated in the "Notice of Award", the check or bid bond accompanying this Bid, and the money payable thereon, shall be paid to the Owner as liquidated damages for such

failure; otherwise, the Bid Bond or check accompanying this Bid shall be returned to the undersigned.

F. Bid Documentation: The following documents are attached to and made a part of this Bid:

- 1 The undersigned acknowledges that a **Bid security (Bond), in an amount equal to at least 5% of the amount of the bid**, is required for all competitive sealed bidding for construction contracts when the price is estimated to equal to or exceed Twenty-Five Thousand Dollars (\$25,000.00). The Bid Bond shall be provided as indicated in the Invitation to Bid.
- 2 The undersigned acknowledges that a **Payment Bond, in an amount equal to 100% of the construction cost**, is required for all competitive sealed bidding for construction contracts when the price is estimated to equal to or exceed Fifty Thousand Dollars (\$50,000.00). Proof of coverage ability of the Payment Bond shall be provided as indicated in the Invitation to Bid.
- 3 The undersigned acknowledges that a **Performance Bond, in an amount equal to 100% of the construction cost**, is required for all competitive sealed bidding for construction contracts when the price is estimated to equal to or exceed One Hundred Thousand Dollars (\$100,000.00). Proof of coverage ability of the Performance Bond shall be provided as indicated in the Invitation to Bid.
5. Certificate of Insurance showing proof of required coverages.
6. Bidder's Affidavit.
7. Non-collusion Affidavit.
8. NEWBERRY COUNTY requires a copy of the bidder's W-9 to be included in the submission.

G. Name, business address (mailing and street) phone number and e-mail address of Bidder to which all formal Notices shall be sent:

*Name* \_\_\_\_\_  
*Address* \_\_\_\_\_  
\_\_\_\_\_  
*City, State, Zip* \_\_\_\_\_  
*Phone Number* \_\_\_\_\_  
*E-mail* \_\_\_\_\_

- H. The terms used in this Bid, which are defined in the General Provisions of the Construction Contract included as a part of the Contract Documents, have the meanings assigned to them in the General Provisions.
- I. The undersigned, as Bidder, declares that he has examined the project and informed himself fully in regard to all conditions pertaining to this project; that he has examined the Drawings and Project Manual for the work and Contractual Documents relative thereto and that he has satisfied himself relative to the work to be performed.
- J. Adjustments To Base Bid:  
The OWNER may elect to award only a portion of the project at the prices provided by the successful Bidder.

- K. The Bidder agrees that his proposal may not be withdrawn for a period of 60 calendar days after the scheduled closing time for receiving bids.
- L. The Bidder acknowledges by his signature that the Owner reserves the right to reject any or all bids and to waive informalities in the bidding.
- M. The undersigned agrees to submit, **within twenty-four (24) hours of the bid due date**, the attached Schedule of Values Form, completed in its entirety, as part of the Bid Submittal. Such Schedule of Values Form shall be submitted to the place designated for receipt of Bids. Bid forms not followed by a properly completed Schedule of Values shall be considered incomplete and shall receive no further consideration. An incomplete Schedule of Values will not be accepted.
- N. The Undersigned has included all required Certificates of Insurance, etc.
- O. The Undersigned hereby affirms and states that the prices quoted herein constitute the total costs for the work involved in the respective items and that this cost also includes taxes, insurance, royalties, transportation charges, use of tools and equipment, superintendence, overhead, profits and other work, services and conditions necessarily involved in the work done and the materials furnished, in accordance with the requirements of the Contract.
- P. The BIDDER hereby states that he proposes, if awarded the Contract, to use the following subcontractors on this project: (List only one subcontractor for each item.)

<i>Sub-Trade</i>	<i>Name</i>
Grading:	_____
Plumbing:	_____
HVAC:	_____
Electrical	_____

- Q. The Bidder shall state on the line below, if a corporation, the name of state in which incorporated and the date of said corporation.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 2025.

\_\_\_\_\_  
(Contractor)

By: \_\_\_\_\_  
(Signature of individual, partner or officer signing the Bid)

Its: \_\_\_\_\_  
(Title)

(SEAL)



License Number: \_\_\_\_\_  
(Seal required if Bidder is a Corporation)

## SCHEDULE OF VALUES

(This Schedule of Values is part of the BID and shall be e-mailed to the office of the Architect at [lgetty@dp3architects.com](mailto:lgetty@dp3architects.com) and the Construction Manager Adam Failla at [adam@claytonconstruction.net](mailto:adam@claytonconstruction.net) within 24 hours after the Bid Date and Time. Note – if a Division is not required in the project scope indicate Not Applicable “NA” on the associated line.)

<i>Division</i>	<i>Category</i>	<i>Subtotal</i>
Zero	General Conditions	
One	Temporary Facilities	
	Cleaning	
Two	Sitework	
	Trenching, Backfilling & Compacting	
	Pavement & Marking	
Three & Four	Cast-In-Place Concrete & Masonry	
Five	Structural Steel & Misc. Metals	
Six	Carpentry (Rough & Finish)	
	Casework	
Seven	Thermal And Moisture Protection	
Eight	Doors, Frames & Hardware	
	Glass & Glazing	
Nine	Wall & Ceiling Systems	
	Flooring	
	Painting	
Ten	Specialties	
Eleven	Food Service Equipment	
Twelve	Furnishings	
Twenty-One	Fire Suppression Systems	
Twenty-Two	Plumbing	
Twenty-Three	HVAC Equipment & Ductwork	
Twenty-Six	Lighting, Panels, Switchgear & Conductors	
	Permits	
	Fees	
	Insurance	
	Bid Security	
	Performance & Payment Bond	
	Overhead / Profit	
	Tax (If Applicable)	
<b>PROJECT TOTAL</b>		

## **INSURANCE REQUIREMENTS**

The contractor shall procure and maintain, during the life of the contract, insurance coverage, for not less than any limits of liability shown between and shall include contractual liability insurance as applicable to the contractor's obligations, with a carrier authorized to do business in the State of South Carolina.

All coverage shall be primary and shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability. Original endorsements, signed by a person authorized to bind coverage on its behalf, shall be furnished to the Owner by the successful bidder.

### **CERTIFICATES OF INSURANCE MUST BE INCLUDED IN THE BID.**

- A. Commercial General Liability: The contractor shall maintain insurance for protection against all claims arising from injury to person or persons not in the employment of the contractor and against all claims resulting from damage to any property due to any act or omission of the contractor, his agents, or employees in the operation of the work or the execution of this contract.

Contractor shall maintain General Liability coverage required for a period of not less than five (5) years after project completion. General Liability must include Products/Completed Operations coverage.

Where the work to be performed involves excavation of other underground work or construction, the property damage insurance provided shall cover all claims due to destruction of subsurface property such as wire, conduits, pipes, etc. caused by the contractor's operation. The minimum shall be as follows:

Bodily Injury (Injury or Accidental Death) and Property Damage	\$1,000,000.00 General Liability \$2,000,000.00 Aggregate
---	--

- B. Comprehensive Automobile Liability: The contractor shall maintain Automobile Liability Insurance for protection against all claims arising from the use of vehicles, rented vehicles, or other vehicles in the prosecution of the work included in the contract. Such insurance shall cover the use of automobiles and trucks on and off the site of the project. The minimum amounts of Automobile Liability Insurance shall be as follows:

Bodily Injury (Injury or Accidental Death) and Property Damage	\$1,000,000.00 Combined Single Limit
---	--------------------------------------

- C. South Carolina Workers' Compensation Insurance: The contractor shall maintain Workers' Compensation Insurance for all of his/her employees who are in any way connected with the performance under this agreement. Such insurance shall comply with all applicable state laws.

South Carolina Workers' Compensation Employers Liability Insurance	Statutory Limits \$500,000.00 Each Accident \$500,000.00 Disease Each Employee \$500,000.00 Disease Policy Limit
---	---

Contractor shall provide the Agency with a Certificate of Insurance showing proof of insurance acceptable to the Agency. Certificates containing wording that releases the insurance company from liability of non-notification of cancellation of insurance policy are not acceptable.

Contractor and/or its insurers are responsible for payment of any liability arising out of Workers' Compensation, unemployment or employee benefits offered to its employees.

Insurance is to be placed with insurers with a current AM Best's rating of not less than A:VII, and licensed to operate in South Carolina by the South Carolina Department of Insurance, unless otherwise acceptable to the Agency.

Workers' Compensation policy is to be endorsed to include a waiver of subrogation in favor of the Agency, its officers, officials, employees and agents.

Deductibles, Co-Insurance Penalties & Self-Insured Retention: The contractor shall agree to be fully and solely responsible for any costs or expenses as a result of a coverage deductible, or insurance penalty, or self-insured retention; including any loss not covered because of the operation of such deductible, co-insurance penalty or self-insured retention.

Subcontractors' Insurance: The contractor shall agree to cause each subcontractor employed by the contractor to purchase and maintain insurance of the type specified herein, unless the contractor's insurance provides coverage on behalf of the subcontractor. When requested by the Agency, the contractor shall agree to obtain and furnish copies of certificates of insurance evidencing coverage by each subcontractor.

**BID BOND**

(A Bid Bond is part of the BID. Refer to Section 00 21 13 Instruction to Bidders, paragraph 3.14-B for acceptable formats.)

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned as Principal and

\_\_\_\_\_  
as Surety, are hereby held and firmly bound unto

\_\_\_\_\_  
NEWBERRY COUNTY as OWNER in the penal sum of

\_\_\_\_\_  
for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 2025.

The conditions of the above obligation is such that whereas the Principal has submitted to NEWBERRY COUNTY certain BID, attached hereto and hereby made a part hereof to enter into a Contract in writing for the **NEWBERRY COUNTY - REUNION PARK IMPROVEMENTS**.

NOW THEREFORE,

If said Bid shall be rejected, or in the alternate, If said Bid shall be accepted and the Principal shall execute and deliver a Contract in the Form of Agreement attached hereto (properly completed in accordance with said Bid) and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that obligations of said Surety and its Bonds shall be in no way impaired or affected by any extension of the time within which the Owner may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

In the Present of:

PRINCIPAL:

Witness: \_\_\_\_\_

By: \_\_\_\_\_

SURETY:

Witness: \_\_\_\_\_

By: \_\_\_\_\_

## PERFORMANCE AND PAYMENT BOND – PROOF OF COVERAGE

(A proof of ability to provide Performance and Payment Bonds is part of the BID. Refer to Section 00 21 13 Instructions To Bidders paragraph 3.15-C for acceptable formats.)

KNOW ALL MEN BY THESE PRESENTS: That we

\_\_\_\_\_

as Principal, also referred to as CONTRACTOR, and

\_\_\_\_\_

as Surety, are held and firmly bound unto NEWBERRY COUNTY as Owner, in the full sum of

\_\_\_\_\_

(\$ \_\_\_\_\_) Dollars, for the payment of which will and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, by these presents.

WHEREAS, the above bound principal has entered into a contract with the Owner dated \_\_\_\_\_ day of \_\_\_\_\_, 2025., for

\_\_\_\_\_.

NOW, THEREFORE, the conditions of this obligation are such that if the above bound Principal shall faithfully and fully comply with the terms and conditions of said contract, including, but not limited to any obligations created by way of warranties and/or guarantees for workmanship and materials which warranty and/or guarantee may extend for a period of time beyond completion of said contract, and such alterations or additions as may be made therein or in the plans and specifications, and shall indemnify and save the Owner harmless against all claims for damages by reason of any default or negligence, want of skill or care on the part of said principal or Agents in and about the performance of said contract, and shall comply with all laws pertaining to said work, and shall comply with and perform any and all warranties and/or guarantees provided for in said contract, then this obligation shall be void; otherwise of full force and effect.

PROVIDED, further that upon either the default of the Principal, or the failure of the said Principal to promptly and efficiently prosecute said work, in any respect, in accordance with the Contract Documents, the above bound Surety shall either remedy the default of the Principal or shall take charge of said work, and complete the Contract at his own expense, pursuant to its terms, receiving, however, any balance of funds in the hands of said Owner due under said contract.

It shall be the duty of the Surety to give an unequivocal notice in writing to the Owner within ten- (10) days after receipt of a declaration of default of the Surety's election either to remedy the default or defaults promptly, or to perform the contract promptly, time being of the essence. In said notice of election, the Surety shall indicate the date on which the remedy or performance will commence, and it shall then be the duty of the Surety to give prompt notice in writing to the Owner immediately upon completion of (a) the remedy and/or correction of each default, (b) the remedy and/or correction of each item of condemned work, (c) the furnishings of each omitted item of work, and (d) the performance of the contract. The Surety shall not assert solvency of its Principal as justification for its failure to give notice of election or for its failure to promptly remedy the default or defaults or perform the contract.

In the event said Principal shall fail or delay the prosecution and completion of said Work and said Surety shall also fail to act promptly as hereinabove provided, then the Owner shall cause ten- (10) days notice of such failure to be given, both to said Principal and Surety, and at the expiration of said ten- (10) days, if said Principal or Surety do not proceed promptly to execute said Contract, the Owner shall have the authority to cause said work to be done and when the same is completed and the cost thereof estimated, the said Principal and Surety shall and hereby agree, to pay any excess in the cost of said work above the agreed price to be paid under said Contract.

Upon completion of said Contract pursuant to its terms, if any funds remain due on said Contract, the same shall be paid to said Principal or Surety.

The said Principal and Surety further agree as part of this obligation to pay all such damages of any kind to person or property that may result from a failure in any respect to perform and complete said Contract including, but not limited to, all repair and replacement costs necessary to rectify purchase and installation error and fees.

The decision of the Owner, upon any disputed question connected with the execution of said Contract, or any failure or delay in the prosecution of the work by said Principal or Surety, shall be final and conclusive.

The Surety agrees that other than as is provided in this bond, it may not demand of the Owner that the Owner shall (a) perform anything or act, (b) give any notice, (c) furnish any clerical assistance, (d) render any service, (e) furnish any papers or documents, or (f) take any other action of any nature or description which is not required of the Owner to be done under the contract documents.

IN WITNESS WHEREOF, the Surety and Principal have executed this instrument under their several seals this

\_\_\_\_\_ day of \_\_\_\_\_, 2025.,  
the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In the Present of:

PRINCIPAL:

Witness: \_\_\_\_\_

By: \_\_\_\_\_

SURETY:

Witness: \_\_\_\_\_

By: \_\_\_\_\_

NOTE:

- (a) Where the Performance Bond is executed by an attorney-in-fact, there shall be attached to each copy of the Bond, a certified copy of Power of Attorney properly executed and dated.
- (b) An authorized agent of the bonding company, licensed to do business in South Carolina shall countersign each copy of the Bond. The title of the person countersigning the Bond shall appear after his or her signature.
- (c) The Seal of the bonding company shall be attached to each copy of the Bond.
- (d) The CONTRACTOR'S signature on the Bond shall correspond with the signature in the Contract.
- (e) The Bond shall be accompanied by a corporate resolution (which may be combined with the corporate resolution granting the signing officer authority to execute contracts) granting the corporate officer whom executes the Bond, the authority to do so.
- (f) Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended), and be authorized to transact business in the State of South Carolina.

## BIDDER'S AFFIDAVIT

(This Affidavit is part of the BID)

STATE OF: \_\_\_\_\_

COUNTY OF: \_\_\_\_\_

Being duly sworn deposes and says that he resides at:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

That he is: \_\_\_\_\_

*(Give Name and Title)* who signed the above Proposal or BID, that he was duly authorized to sign and that the BID is the true offer of the BIDDER, that the seal attached is that seal of the BIDDER and that all the declarations and statements contained in the BID are true to the best of his knowledge and belief.

\_\_\_\_\_  
*(Affiant)*

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 2025.

\_\_\_\_\_  
*(Notary Public)*

My Commission expires: \_\_\_\_\_ day of \_\_\_\_\_, 202\_\_.

*(SEAL)*



**FORM OF NON-COLLUSION AFFIDAVIT**

(This Affidavit is part of the BID)

STATE OF: \_\_\_\_\_

COUNTY OF: \_\_\_\_\_

\_\_\_\_\_  
Being duly sworn deposes and says that he is

\_\_\_\_\_  
(Sole Owner, Partner, President, Secretary, Etc...) of

\_\_\_\_\_

the party making the foregoing Proposal or BID that such BID is genuine and not collusive or sham; that said BIDDER has not colluded, conspired, connived, or agreed, directly or indirectly, with any BIDDER or person, to put in a sham BID, or that such other person shall refrain from bidding, and has not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the Bid Price of Affiant or any other BIDDER, or to fix any overhead, profit or cost element of said Bid Price, or of that of any other BIDDER, or to secure any advantage against OWNER any person interested in the proposed Contract; and that all statements in said Proposal or Bid are true; and further, that such BIDDER has not, directly or indirectly submitted this BID, or the contents thereof, or divulged information or data relative thereto to any association or to any member or agent thereof.

\_\_\_\_\_  
(Affiant)

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 2025.

\_\_\_\_\_  
(Notary Public)

My Commission expires: \_\_\_\_\_ day of \_\_\_\_\_, 202\_\_.

(SEAL)

**END OF SECTION**

**SECTION 01 23 00  
ALTERNATES**

**1.01 PROVISIONS INCLUDED**

- A. The conditions of the Contract and Division 1, General Requirements, apply to the work under this Section.

**1.02 DESCRIPTION OF WORK**

- A. Furnish all labor, materials and services necessary for the proper and complete execution of accepted alternates. The amount of alternate prices to be added to or deducted from the base bid shall be stated on the Bid Form and shall include the cost of any and all modifications made necessary by the Owner's acceptance of an alternate.
- B. State the amount to be added to or deducted from the base bid for each of the following alternates, if these alternates are added to the work of the Contract. The base bid shall not include the following listed alternates or work required to be performed in connection thereto.

**1.03 SCHEDULE OF ALTERNATES**

- A. Alternate No. 1: Concrete Sidewalks in Lieu of Asphalt Paving
  - 1. Base Bid Item: All paving to be asphalt and heavy-duty asphalt. Refer to civil drawings for locations.
  - 2. Alternative Item: All paving to be concrete and heavy-duty concrete. Refer to civil drawings for locations.
- B. Alternate No. 2: New Flagpoles in Lieu of Relocation of Existing Flagpoles
  - 1. Base Bid Item: Relocate existing flagpoles.
  - 2. Alternative Item: In lieu of relocating existing flagpoles, demolish existing flagpoles and install new flagpoles per specifications.

**END OF SECTION**

**SECTION 01 31 50**  
**COORDINATION DRAWINGS - REVISED**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:
  - 1. Coordination and Installation Drawings.
- B. Each contractor shall participate in coordination and installation requirements.
- D. Related Sections:
  - 1. Section 013100 "Project Management and Coordination" for general coordination procedures.
  - 2. Section 013200 "Construction Progress Documentation", for preparing and submitting Contractor's coordination drawings.
  - 3. Sections contained in Divisions 21, 22, 23, 26, 27, & 28, for MEP coordination.

**1.3 COORDINATION**

- A. Coordinate the development of the Coordination and Installation Drawings to ensure efficient, coordinated and orderly installation of each part of the Work.
  - 1. The Contractor shall include coordination and installation drawings in preparing a CPM schedule in accordance with Section 013200 – "Construction Progress Documentation".
  - 2. Phase coordination and installation drawings 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, i.e. below slab and above slab phases.
  - 3. Indicate adequate provisions to coordinate items scheduled for later installation.

**1.4 COMPOSITE COORDINATION AND INSTALLATION DRAWINGS**

- A. General: Prior to fabricating or installing work, the contractor shall prepare, submit and use composite installation and coordination drawings to assure proper coordination and installation of work. Installation or construction work shall not begin until the coordination drawings are completed, submitted, and approved.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordinated composite drawings on standard printed data. Drawings shall include, but not be limited to, the following information, as applicable:
    - a. Underslab and Crawlspace Plans
    - b. Floor Plans and Reflected Ceiling Plans
    - c. Roof Plans

- d. Overhead Plenum Space
  - e. Mechanical Rooms
  - f. Structural and Slab Penetrations
2. Use applicable Drawings as a basis for preparation of coordinated composite drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
  3. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, plumbing, fire protection and electrical systems. Composite coordination drawings shall include new and existing elements, components, and systems.
  4. Show relationship and integration of different construction elements that require coordination during fabrication or installation to fit in space provided or to function as intended.
  5. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
  6. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are important to efficient flow of Work.
  7. Show location and size of access doors required for access to concealed dampers, valves, and other controls, including space required opening the access door.
  8. Consideration shall be made for scheduling, sequencing, movement, and positioning of large equipment into building during construction.
  9. Indicate penetrations in floors, walls, and ceilings and their relationship to assembly construction, other penetrations and installations. Identify where additional bracing and offsets are required to comply with Contract Documents.
  10. Indicate any required installation sequences to minimize cutting and patching.
  11. Indicate equipment and devices indicated on wiring diagrams and schematics. Where field connections are shown to factory-wired terminals include manufacturer's literature showing internal wiring.
  12. Include dimensions on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to the Design Professional indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Organization: Organize drawings as follows:
1. Below Slab and Crawlspace Plans: Show structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical work.
  2. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  3. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, plumbing, fire protection and electrical equipment, and related Work. Indicate subframing for support of ceiling and wall systems, mechanical, electrical, plumbing and fire protection components, and related work. Locate components within ceiling plenum to accommodate architectural ceiling height and layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  4. Roof Plan: Show architectural and structural elements, and mechanical, plumbing, fire-protection, and electrical work.
  5. Mechanical Rooms: Showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment, piping and conduit.
  6. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

- C. Systems: Include, but do not necessarily limit to, the following:
1. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Ductwork, grilles, registers, diffusers, dampers, access panels.,
    - d. Equipment connections, including MEP equipment, food service equipment and laboratory equipment.
    - e. Fire rated partitions and locations of fire, combination fire/smoke and smoke dampers.
    - f. Clearances, including maintenance, coil and filter removal, valve stem, insulation installation, etc.
    - g. Fire-rated enclosures around ductwork.
  2. Electrical and Specialty Systems Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/2 inch diameter and larger, and racks of smaller conduit.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
    - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    - d. Location of pull boxes and junction boxes dimensioned from column center lines.
  3. Fire Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  4. Framing
    - a. All king studs, headers, bracing, miscellaneous framing, and any items that may affect coordination with other disciplines.
- D. Preparation: Prepare coordination digital data files in accordance with the following requirements:
1. File Preparation Format: AutoCAD or REVIT. Reproduction of any portion of the contract drawings for re-submittal as a shop drawing is prohibited. Shop drawings produced in such a manner will be rejected and returned not reviewed. Installation and coordination drawings shall be to scale reflecting actual equipment sizes approved for the project.
  2. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. 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 Revit.
    - c. Contractor shall execute data licensing agreement in the form of AIA Document C106, or in alternate Format acceptable to and generated by the Architect, Engineers, and Consultants.
  3. Meetings: Contractor coordination meetings shall be held continuously until the coordination drawings are complete and approved by all parties. Meetings shall be scheduled as required to complete the drawings in a timely manner as to not impact the project schedule. Additional time or compensation shall not be awarded based on the complexity or effort required to complete the coordination drawings.
  4. Conflicts: In the event of conflicts involving location and layout of work, unless otherwise directed the General Contractor shall use the following priority to resolve the conflict:
    - a. Structure and partitions shall have highest priority.
    - b. Equipment locations and access
    - c. Ceiling systems and recessed light fixtures.

- d. Gravity drainage lines.
  - e. Medium pressure ductwork and devices.
  - f. Large pipe mains, valves and devices.
  - g. Pneumatic tube and material conveying systems (where applicable)
  - h. Low pressure ductwork, diffusers, registers, grilles, dampers
  - i. Fire protection piping, devices and heads.
  - j. Small piping, tubing, electrical conduit and devices.
    - 1) Conduits installed in corridors shall be maintained at least 6"-9" above finished ceiling and similarly grouped and tightly spaced.
    - 2) The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc..
  - k. Access panels.
5. Any conflicts or discrepancies discovered in the preparation of the drawings which cannot be resolved by the Contractor(s) shall be brought to the Architect's attention for resolution.

## **1.5 SUBMITTALS**

- A. Submit drawing files using Portable Data File (PDF) format. Include transmittal indicating that each specialty trade has signed-off on each submitted coordination drawing.
  - 1. Composite overlay drawing of each area with all trades shown.
  - 2. Individual trade drawing of each area, i.e. Reflected Ceiling Plan, HVAC Ductwork, HVAC Piping, Plumbing, Fire Protection, Electrical.
  - 3. Prominent Architectural Features which may impact the coordination of indicated systems, such as cloud ceilings, soffits, etc.
- B. Consultant shall review coordination and installation drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Consultant determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Consultant will so inform Contractor, who shall make changes as directed and resubmit.
- C. Review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with architectural, structural, mechanical, electrical and other work.
- D. Contractor is responsible for timely updates to the coordination drawings to indicate as-built conditions for their own work. Updates are required to include all changes regardless of the source or reason for the change, including changes initiated by the Owner or Architect.

## **1.6 INSTALLATION**

- A. Conflicts discovered after the created and submission of the coordination and installation drawings and during the installation of the Work will be the responsibility of the Contractor(s) to resolve with the approval of Architect. Costs for these resolutions shall be the responsibility of the Contractor.
- B. Work fabricated/installed prior to the completion of the coordination and installation drawings is performed at the Contractors own risk, and compensation of time/costs for corrections will not be awarded.

- C. Any work installed that is not in conformance with final approved coordination and installation drawings shall be required to be removed and relocated. Compensation of time/costs for corrections will not be awarded.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL - REVISED**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for salvaging, recycling and disposing of construction waste.

**1.2 RELATED SECTIONS**

- A. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS:

**1.3 DEFINITIONS**

- A. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waste or debris.
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- D. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- E. Recycle: Diversion of demolition and construction waste from the landfill for reuse.
- F. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- G. Salvage for Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Salvage/Recycle Requirements: Salvage and recycle as much non-hazardous demolition and construction waste as possible including the following materials:
  - 1. Construction Waste:
    - a. Site-clearing waste.
    - b. Concrete and concrete reinforcing steel.



- c. Masonry and CMU.
- d. Lumber, wood sheet materials and wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Wire and cable
- l. Electrical conduit.
- m. Packaging: 100 percent of the following uncontaminated packaging materials: Paper, cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates, plastic pails.

## **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site. Review methods and procedures related to waste management including, but not limited to, the following:
  - 1. Review requirements for documenting quantities of each type of waste and its disposition.
  - 2. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  - 3. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  - 4. Review waste management requirements for each trade.
  - 5. Provide recycling education and recycling information to Contractor and subcontractor employees working on the project.
  - 6. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 7. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 PLAN IMPLEMENTATION**

- A. General: Provide containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Review plan procedures and locations established for salvage, recycling, and disposal.

3. Provide appropriate recycling signage for containers and workspaces.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  2. Comply with project requirements for controlling dust and dirt, environmental protection, and noise control.

### **3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL**

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical. For waste which cannot be separated at Project site, co-mingle only with waste which is to be separated later at a recycling facility.
  1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.
- C. On-site crushing of asphalt pavement, brick, and concrete (ABC) rubble is not allowed. All ABC waste must be transported off-site to an asphalt batching plant or to an ABC crushing or recycling operation that has been sited and permitted for that purpose.

### **3.3 RECYCLING DEMOLITION WASTE**

- A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Deposit all debris in designated container to be transported to approved aggregate recycling facility to be crushed and screened for use as satisfactory soil for fill or sub-base.

### **3.4 RECYCLING CONSTRUCTION WASTE**

- A. Packaging:
  1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- C. Concrete: Deposit all debris in designated container to be transported to approved aggregate recycling facility to be crushed and screened for use as satisfactory soil for fill or sub-base.
  - D. Masonry: Deposit all masonry debris in designated container to be transported to approved aggregate recycling facility to be. Crushed and screened for use as satisfactory soil for general fill or satisfactory soil for fill or sub-base. Clean and stack undamaged whole masonry units on wood pallets for reuse.
  - E. Metals: Separate metals by material type if practical. Stack salvageable structural steel members according to size, type of member, and length.
  - F. Wood Materials:
    1. Clean Cut-Offs of Lumber: Deposit into designated clean wood container to be transported to designate recycling facility for use as mulch or bio-fuel.
    2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
  - G. Clean Gypsum Board: Deposit scraps of clean gypsum board into designated container protected from weather and transport to appropriate gypsum recycling facility to be processed into new gypsum board.

### **3.5 DISPOSAL OF WASTE**

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. For solid waste disposal facilities, dispose of materials only in facilities which currently comply with applicable local regulations.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off the property and legally dispose of waste materials.

### **END OF SECTION**

**SECTION 02 41 18**  
**SITE DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Demolish and remove from the site those items so indicated on the Drawings, including but not limited to buildings, building pads, parking and roadway areas, miscellaneous structures, poles, walls, utilities, signs, etc.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in other divisions of these specifications.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with the International Building Code with due regard to the protection of the public and the provision of safeguards during the performance of the work.
- C. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- D. Comply with requirements of governmental agencies having jurisdiction.
- E. Contractor is responsible for being aware of and complying with Asbestos NESHAP regulations, as well as other applicable codes, laws and regulations.
  - 1. The Owner is to be notified immediately upon discovery of asbestos materials.

**PART 2 - PRODUCTS**

- A. No products are required in this Section.

**PART 3 - EXECUTION**

**3.1 SURFACE CONDITIONS**

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the safe, timely, and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 DEMOLITION

- A. General:
  - 1. Prior to start of demolition, carefully study the Drawings and these Specifications.
  - 2. In company with the Owner's representative, visit the site and verify the extent of demolition to be performed under this Contract.
- B. Using only the means and equipment approved for this purpose by the governmental agencies having jurisdiction, demolish and completely remove from the job site the existing construction designated to be removed.
  - 1. Shut off, cap, reroute, and otherwise protect existing public utility lines in accordance with the requirements of the public agency or utility having jurisdiction.
  - 2. Remove rocks larger than 3" diameter, roots, wood, and debris.
- C. Demolished site material shall be considered to be property of the Contractor and shall be completely removed from the job site.
- D. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- E. Use any means necessary to protect the public safety during the demolition process.
- F. Use whatever means necessary to protect the adjacent structures from damage during demolition.
- G. Protection of trees: It may become desirable to save certain trees in areas where cut or fill is eighteen inches or less and in parking areas. Consequently, the Contractor shall obtain approval from Engineer prior to removal of significant trees from such areas. The Contractor shall protect existing trees to remain during construction by constructing barricades around such trees as directed.
- H. Erosion control: Construct and maintain erosion control as shown on the Drawings and in accordance with the local County's requirements.

### 3.3 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

### END OF SECTION

**SECTION 03 30 00  
CAST-IN-PLACE CONCRETE - REVISED**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes Cast-in-Place Concrete for Following Items:
  - 1 Thrust blocks.
  - 2 Manholes.
  - 3 Fence post footing.

**1.02 SUBMITTALS**

- A. Product Data: Submit data on joint devices, attachment accessories, admixtures.
- B. Design Data:
  - 1 Submit concrete mix design for each concrete strength.
  - 2 Submit separate mix designs if admixtures are required for following:
    - a Hot and cold weather concrete Work.
    - b Air entrained concrete Work.
  - 3 Identify mix ingredients and proportions, including admixtures.
  - 4 Identify chloride content of admixtures and whether or not chlorides were added during manufacture.
- C. Manufacturer's Certificate: Products meet or exceed specified requirements.

**1.03 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

**1.04 QUALITY ASSURANCE**

- A. Perform Work according to ACI 301 and 318.
- B. Comply with ACI 305R when pouring concrete during hot weather.
- C. Comply with ACI 306.1 when pouring concrete during cold weather.
- D. Acquire cement and aggregate from one source for Work.
- E. Perform Work according to SCDOT standards.

**1.05 AMBIENT CONDITIONS**

- A. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Concrete:
  - 1 Cement:
    - a Comply with ASTM C150, Type I - Normal.
    - b Type: Portland.
  - 2 Normal Weight Aggregates:
    - a Comply with ASTM C33.

- b Coarse Aggregate Maximum Size: 3/4 inches, according to ACI 318.
  - 3 Water:
    - a Comply with ACI 318.
    - b Potable.
- B. Admixtures:
  - 1 Air Entrainment: Comply with ASTM C260.
  - 2 Chemical:
    - a Comply with ASTM C494.
    - b Type A - Water Reducing.
  - 3 Fly Ash or Calcined Pozzolan: Comply with ASTM C618, Class F or C.
  - 4 Silica Fume: Comply with ASTM C1240.
  - 5 Slag:
    - a Description: Ground-granulated blast-furnace slag.
    - b Comply with ASTM C989.
    - c Grade 100.
  - 6 Plasticizing:
    - a Comply with ASTM C1017.
    - b Type I plasticizing, II plasticizing and retarding.
- C. Joint Devices and Filler:
  - 1 Joint Filler, Type A:
    - a Description: Asphalt-impregnated fiberboard or felt.
    - b Comply with ASTM D1751, D994.
    - c Thickness: 1/4 inch.
    - d Profile: Tongue-and-groove.
  - 2 Sealant:
    - a Comply with ASTM D6690, Type I.

## **2.02 CONCRETE MIX**

- A. Select proportions for normal weight concrete according to ACI 301, Method 1, 2, 3.
- B. Performance and Design Criteria:
  - 1 Compressive Strength: 3,000 psi or as noted on Drawings.
  - 2 Cement Type: ASTM C150.
  - 3 Aggregate Type: Normal weight.
  - 4 Maximum Water-Cement Ratio: 0.45 by weight
  - 5 Aggregate Size:
    - a Maximum: 3/4 inch
  - 6 Air Content: 3 to 6 percent, plus or minus 1.5 percent.
  - 7 Admixture Type: Air - Entraining
  - 8 Maximum Fly Ash or Pozzolan Content: 50 percent of cementitious materials by weight.
  - 9 Maximum Slag Content: 50 percent of cementitious materials by weight.
  - 10 Slump: 3 inches, plus or minus 1 inch.

- C. Admixtures:
  - 1 Include admixture types and quantities indicated in concrete mix designs only if approved by Engineer.
  - 2 Cold Weather:
    - a Use accelerating admixtures in cold weather.
    - b Use of admixtures will not relax cold-weather placement requirements.
  - 3 Hot Weather: Use set-retarding admixtures.
  - 4 Do not use calcium chloride or admixtures containing calcium chloride.
  - 5 Add air entrainment admixture to concrete mix for Work exposed to freezing and thawing or deicing chemicals.
  - 6 For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fumes, and slag content as required by applicable code.
- D. Average Compressive Strength Reduction: Not permitted.
- E. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94, C685.
- F. Site-Mixed Concrete: Mix concrete according to ACI 318.

### **2.03 ACCESSORIES**

- A. Bonding Agent:
  - 1 Description: Polymer resin emulsion, Polyvinyl acetate, Latex emulsion, Two- component modified epoxy resin, Non-solvent two-component polysulfide epoxy, Mineral-filled polysulfide polymer epoxy, Mineral-filled polysulfide polymer epoxy resin, Polyamide-cured epoxy.
- B. Non-shrink Grout:
  - 1 Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
  - 2 Comply with ASTM C1107.
  - 3 Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
- C. Concrete Reinforcing Fibers:
  - 1 Description: High-strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete.
  - 2 Comply with ASTM C1116.
  - 3 Tensile Strength: 130 ksi.
  - 4 Toughness: 15 ksi.
  - 5 Fiber Length: 3/4 inch.
  - 6 Fiber Count: 34 million per lb.

## **PART 3 PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.



### **3.02 PREPARATION**

- A. Previously Placed Concrete:
  - 1 Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
  - 2 Remove laitance, coatings, and unsound materials.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- D. Remove water from areas receiving concrete before concrete is placed.

### **3.03 INSTALLATION**

- A. Placing Concrete:
  - 1 Place concrete according to ACI 301.
  - 2 Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.
  - 3 Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints, are not disturbed during concrete placement.
  - 4 Joint Filler:
    - a Separate slabs on grade from vertical surfaces with 1/4-inch-thick joint filler.
    - b Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface.
    - c Finish Joint Sealer Requirements: As specified by manufacturer.
  - 5 Deposit concrete at final position, preventing segregation of mix.
  - 6 Place concrete in continuous operation for each panel or section as determined by predetermined joints.
  - 7 Consolidate concrete.
  - 8 Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
  - 9 Place concrete continuously between predetermined expansion, control, and construction joints.
  - 10 Do not interrupt successive placement and do not permit cold joints to occur.
- B. Curing and Protection:
  - 1 Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
  - 2 Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.
  - 3 Cure concrete according to ACI 308.1.

### 3.04 FIELD QUALITY CONTROL

- A. Perform inspection and testing according to ACI 318.
- B. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- D. Concrete Inspections:
  - 1 Continuous Placement Inspection: Inspect for proper installation procedures.
  - 2 Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- E. Strength Test Samples:
  - 1 Sampling Procedures: Comply with ASTM C172.
  - 2 Cylinder Molding and Curing Procedures:
  - 3 Comply with ASTM C31.
  - 4 Cylinder Specimens: Standard Field cured.
  - 5 Sample concrete and make one set of three cylinders for every 75 cu. yd. or less of each class of concrete placed each day, and for every 5,000 sq. ft. of surface area for slabs and walls.
  - 6 If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch if less than five batches are used.
  - 7 Make one additional cylinder during cold weather concreting and field cure.
- F. Field Testing:
  - 1 Slump Test Method: Comply with ASTM C143.
  - 2 Air Content Test Method: Comply with ASTM C173, C231.
  - 3 Temperature Test Method: Comply with ASTM C1064.
  - 4 Compressive Strength Concrete:
    - a Measure slump and temperature for each sample.
    - b Measure air content in air-entrained concrete for each sample.
- G. Cylinder Compressive Strength Testing:
  - 1 Test Method: Comply with ASTM C39.
  - 2 Test Acceptance: According to ACI 318.
  - 3 Test one cylinder at 7 days.
  - 4 Test one cylinder at 28 days.
  - 5 Retain one cylinder for testing when requested by Engineer.
  - 6 Dispose of remaining cylinders if testing is not required.
- H. Core Compressive Strength Testing:
  - 1 Sampling and Testing Procedures: Comply with ASTM C42.
  - 2 Test Acceptance: According to ACI 318.
  - 3 Drill three cores for each failed strength test from failed concrete.
- I. Water-Soluble Chloride Ion Concentration Test Method:
  - 1 Comply with ASTM C1218.
  - 2 Test at 28 days.

- 3 Maximum Chloride Ion Concentration: As permitted by applicable code.
- J. Patching:
- 1 Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
  - 2 Honeycombing or Embedded Debris in Concrete:
    - a Not acceptable.
    - b Notify Engineer upon discovery.
  - 3 Patch imperfections as directed by Engineer, according to ACI 301, according to ACI 318.
- K. Defective Concrete:
- 1 Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
  - 2 Repair or replacement of defective concrete will be determined by Architect/Engineer.
  - 3 Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

**END OF SECTION**

**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide cast-in-place concrete, including formwork and reinforcement, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these Specifications.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Reference standards: Comply with the following codes, specifications and standards, except as otherwise shown or specified:
  - 1. American Concrete Institute (ACI) Publications:
    - ACI 301 Specification for Structural Concrete for Buildings
    - ACI 305 Recommended Practice for Hot Weather Concreting
    - ACI 306 Recommended Practice for Cold Weather Concreting
    - ACI 315 Manual of Standard Practice for Detailing Reinf Concrete Structures
    - ACI 318 Building Code Requirements for Reinforced Concrete
    - ACI 347 Recommended Practice for Concrete Framework
  - 2. American Society for Testing and Materials (ASTM) Publications:
    - A185 Welded Steel Wire Fabric for Concrete Reinforcement
    - A615 Deformed and Plain Billet Steel Bars for Concrete Reinf
    - C31 Making and Curing Concrete Test Specimens in the Field
    - C33 Concrete Aggregates
    - C39-72 Compressive Strength of Cylindrical Concrete Specimens
    - C94 Ready-Mixed Concrete
    - C150 Portland Cement
    - C260 Air-Entraining Admixtures for Concrete
  - 3. Concrete Reinforcing Steel Institute (CRSI): "Manual of Standard Practice"
  - 4. American Welding Society (AWS) Publication:
    - D12.1-61 Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete
- C. Testing agency: A testing laboratory will be retained by the Owner to perform material evaluation tests required by these specifications.
- D. Qualifications of contractors performing concrete work: Minimum of two (2) years experience on comparable concrete projects.

- E. Plant qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C94.

### 1.3 SUBMITTALS

- A. Comply with the pertinent provisions of the Contract Documents.
- B. Within 15 calendar days after receiving the Owner's Notice to Proceed, submit proposed mix designs for approval.
  - 1. Proportions shall be determined by means of laboratory tests of concrete made with the cement and aggregate proposed for use.
  - 2. Provide report in detail from an approved testing laboratory showing 7-day and 28-day strengths obtained using materials proposed.
  - 3. Required average strength above specified strength:
    - a. Determinations of required average strength above specified strength ( $f'_c$ ) shall be in accordance with ACI 318 and ACI 301.
    - b. Establish the required average strength of the design mix using the materials proposed to be employed. Standard deviations shall be determined by thirty tests. Average strength used for selecting proportions shall exceed specified strength ( $f'_c$ ) by at least:

400 psi	Standard deviation is less than 300
550 psi	Standard deviation is 300 to 400
700 psi	Standard deviation is 400 to 500
900 psi	Standard deviation is 500 to 600
1200 psi	Standard deviation is above 600 or unknown
    - c. When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be selected from trial mixes having proportions and consistencies suitable for the work using at least three (3) different water/cement ratios which will produce a range of strengths encompassing those required. Average strength required shall be 1200 psi above specified strength.
  - 4. Cost of this work shall be borne by the Contractor.
- C. Manufacturer's data: Submit manufacturer's specification with application instructions for proprietary materials and items, including curing compound, form release agents, admixtures, patching compounds, and others as required by the Engineer.
- D. Shop drawings: Submit the following shop drawings to the Engineer for approval before work is started:
  - 1. Reinforcing steel drawings: Prepare in accordance with ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, dimensions and details of bar reinforcing and accessories.
  - 2. Cementitious coating.

## 1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 01.
- B. Store reinforcement in a manner that will avoid excessive rusting or coating by grease, oil, dirt and other objectionable materials.
- C. Keep reinforcement in separate piles or racks so as to avoid loss of identification after bundles are broken.

## PART 2 - PRODUCTS

### 2.1 FORMS

- A. Use form materials conforming to ACI 347.
- B. Form lumber: Use lumber of sufficient quality and grade, size and stiffness to adequately support the work and ensure dimensional accuracy.
- C. Form ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole.
  - 1. Use ties with cones that allow a 1" break back and facilitate patching.
  - 2. On structures containing water or other liquid or below grade structures, use embedded rod ties with integral waterstops in addition to cones.
  - 3. Through-bolts that utilize a removable tapered sleeve in water containing and below grade applications: Use mechanical EPDM rubber plugs to seal holes made after removal of taper ties. Acceptable product is X-Plug by the Greenstreak Group, Inc. 800-325-9504. Follow manufacturers' instructions for installation. Friction fit plugs are not allowed.
  - 4. Wire ties and wood spreaders will not be permitted.
- D. Form coatings: Form release coating shall be neat oil with surface wetting agent or chemical release agent which effectively prevents absorption of moisture, prevents bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.
  - 1. On surfaces to receive an applied coating, use a residual free chemical form release agent which is compatible with the applied coating and will not prevent the applied finish from satisfactorily bonding to the concrete.
- E. Chamfer strips: Chamfer strips shall be wood or polyvinyl strips or approved equal, designed to be nailed in the forms to provide a 3/4" chamfer (unless indicated otherwise) at all exposed edges and corners of concrete members.

### 2.2 REINFORCEMENT

- A. Comply with the following as minimums:
  - 1. Bars: ASTM A615, Grade 60, unless otherwise shown on the Drawings, using deformed bars for Number 3 and larger.
  - 2. Welded wire fabric: ASTM A185.
    - a. Use sheet (mat) welded wire fabric only.

- b. Welded wire fabric supplied in rolls will not be accepted.
  - 3. Bending: ACI 315 and ACI 318.
- B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the CRSI "Manual of Standard Practices".
- C. Do not use reinforcement having any of the following defects:
  - 1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances.
  - 2. Bends or kinks not indicated on the Drawings or required for this Work.
  - 3. Bars with excessive rust, scale, dirt, oil or other defects which will reduce the bond or the effective cross section of the bar.
- D. Furnish all support bars, tie bars, chairs, bolsters, etc. required for properly supporting and spacing bars in the forms.
  - 1. For slabs on grade, use supports with stand plates or horizontal runners where wetted base materials will not support chair legs. Other supports must be approved by the Engineer.
  - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are hot-dip galvanized, plastic protected or stainless steel.
  - 3. Supply supports for welded wire fabric as follows:

#### **Welded Wire Fabric Support Spacing**

<b>Welded Wire Reinforcement (diameter)</b>	<b>Welded Wire Spacing (inches)</b>	<b>Maximum Support Spacing (feet)</b>
W9 or larger	12 and greater	4
W5 to W8	12 and greater	3
W9 and larger	Less than 12	3
W4 to W8	Less than 12	2
Less than W4	Less than 12	1.5

- E. Tie wire: FS QQ-W-461, annealed steel, black, 16 gauge minimum.
- F. Welding electrodes: AWS A5.1, low hydrogen, E70 series.
- G. Splice devices: Shall be sized to develop one hundred twenty-five (125%) percent of yield strength of bar.

### 2.3 CONCRETE MATERIALS

- A. Cement: Use portland cement: ASTM C150, Type I, Type I-P or Type II, low alkali.
  - 1. Where concrete will be exposed to sewage, use Type II or I-P cement.
  - 2. Fly ash shall conform to ASTM C618, Class C or F.
  - 3. Fly ash content shall not exceed 20% by weight of the total amount of cementitious materials (portland cement plus fly ash).
- B. Aggregates:
  - 1. Fine aggregate: Conform to ASTM C33.

2. Coarse aggregate: Conform to ASTM C33, Size #57.
- C. Water: Clean and potable and free from injurious amounts of deleterious materials.
- D. Admixtures:
1. Air entraining admixture: ASTM C260.
  2. Water reducing, set controlling admixture: Conform to ASTM C494.
    - a. Type A - water reducing.
    - b. Type D - water reducing and retarding.
  3. Superplasticizers: Conform to ASTM C494, Types F and G.
    - a. Use superplasticizers in thin section placements and in areas of congested reinforcing and/or embedded items, or where otherwise approved by the Engineer.
    - b. Use where conventional consolidation techniques are impractical.
  4. Do not use admixtures containing calcium chloride.
- E. Fiber reinforcing:
1. Use fiber reinforcing where indicated on the drawings.
  2. Provide polypropylene or co-polymer fibers as manufactured by High Tech Fibers, Inc., Fibermesh Company or an approved equal.
  3. Where required, use fiber reinforcing at a rate of 2.0 lbs. per cubic yard unless another rate is indicated on the drawings.
- F. Curing compounds:
1. On all vertical and formed surfaces, construction joints, basin slabs, surfaces to receive an applied coating or finish, and other surfaces except as otherwise indicated or specified, use a non-residual, non-staining curing compound conforming to ASTM C309 Type 1 and 1D. Acceptable products are:
    - a. L&M Cure by L&M Construction Chemicals, Inc.
    - b. Horn WB-75 by A.C. Horn Company.
    - c. Sonosil by Sonneborn, Inc.
    - d. Approved equal.
  2. On building floor slabs not otherwise receiving an applied coating or finish and on other flatwork as indicated on the Drawings, provide an acrylic copolymer curing and sealing compound conforming to ASTM C309 Type 1 and the following:
    - a. Non-yellowing.
    - b. Minimum 20% solids.
    - c. Maximum unit moisture loss in accordance with ASTM C156 - 0.40 kg./sq.m at 72 hours.
    - d. Acceptable products are Dress & Seal by L&M Construction Chemicals, Inc., Clear Seal Standard by A. C. Horn Company, Kure-N-Seal 0800 by Sonneborn, Inc., or approved equal.

## 2.4 CONCRETE MIXES

- A. Provide concrete with the compressive strengths shown on the Drawings. When such strengths are not shown on the Drawings, provide the following 28-day strengths as minimum:
1. All structural concrete except as indicated in No. 2 and No. 3 below or as noted otherwise on the plans: 4000 psi.



2. All sidewalks, curbs and gutters, and unreinforced foundations with fiber reinforcing: 4000 psi.
  3. Thrust blocking, backfill or encasement for piping, and concrete fill: 2500 psi.
  4. Prestressed or precast concrete: 5000 psi.
- B. Maximum water cement ratios:
- |                   |      |
|-------------------|------|
| 4000 psi concrete | 0.5  |
| 3000 psi concrete | 0.53 |
| 2500 psi concrete | 0.67 |
- C. Entrained air:
- |                            |              |
|----------------------------|--------------|
| 3000 and 4000 psi concrete | 5% ± 1%      |
| 2500 psi concrete          | Not Required |
- D. Slump:
- |                            |         |
|----------------------------|---------|
| 3000 and 4000 psi concrete | 4" ± 1" |
| 2500 psi concrete          | 5" ± 1" |
- E. Production of concrete:
1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C94 except as otherwise indicated.
  2. Monitor time and mix proportions by plant delivery slips.
  3. Air entraining admixtures: Add air entraining admixture into the mixture as a solution and measure by means of an approved mechanical dispensing device.
  4. Water reducing and retarding admixture: Add water reducing and retarding admixture and measure as recommended by the manufacturer.
  5. Addition of water to the mix upon arrival at the job site shall not exceed that necessary to compensate for a 1" loss in slump, nor shall the design maximum water-cement ratio be exceeded. Water shall not be added to the batch at any later time.
  6. Weather conditions: Control temperature of mix as required by ACI 306 "Cold Weather Concreting" and by ACI 305 "Hot Weather Concreting".

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Water, mud, organic, and other detrimental material shall be removed from excavations before concrete is deposited.
- C. Notify the Engineer prior to placing concrete and place no concrete until the formwork, reinforcing and embedded items have been observed by the Engineer.

### 3.2 FORMWORK

#### A. General:

1. Construct forms in conformance with ACI 347.
2. Design, erect, support, brace and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.
3. Construct forms to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in the finished structure.
4. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and prevent fins.

#### B. Form construction and erection:

1. Construct forms in conformance with ACI 347.
2. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts and other embedded items as required.
3. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders approved by the Engineer.
4. Unless specifically stated otherwise, provide 3/4" chamfer at all exposed edges of concrete.
5. Provide temporary openings in the formwork where necessary to facilitate cleaning and inspection of the formwork.
6. Coat form contact surfaces with approved form coating compound prior to placing reinforcing steel.
7. Do not allow excess form coating material to accumulate in the forms or to come in contact with reinforcing surfaces which will bond to fresh concrete.
8. Side forms for footings may be omitted, and concrete may be placed directly against excavation only when requested by the Contractor and approved by the Engineer.
9. Provide a positive means of adjustment of shores and struts and ensure that all settlement is taken up during concrete placing.
10. Construct blockouts and formed openings of sufficient size and proper location to permit final alignment of items within it or passing through it.
  - a. Allow sufficient space for grouting, packing or sealing around any items penetrating the opening as may be required to ensure watertightness.
  - b. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrapped air during grouting.
  - c. Provide only blockouts or openings that are shown on the drawings or otherwise approved by the Engineer.

#### C. Formwork reuse: Reuse only forms that are in good condition and which maintain a uniform surface texture on expose concrete surfaces.

1. Apply a light sanding as necessary to obtain a uniform texture.
2. Plug unused tie holes and penetrations flush with the form surface.

- D. Removal of forms:
1. Do not disturb or remove forms until the concrete has hardened sufficiently to permit form removal with complete safety. Do not remove shoring until the member has acquired sufficient strength to support its own weight, the load upon it, and the added load of construction.
  2. Do not remove forms before the following minimum times without prior approval from the Engineer:
    - a. Sides of footings or slabs on grade 24 hrs
    - b. Walls not supporting load 48 hrs
    - c. Vertical sides of beams 48 hrs
    - d. Columns not supporting load 48 hrs
    - e. Suspended slabs or beam bottoms (forms only) 10 days
  3. In determining the minimum stripping times, consider only the cumulative time during which the ambient temperature of the air surrounding the concrete is above 50°.
  4. Do not remove shoring for suspended slabs or beams until the concrete has reached 75% of the specified 28 day strength.
  5. When reshoring or backshoring is permitted or required, plan the operations in advance and submit procedures to the Engineer for approval.
    - a. Design and plan all reshoring operations to support all construction loading and in accordance with ACI 347.
  6. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
  7. Do not permit steel spreaders, form ties, or other metal to project from or be visible on any concrete surface except where so shown on the drawings.
  8. Whenever the formwork is removed during the curing period, continue to cure the exposed concrete by one of the methods specified herein.

### 3.3 EMBEDDED ITEMS

- A. Embedded items: Set anchor bolts and other embedded items accurately and securely in position in the forms until the concrete is placed and set.
1. Use templates where practical for all anchor bolts.
  2. Check locations of all anchor bolt and special castings prior to placing concrete and verify locations after concreting.
- B. Piping cast in concrete:
1. Install and secure sleeves, wall pipes and pipe penetrations before placing concrete.
  2. Do not weld or otherwise attach piping to reinforcing steel.
  3. Support piping to be encased in concrete securely and on firm foundation so as to prevent movement or settlement during concreting.
- C. Locate electrical conduit so that it will not impair the strength of the construction.
1. Do not use conduits running within (not passing through) a slab, wall or beam that are larger in outside diameter than 1/3 overall concrete thickness unless otherwise approved by the Engineer.
  2. Do not space conduits closer than three conduit diameters apart unless otherwise approved by the Engineer.

### 3.4 REINFORCEMENT

- A. General: Comply with the specified codes and standards and Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports and as herein specified.
  - 1. Clean reinforcement and remove loose dust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
  - 2. Position and secure reinforcement against displacement by forms, construction, and the concrete placement operations.
  - 3. Use adequate number of ties to secure reinforcing.
  - 4. Do not weld or field bend reinforcing without prior approval by the Engineer.
- B. Placing reinforcing:
  - 1. Provide and install all chairs, runners, bolsters, standees and other accessories in sufficient quantities to satisfactorily position the reinforcing and hold it in place during concrete placement.
  - 2. Support reinforcing for slabs on ground on chairs or bolsters with stand plates or a properly sized concrete cube.
    - a. Use concrete bricks as supports only as approved by the Engineer.
  - 3. Secure and tie dowels in place prior to placing concrete. Do not press dowels into wet concrete.
- C. Concrete cover: Unless otherwise indicated on the drawings or specified herein, install reinforcing with clear concrete coverage in conformance with ACI 318.
  - 1. All reinforcement, regardless of size, exposed to water or sewage shall have 2" cover.
  - 2. Place reinforcement a minimum of 2" clear of any openings or metal pipe or fittings.
- D. Splicing reinforcement: Splice reinforcement steel in accordance with the latest revisions of ACI 318 "Building Code Requirements for Reinforced Concrete" unless shown otherwise on the drawings.
  - 1. All splices at wall corners or intersections and at wall and foundation intersections shall be Class B tension splices per ACI 318, Sections 12.2.2 and 12.15.
  - 2. All other splices of vertical or horizontal steel in walls shall be Class B tension splices as per ACI 318 per ACI 318, Sections 12.2.2 and 12.15.
  - 3. Horizontal ring steel in circular, non-prestressed concrete tanks shall be Class B tension splices and the splices shall be staggered so that no more than 50% of the bars are spliced at any one location.
  - 4. All welded or mechanical splicing devices shall develop 125% of the yield strength of the bar.
  - 5. Column vertical bars shall lap 30 bar diameters with dowels at the base of the column unless otherwise noted. Dowels shall be the same size and quantity as column vertical bars unless otherwise noted.
  - 6. All splices not otherwise shown or specified shall be Class B tension lap splices per ACI 318, Sections 12.2.2 and 12.15.
- E. Tolerances: Place bars in the locations indicated within the tolerances conforming to the CRSI "Manual of Standard Practice".

- F. Welded wire mesh: Install welded wire fabric in as long of a length as practicable and lay flat before placing concrete.
1. Use only mat welded wire fabric. Do not use welded wire fabric from rolls.
  2. Support and tie mesh to prevent movement during concrete placement.
  3. Lap adjoining pieces at least one full mesh and lace splices with wire.
  4. Provide, at a minimum, supports for welded wire fabric according to the Table in Section 2.2.D.3. Confirm the adequacy of the support spacings listed therein for the anticipated construction loads. Increase the number of supports, if necessary, to assure that the final position of the welded wire fabric will conform to that shown on the drawings.
  5. Do not place welded wire fabric on the subbase surface and then hook or "pull up" the reinforcement during concrete placement.
  6. Do not lay welded wire fabric on top of the freshly placed concrete and then "walk it" into place.

### 3.5 PLACING CONCRETE

- A. Preparation:
1. Remove foreign matter accumulated in the forms.
  2. Rigidly close openings left in the formwork.
  3. Wet wood forms sufficiently to tighten up cracks. Wet other material sufficiently to maintain workability of the concrete.
  4. Use only clean tools.
  5. Provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.
  6. Before commencing concrete, inspect and complete installation of formwork, reinforcing steel and all items to be embedded or cast-in.
- B. Conveying:
1. Transport and handle concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.
  2. Provide equipment for lifting, dumping, chuting, pumping or conveying the concrete, of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of materials.
  3. Use hoppers and elephant trunks where necessary to prevent the free fall of concrete for more than 4'.
  4. Do not use concrete that is not placed within 1-1/2 hours after water is first introduced into the mix unless the slump is such that it meets the specified limits without the addition of water to the batch.
- C. Placing:
1. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.
  2. Deposit concrete in horizontal layers not deeper than 2', avoiding inclined layers.
  3. Place concrete at such a manner that concrete upon which fresh concrete is deposited is still plastic.
  4. Bring slab surfaces to the correct level with screeds set to the proper elevation.
- D. Hot weather placement: Place concrete in hot weather in accordance with ACI 305 "Hot Weather Concreting" and as specified herein.

1. Do not place concrete whose temperature exceeds 100°F.
  2. Thoroughly wet forms and reinforcing prior to placement of concrete.
  3. Use additional set retarder as necessary to increase set time.
  4. Limit the size of the pour where it may reduce the likelihood of cold joints due to reduced set time.
  5. Shade the fresh concrete as soon as possible after placing.
  6. Start curing as soon as the concrete is sufficiently hard to permit without damage.
- E. Cold weather placement: Place concrete in cold weather in accordance with ACI 306 and as specified herein.
1. Except when authorized specifically by the Engineer, do not place concrete when the atmospheric temperature is below 40°F.
  2. When cold weather placement is approved by the Engineer, heat either the mixing water or aggregate or both so that the concrete temperature is between 65°F and 85°F.
  3. Protect the freshly placed concrete by adequate housing or covering and provide heat to maintain a temperature of not less than 50°F for not less than four days.
  4. Do not add salts, chemicals, or other materials to the concrete mix to lower the freezing point of the concrete.
- F. Consolidation:
1. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand spading, rodding, or tamping.
    - a. Use vibrators having a 2" head diameter and a minimum frequency of 8000 vibrations per second.
    - b. Provide sufficient number of vibrators to properly consolidate the concrete, keeping up with placement operations.
    - c. Provide at least one spare vibrator on site.
  2. Insert and withdraw vibrators at points approximately 18" apart.
  3. Do not vibrate forms or reinforcement.
  4. Do not use vibrators to transport concrete inside the forms.

### 3.6 PROTECTION

- A. Protect the surface finish of newly placed concrete from damage by rainwater or construction traffic.
- B. Do not apply design loads to structures until the concrete has obtained the specified strength.
1. Do not backfill against walls until they have reached the specified strength and all supporting or bracing walls, slabs, etc. have also reached the specified strength, unless otherwise permitted by the Engineer.
  2. Protect structures from construction overloads.

### 3.7 CURING

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures and mechanical injury.

- B. Continuously cure concrete for a period of not less than 7 days after placement.
  - 1. When seven-day cylinder breaks indicate, in the opinion of the Engineer, the possibility of low strength concrete, provide additional curing as per the request of the Engineer.
  - 2. When temperatures during the curing period fall below 40°F, provide additional curing time as directed by the Engineer.
- C. Unless otherwise directed by the Engineer, cure concrete not in contact with forms in accordance with one of the following procedures:
  - 1. Ponding or sprinkling: Keep entire concrete surface wet by continuously sprinkling or by allowing water to pond, covering all surfaces.
  - 2. Wet burlap: Thoroughly wet and cover all concrete surfaces with wet burlap mats as soon as the concrete has set sufficiently to avoid marring the surface.
    - a. Keep the burlap continuously wet during the curing period.
  - 3. Curing blankets: Thoroughly wet concrete surfaces to be cured and cover with curing blankets as soon as the concrete has set sufficiently to avoid marring the surface.
    - a. Weight the blankets down to maintain close contact with the concrete surface.
    - b. Use sheets of waterproof kraft paper with the joints between sheets taped continuously; or
    - c. Use sheets of 4 mil or thicker polyethylene with the joints between sheets continuously taped.
  - 4. Wet sand: Apply a layer of sand over the entire surface and keep it continuously wet.
  - 5. Curing compound: Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces.
    - a. Spray the entire surface with two coats of liquid curing compound, applying the second coat in the direction of 90° to the first coat.
    - b. Apply compound in accordance with the manufacturer's instructions to cover the surface with a uniform film which will seal thoroughly.
- D. Hot weather: When necessary, provide wind breaks, shading, fog spraying, sprinkling, ponding or wet covering with a light colored material applying as quickly as concrete hardening and finishing operations will allow.

### 3.8 CONCRETE FINISHING

- A. Finish schedule: Unless otherwise indicated on the drawings, finish all concrete surfaces in accordance with the following schedule:
  - 1. Form finish: Formed surfaces not ordinarily exposed to view, including:
    - a. Interior walls of open tanks below a line one foot lower than the lowest normal water level.
    - b. The underside of slabs not exposed to view.
    - c. Walls below grade.
  - 2. Cementitious coating: All formed surfaces exposed to view including:
    - a. Interior walls of tanks above a line one foot lower than the lowest normal water level.
    - b. The underside of slabs, soffits, etc. exposed to view.

3. Float finish: Slab surfaces not exposed to view or not receiving an applied thin finish, including:
  - a. Bottom slabs of tanks or structures containing water sewage or other liquid.
  - b. Foundations not exposed to view.
  - c. Roof slabs to be covered with insulation and/or built-up roofing.
4. Trowel finish: Interior slab surfaces exposed to view or to receive an applied thin film coating or floor finish, including:
  - a. Interior, indoor slabs and floors of buildings.
  - b. Surfaces on which mechanical equipment moves.
  - c. Floors receiving vinyl tile, resilient flooring, carpet, paint, etc.
5. Broom finish: Exterior, outdoor slabs exposed to view including:
  - a. Outdoor floor slabs and walkways.
  - b. Other floors which may become wet or otherwise require a non-skid surface.
  - c. Sidewalks and concrete pavements.
6. Scratch finish: Surfaces which are to receive a thick topping or additional concrete cast against them including:
  - a. Surfaces receiving concrete equipment pads.
  - b. Floors receiving concrete topping.
  - c. Construction joints not otherwise keyed.
7. Edge finish: Exposed edges of slabs not receiving chamfer including:
  - a. Sidewalk edges and joints.
  - b. Pavement edges and joints.
  - c. Other slab edges not chamfered.

B. Finishing procedures:

1. Form finish:
  - a. Repair defective concrete.
  - b. Fill depressions deeper than 1/4".
  - c. Fill tie holes.
  - d. Remove fins exceeding 1/8" in height.
2. Cementitious finish:
  - a. Patch all tie holes and defects and remove all fins.
  - b. Within one day of form removal, fill all bug holes, wet the surfaces and rub with carborundum brick until a uniform color and texture are produced; or
  - c. Dampen surfaces, brush apply a grout slurry consisting of 1 part portland cement to 1-1/2 parts sand, and rub the surface vigorously with a stone. Remove all excess grout.
  - d. Provide a two coat cement base waterproofing, sealing finish of Thoroseal and Thoroseal Plaster Mix as manufactured by Standard Dry Wall Products, Inc. or an approved equal.
    - 1) Patch all tie holes and defects and removal all fins, and clean surface of all dirt, laitance, grease, form treatments, curing compounds, etc.
    - 2) Key coat: Apply key coat of Thoroseal at a rate of two (2) lbs. per sq. yd. by fiber brush. Mix material using one part of Acryl 60 to three parts clean water. Should material start to drag during application, dampen surface with water. During hot weather periods, dampen surfaces with water prior to application of key coat material. Key coat shall be allowed to cure for five (5) days before applying finish coat.



- 3) Apply a finish coat consisting of a four (4) to six (6) lbs. per sq. yd. application of Thoroseal Plaster Mix using steel trowel or spray gun. Color to be selected by the Owner. Mix dry material using one (1) part Acryl 60 to three (3) parts clean water. Firmly press the mix into all voids and level with a steel trowel. When surface is set so that it will not roll or lift, float it uniformly using a sponge float.
3. Float finish:
  - a. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
  - b. Cut down all high spots and fill all low spots and float the slab to a uniform sandy texture.
4. Trowel finish:
  - a. Float finish as specified herein.
  - b. Power trowel to a smooth surface free of defects.
  - c. After the surface has hardened sufficiently, hand trowel until a ringing sound is produced as the trowel is moved over the concrete surface.
5. Broom finish:
  - a. Float finish as specified herein.
  - b. Provide a scored texture by drawing a broom across the surface.
6. Scratch surface:
  - a. Screed the surface to the proper elevations.
  - b. Roughen with rakes or stiff brushes.
7. Edge finish: Tool slab edges and joints with a 1/4" radius edging tool.

### 3.9 SURFACE REPAIR

- A. Patching mortar:
  1. Make a patching mortar consisting of 1 part portland cement to 2-1/2 parts sand by damp loose volume.
  2. Mix the mortar using one part acrylic bonding admixture to two parts water.
- B. Tie holes: Clean and dampen all tie holes and fill solidly with patching mortar.
- C. Surface defects:
  1. Remove all defective concrete down to sound solid concrete.
  2. Chip edges perpendicular to the concrete surface or slightly undercut, allowing no feather edges.
  3. Dampen surfaces to be patched.
  4. Patch defects by filling solidly with repair mortar.
- D. Allow the Engineer to observe the work before placing the patching mortar.
- E. Repair defective areas greater than 1 sq. ft. or deeper than 1-1/2" as directed by the Engineer using materials approved by the Engineer at no additional expense to the Owner.

### 3.10 JOINTS

- A. Construction joints:
  - 1. Unless otherwise approved by the Engineer, provide construction joints as shown on the drawings.
  - 2. If additional construction joints are found to be required, secure the Engineer's approval of joint design and location prior to start of concrete placement.
  - 3. Continue all reinforcing across construction joints and provide 1-1/2" deep keyways unless indicated otherwise on the drawings.
    - a. Form keyways in place.
  - 4. Provide waterstops in all construction joints of liquid containing structures, structures below grade or other structures as shown on the drawings.
- B. Expansion joints:
  - 1. Provide expansion joints of size, type and locations as shown on the drawings.
  - 2. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except smooth dowels bonded on only one side of the joints, where indicated on the drawings) to extend continuously through any expansion joint.
  - 3. Provide waterstops where required.
- C. Control or contraction joints:
  - 1. Locate and construct control and contraction joints in accordance with the Drawings.
  - 2. Where no specific joint pattern is indicated in slabs on grade or concrete pavements, submit a proposed joint layout to the Engineer for approval.
  - 3. Where no specific joint details are shown on the drawings, joints may be tooled, preformed or saw-cut.
  - 4. Saw-cut joints as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw.

### 3.11 FIELD QUALITY CONTROL

- A. Concrete cylinder tests:
  - 1. During construction, prepare test cylinders for compressive strength testing, using 6" diameter by 12" long single use molds, complying with ASTM C31.
    - a. Make a set of three test cylinders from each pour of 50 cubic yards or less, plus one additional set of cylinders for each additional 50 cubic yards or fraction thereof.
    - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
    - c. Deliver cylinders to testing lab selected by the Owner.
    - d. Cost for preparation and delivery of cylinders shall be borne by the Contractor. Cost for testing cylinders will be borne by the Owner.
  - 2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
    - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.
    - b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished as directed by the Engineer.

- c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
    - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C42. Such testing shall be performed at no additional cost to the Owner.
- B. Other field concrete tests:
  - 1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
    - a. Slump test may be made on any concrete batch at the discretion of the Engineer.
    - b. Failure to meet specified slump requirements (prior to addition of any superplasticizers) will be cause for rejection of the concrete.
  - 2. Temperature: The concrete temperature may be checked at the discretion of the Engineer.
  - 3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.
- C. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.
  - 1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
  - 2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.
- D. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.
- E. Dimensional tolerances:
  - 1. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
  - 2. Where anchor bolts or other embedded items are required for equipment installation, comply with the manufacturer's tolerances if more stringent than those stated in ACI 301.
- F. Watertight concrete:
  - 1. All liquid containing structures, basements or pits below grade shall be watertight.
  - 2. Any visible leakage or seepage shall be repaired as instructed by the Engineer at no expense to the Owner.
  - 3. Where physical evidence of honeycombing, cold joints or other deficiencies which may impair the watertightness of a structure exists, the Engineer may at his discretion call for leak testing of the structure.
    - a. Fill the structure with water and allow to stand for not less than 48 hours.
    - b. Make repairs on the structure until all visible leaks are sealed and the leakage rate of the water in the structure is less than 0.1% of the volume held in the structure per day.

- c. The cost of testing and repairs shall be performed at no expense to the Owner.
- G. Concrete which fails to meet strength requirements, dimensional tolerances, watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

### 3.12 MEASUREMENT AND PAYMENT

- A. No measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

**SECTION 03 30 02**  
**CONCRETE CURB AND GUTTER, AND SIDEWALK**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide cast-in-place concrete, including formwork, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these Specifications.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Reference standards: Comply with the following codes, specifications and standards, except as otherwise shown or specified:
  - 1. American Concrete Institute (ACI) Publications:
    - ACI 305 Recommended Practice for Hot Weather Concreting
    - ACI 306 Recommended Practice for Cold Weather Concreting
  - 2. American Society for Testing and Materials (ASTM) Publications:
    - A 185 Welded Steel Wire Fabric for Concrete Reinforcement
    - C 31 Making and Curing Concrete Test Specimens in the Field
    - C 33 Concrete Aggregates
    - C 39-72 Compressive Strength of Cylindrical Concrete Specimens
    - C 94 Ready-Mixed Concrete
    - C 150 Portland Cement
    - C 260 Air-Entraining Admixtures for Concrete
- C. Testing agency: A testing laboratory will be retained by the Owner to perform material evaluation tests required by these specifications.
- D. Qualifications of contractors performing concrete work: Minimum of two (2) years experience on comparable concrete projects.
- E. Plant qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C 94.

**1.3 SUBMITTALS**

- A. Comply with the pertinent provisions of Section 01 33 01.

- B. Within 15 calendar days after receiving the Owner's Notice to Proceed, submit proposed mix designs for approval.
  - 1. Proportions shall be determined by means of laboratory tests of concrete made with the cement and aggregate proposed for use.
  - 2. Provide report in detail from an approved testing laboratory showing 7-day and 28-day strengths obtained using materials proposed.
  - 3. Required average strength above specified strength:
    - a. Determinations of required average strength above specified strength ( $f_c$ ) shall be in accordance with ACI 318 and ACI 301.
  - 4. Cost of this work shall be borne by the Contractor.
- C. Manufacturer's data: Submit manufacturer's specification with application instructions for proprietary materials and items, including curing compound, form release agents, admixtures, patching compounds, and others as required by the Engineer.

#### 1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 01.

### PART 2 - PRODUCTS

#### 2.1 FORMS

- A. Use form materials conforming to ACI 347.
- B. Form coatings: Form release coating shall be neat oil with surface wetting agent or chemical release agent which effectively prevents absorption of moisture, prevents bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.
  - 1. On surfaces to receive an applied coating, use a residual free chemical form release agent that is compatible with the applied coating and will not prevent the applied finish from satisfactorily bonding to the concrete.

#### 2.2 SIDEWALK REINFORCEMENT

- A. Fiber reinforcing:
  - 1. Use fiber reinforcing where indicated on the drawings.
  - 2. Provide polypropylene or co-polymer fibers as manufactured by High Tech Fibers, Inc., Fibermesh Company or an approved equal.
  - 3. Where required, use fiber reinforcing at a rate of 2.0 lbs. per cubic yard unless another rate is indicated on the drawings.
- B. Provide welded wire mesh for sidewalk reinforcement in compliance with ASTM A 185.

#### 2.3 PREMOLDED JOINT FILLERS

- A. In concrete pavements (exterior) and concrete sidewalks, use self-expanding cork joint fillers complying with ASTM 1752, Type III.

## 2.4 CONCRETE MATERIALS

- A. Cement: Use portland cement: ASTM C 150, Type I, Type I-P or Type II, low alkali.
- B. Aggregates:
  - 1. Fine aggregate: Conform to ASTM C 33.
  - 2. Coarse aggregate: Conform to ASTM C 33, Size #57.
- C. Water: Clean and potable and free from injurious amounts of deleterious materials.
- D. Admixtures:
  - 1. Air entraining admixture: ASTM C 260.
  - 2. Water reducing, set controlling admixture: Conform to ASTM C 494.
    - a. Type A - water reducing.
    - b. Type D - water reducing and retarding.
  - 3. Do not use admixtures containing calcium chloride.
- E. Curing compounds:
  - 1. On all vertical and formed surfaces and construction joints, use a non-residual, non-staining curing compound conforming to ASTM C 309 Type 1 and 1D. Acceptable products are:
    - a. L&M Cure by L&M Construction Chemicals, Inc.
    - b. Horn WB-75 by A.C. Horn Company.
    - c. Sonosil by Sonneborn, Inc.
    - d. Approved equal.

## 2.5 CONCRETE MIXES

- A. Provide concrete with the compressive strength of 4000 psi for a 28-day strength as minimum:
- B. Entrained air: 4000 psi concrete, 5%  $\pm$  1%.
- C. Slump: 4000 psi concrete, 4"  $\pm$  1".
- D. Production of concrete:
  - 1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94 except as otherwise indicated.
  - 2. Monitor time and mix proportions by plant delivery slips.
  - 3. Air-entraining admixtures: Add air-entraining admixture into the mixture as a solution and measure by means of an approved mechanical dispensing device.
  - 4. Water reducing and retarding admixture: Add water reducing and retarding admixture and measure as recommended by the manufacturer.
  - 5. Addition of water to the mix upon arrival at the job site shall not exceed that necessary to compensate for a 1" loss in slump, nor shall the design maximum water-cement ratio be exceeded. Water shall not be added to the batch at any later time.
  - 6. Weather conditions: Control temperature of mix as required by ACI 306 "Cold Weather Concreting" and by ACI 305 "Hot Weather Concreting".

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Water, mud, organic, and other detrimental material shall be removed from excavations before concrete is deposited.
- C. Notify the Engineer prior to placing concrete and place no concrete until the formwork, reinforcing and embedded items have been inspected by the Engineer.

### 3.2 FORMWORK

- A. General:
  - 1. Construct forms in conformance with ACI 347.
  - 2. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement.
  - 3. Coat form contact surfaces with approved form coating compound prior to placing reinforcing steel.
- B. Formwork reuse: Reuse only forms that are in good condition and which maintain a uniform surface texture on exposed concrete surfaces.
  - 1. Apply a light sanding as necessary to obtain a uniform texture.
- C. Removal of forms:
  - 1. Do not disturb or remove forms until the concrete has hardened sufficiently to permit form removal with complete safety.
  - 2. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
  - 3. Whenever the formwork is removed during the curing period, continue to cure the exposed concrete by one of the methods specified herein.

### 3.3 PLACING CONCRETE

- A. Preparation:
  - 1. Remove foreign matter accumulated in the forms.
  - 2. Rigidly close openings left in the formwork.
  - 3. Wet wood forms sufficiently to tighten up cracks. Wet other material sufficiently to maintain workability of the concrete.
  - 4. Use only clean tools.
  - 5. Provide and maintain sufficient tools and equipment on hand to facilitate uninterrupted placement of the concrete.
  - 6. Before commencing concrete, inspect and complete installation of formwork and wire mesh.



- B. Conveying:
1. Transport and handle concrete from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete.
  2. Provide equipment for lifting, dumping, chuting, pumping or conveying the concrete, of such size and design as to ensure a practically continuous flow of concrete at the delivery and without separation of materials.
  3. Do not use concrete that is not placed within 1½ hours after water is first introduced into the mix unless the slump is such that it meets the specified limits without the addition of water to the batch.
- C. Placing:
1. Deposit concrete as nearly as practicable in its final location so as to avoid separation due to rehandling and flowing.
  2. Place concrete at such a manner that concrete upon which fresh concrete is deposited is still plastic.
- D. Hot weather placement: Place concrete in hot weather in accordance with ACI 305 "Hot Weather Concreting" and as specified herein.
1. Do not place concrete whose temperature exceeds 100°F.
  2. Thoroughly wet forms and reinforcing prior to placement of concrete.
  3. Use additional set retarder as necessary to increase set time.
  4. Start curing as soon as the concrete is sufficiently hard to permit without damage.
- E. Cold weather placement: Place concrete in cold weather in accordance with ACI 306 and as specified herein.
1. Do not place concrete when the atmospheric temperature is below 40°F.
  2. Do not add salts, chemicals, or other materials to the concrete mix to lower the freezing point of the concrete.
- F. Consolidation:
1. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand spading, rodding, or tamping.
    - a. Use vibrators having a 2" head diameter and a minimum frequency of 8000 vibrations per second.
    - b. Provide sufficient number of vibrators to properly consolidate the concrete, keeping up with placement operations.
    - c. Provide at least one spare vibrator on site.
  2. Insert and withdraw vibrators at points approximately 18" apart.
  3. Do not vibrate forms.
  4. Do not use vibrators to transport concrete inside the forms.

### 3.4 PROTECTION

- A. Protect the surface finish of newly placed concrete from damage by rainwater or construction traffic.
- B. Do not apply design loads to structures until the concrete has obtained the specified strength.

### 3.5 CURING

- A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures and mechanical injury.
- B. Curing compound: Apply curing compound immediately after completion of the finish on uniformed surfaces and within two hours after removal of forms on formed surfaces.
  - 1. Spray the entire surface with two coats of liquid curing compound, applying the second coat in the direction of 90° to the first coat.
  - 2. Apply compound in accordance with the manufacturer's instructions to cover the surface with a uniform film that will seal thoroughly.

### 3.6 CONCRETE FINISHING

- A. Finish schedule: Unless otherwise indicated on the drawings, finish all concrete surfaces in accordance with the following schedule:
  - 1. Form finish: Formed surfaces not ordinarily exposed to view, including the underside of slabs not exposed to view.
  - 2. Broom finish: Exterior, outdoor slabs exposed to view including:
    - a. Outdoor floor slabs and walkways.
    - b. Other floors which may become wet or otherwise require a non-skid surface.
    - c. Sidewalks and concrete pavements.
  - 3. Edge finish: Exposed edges of slabs not receiving chamfer including:
    - a. Sidewalk edges and joints.
    - b. Pavement edges and joints.
    - c. Other slab edges not chamfered.
- B. Finishing procedures:
  - 1. Form finish:
    - a. Repair defective concrete.
    - b. Fill depressions deeper than 1/4".
    - c. Fill tie holes.
    - d. Remove fins exceeding 1/8" in height.
  - 2. Broom finish:
    - a. Float finish as specified herein.
    - b. Provide a scored texture by drawing a broom across the surface.
  - 3. Edge finish: Tool slab edges and joints with a 1/4" radius edging tool.

### 3.7 SURFACE REPAIR

- A. Patching mortar:
  - 1. Make a patching mortar consisting of 1 part portland cement to 2-1/2 parts sand by damp loose volume.
  - 2. Mix the mortar using one part acrylic bonding admixture to two parts water.
- B. Surface defects:
  - 1. Remove all defective concrete down to sound solid concrete.
  - 2. Chip edges perpendicular to the concrete surface or slightly undercut, allowing no feathered edges.
  - 3. Dampen surfaces to be patched.
  - 4. Patch defects by filling solidly with repair mortar.

- C. Allow the Engineer to inspect the work before placing the patching mortar.
- D. Repair defective areas greater than 1 sq. ft. or deeper than 1-1/2" as directed by the Engineer using materials approved by the Engineer at no additional expense to the Owner.

### 3.8 JOINTS

- A. Construction joints:
  - 1. Unless otherwise approved by the Engineer, provide construction joints every ten (10) feet, or as shown on the drawings.
  - 2. Continue all reinforcing across construction joints and provide 1-1/2 " deep keyways unless indicated otherwise on the drawings.
- B. Expansion joints: Provide 1/2" expansion joints with premolded joint filters every thirty (30) feet.

### 3.9 FIELD QUALITY CONTROL

- A. Concrete cylinder tests:
  - 1. During construction, prepare test cylinders for compressive strength testing, using 6" diameter by 12" long single use molds, complying with ASTM C 31.
    - a. Make a set of three test cylinders from each pour.
    - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
    - c. Deliver cylinders to testing lab selected by the Owner.
    - d. Cost for preparation and delivery of cylinders shall be borne by the Contractor. Cost for testing cylinders will be borne by the Owner.
  - 2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
    - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.
    - b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished as directed by the Engineer.
    - c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
    - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C 42. Such testing shall be performed at no additional cost to the Owner.
- B. Other field concrete tests:
  - 1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
    - a. Slump test may be made on any concrete batch at the discretion of the Engineer.
    - b. Failure to meet specified slump requirements will be cause for rejection of the concrete.

2. Temperature: The concrete temperature may be checked at the discretion of the Engineer.
  3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.
- C. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.
1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
  2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.
- D. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.
- E. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
- F. Concrete which fails to meet strength requirements, dimensional tolerances, watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

**END OF SECTION**

**SECTION 22 05 17**  
**SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.
  - 4. Silicone sealants.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 SLEEVES**

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.
- C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

**2.02 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. GPT; an EnPro Industries company.
  - 3. Metraflex Company (The).
- B. Description:
  - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 2. Designed to form a hydrostatic seal of 20 psig minimum.
  - 3. Sealing Elements: EPDM-rubber or High-Temperature Silicone with interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 4. Pressure Plates: Composite plastic or Stainless steel, Type 316.
  - 5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633 or Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

**2.03 GROUT**

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **2.04 SILICONE SEALANTS**

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
    - b. Sherwin-Williams Company (The).
    - c. The Dow Chemical Company.

## **PART 3 - EXECUTION**

### **3.01 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide required annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 84 13 "Penetration Firestopping."

### **3.02 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration,

assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.04 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron or steel pipe sleeves.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron or steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1" annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1" annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron or steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1" annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1" annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves.
  - 5. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

**END OF SECTION**

**SECTION 22 05 18**  
**ESCUTCHEONS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. BrassCraft Manufacturing Co.; a Masco company.
  - 2. Dearborn Brass.
  - 3. Keeney Manufacturing Company (The).

**2.02 ESCUTCHEONS**

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

**2.03 FLOOR PLATES**

- A. Split Floor Plates: Cast brass with concealed hinge.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Chrome-Plated Piping: One-piece cast brass or split-casting brass with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.



- d. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
  - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
  - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
  - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
  - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: Split floor plate.

### **3.02 FIELD QUALITY CONTROL**

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

### **END OF SECTION**

**SECTION 22 05 19**  
**METERS AND GAGES FOR PLUMBING PIPING**

**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. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.

**1.03 ACTION SUBMITTALS**

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

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.01 BIMETALLIC-ACTUATED THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft Inc.
  - 2. Palmer Wahl Instrumentation Group.
  - 3. Weiss Instruments, Inc.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle rigid, back and rigid, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.

- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

## **2.02 LIQUID-IN-GLASS THERMOMETERS**

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
  - 1. Standard: ASME B40.200.
  - 2. Case: Cast aluminum; 6-inch nominal size.
  - 3. Case Form: Back angle unless otherwise indicated.
  - 4. Tube: Glass with magnifying lens and blue organic liquid.
  - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  - 6. Window: Glass or plastic.
  - 7. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 8. Connector: 3/4 inch, with ASME B1.1 screw threads.
  - 9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## **2.03 THERMOWELLS**

- A. Thermowells:
  - 1. Standard: ASME B40.200.
  - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  - 3. Material for Use with Copper Tubing: CNR or CUNI.
  - 4. Material for Use with Steel Piping: CRES.
  - 5. Type: Stepped shank unless straight or tapered shank is indicated.
  - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
  - 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
  - 8. Bore: Diameter required to match thermometer bulb or stem.
  - 9. Insertion Length: Length required to match thermometer bulb or stem.
  - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
  - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## **2.04 PRESSURE GAGES**

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ashcroft Inc.
    - b. Palmer Wahl Instrumentation Group.
    - c. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.100.
  - 3. Case: Liquid-filled Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## **2.05 GAGE ATTACHMENTS**

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install thermometers in the following locations:
  1. Inlet and outlet of each water heater.
- K. Install pressure gages in the following locations:
  1. Building water service entrance into building.
  2. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

### **3.02 THERMOMETER SCHEDULE**

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  1. Liquid-filled Sealed, bimetallic-actuated type.
  2. Metal case, compact-style, liquid-in-glass type.

- B. Thermometer stems shall be of length to match thermowell insertion length.

### **3.03 THERMOMETER SCALE-RANGE SCHEDULE**

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.
- C. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F.

### **3.04 PRESSURE-GAGE SCHEDULE**

- A. Pressure gages at discharge of each water service into building shall be the following:
  - 1. Liquid-filled Sealed Solid-front, pressure-relief, direct-mounted, metal case.
- B. Pressure gages at suction and discharge of each domestic water pump shall be the following:
  - 1. Liquid-filled Sealed Solid-front, pressure-relief, direct-mounted, metal case.

### **3.05 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Water Service Piping: 0 to 160 psi.
- B. Scale Range for Domestic Water Piping: 0 to 100 psi.
- C. Scale Range for Domestic Water Piping: 0 to 160 psi.

**END OF SECTION**

**SECTION 22 05 23.12**  
**BALL VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze ball valves.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

**PART 2 - PRODUCTS**

**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 3. ASME B16.18 for solder-joint connections.
  - 4. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
  - 2. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
  - 1. Include 2-inch stem extensions.
  - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.

**2.02 BRASS BALL VALVES**

- A. Brass Ball Valves, One-Piece:
  - 1. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 400 psig.

- c. Body Design: One piece.
- d. Body Material: Forged brass or bronze.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Brass or stainless steel.
- h. Ball: Chrome-plated brass or stainless steel.
- i. Port: Reduced.
- j. Adjustable packing gland.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

- 1. Description:
  - a. Standard: MSS SP-110 or MSS SP-145.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Forged brass.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.
  - j. Adjustable packing gland.

C. Brass Ball Valves, Two-Piece with Regular Port and Brass Trim:

- 1. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Forged brass.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Regular.
  - j. Adjustable packing gland.

## 2.03 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece:

- 1. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 400 psig.
  - c. Body Design: One piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded.
  - f. Seats: PTFE.
  - g. Stem: Bronze.
  - h. Ball: Chrome-plated brass.
  - i. Port: Reduced.
  - j. Adjustable packing gland.

B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:

- 1. Description:
  - a. Standard: MSS SP-110 or MSS-145.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.

- d. Body Material: Bronze.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Bronze or brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.
  - j. Adjustable packing gland.
- C. Bronze Ball Valves, Two-Piece with Regular Port and Bronze or Brass Trim:
- 1. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 600 psig.
    - c. Body Design: Two piece.
    - d. Body Material: Bronze.
    - e. Ends: Threaded.
    - f. Seats: PTFE.
    - g. Stem: Bronze or brass.
    - h. Ball: Chrome-plated brass.
    - i. Port: Regular.
    - j. Adjustable packing gland.

## **PART 3 - EXECUTION**

### **3.01 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

### **3.02 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

### **3.03 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 and Smaller:
  - 1. Brass ball valve, one piece. Provide with threaded or solder-joint ends.
  - 2. Bronze ball valve, one piece with bronze trim. Provide with threaded or solder-joint ends.
  - 3. Brass ball valves, two-piece with full port and brass trim. Provide with threaded or solder-joint ends.
  - 4. Bronze ball valves, two-piece with full port and bronze or brass trim. Provide with threaded or solder-joint ends.



**END OF SECTION**

**SECTION 22 05 23.14**  
**CHECK VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Bronze swing check valves.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

**PART 2 - PRODUCTS**

**2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 4. ASME B16.18 for solder joint.
  - 5. ASME B31.9 for building services piping valves.
- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

**2.02 BRONZE SWING CHECK VALVES**

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
  - 1. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B62, bronze.
    - e. Ends: Threaded or soldered. See valve schedule articles.
    - f. Disc: Bronze.
- B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
  - 1. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: PTFE.

## **PART 3 - EXECUTION**

### **3.01 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

### **3.02 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### **3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  - 1. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; metal-seat or resilient-seat check valves.
    - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered-ends.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged.

### **3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 1/2" and Smaller:
  - 1. Bronze swing check valves bronze disc, Class 125, with soldered or threaded end connections.

**END OF SECTION**

**SECTION 22 05 29**  
**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal hanger-shield inserts.
  - 4. Fastener systems.
  - 5. Pipe-positioning systems.
  - 6. Equipment supports.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**1.03 QUALITY ASSURANCE**

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## **2.02 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
  - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe and Tube Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## **2.03 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## **2.04 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. B-line, an Eaton business.
    - b. Hilti, Inc.
    - c. MKT Fastening, LLC.
  - 2. Indoor Applications: Zinc-coated steel.
  - 3. Outdoor Applications: Stainless steel.

## **2.05 PIPE-POSITIONING SYSTEMS**

- A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## **2.06 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

## **2.07 MATERIALS**

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A240/A240M.

- E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

### **PART 3 - EXECUTION**

#### **3.01 APPLICATION**

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

#### **3.02 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

### **3.03 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### **3.04 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.



### **3.05 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### **3.06 PAINTING**

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### **3.07 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use thermal hanger-shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

#### **END OF SECTION**

**SECTION 22 05 33**  
**HEAT TRACING FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes heat tracing of plumbing piping for freeze prevention with self-regulating, parallel-resistance electric heating cables:

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For electric heating cable.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.04 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Three years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.01 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES**

- A. Standard: IEEE 515.1.
- B. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length.
- C. Electrical Insulating Jacket: Flame-retardant polyolefin.
- D. Grounding Cover: Copper braid.
- E. Cable Cover: Polyolefin outer jacket with ultraviolet inhibitor.
- F. Terminate cable with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable is to be capable of crossing over itself once without overheating.
- G. Maximum Operating Temperature (Power On): 150 deg F.
- H. Maximum Exposure Temperature (Power Off): 185 deg F.
- I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.

## **2.02 CONTROLS**

- A. Pipe-Mounted Thermostats for Freeze Protection:
  - 1. Remote bulb temperature control unit with adjustable range from 30 to 50 deg F.
  - 2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
  - 3. Remote temperature-sensing bulb on capillary, resistance temperature device, or thermistor for directly sensing outside air or pipe-wall temperature.
  - 4. Corrosion-resistant, waterproof control enclosure.
- B. Control Panel:
  - 1. Automatic control with manual on, automatic, and standby/reset switch.
  - 2. Remote temperature sensor senses outside air temperature; programmable to energize the freeze-protection cable when temperature falls below 34 to 44 deg F temperature range.
  - 3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and temperature sensors.
  - 4. Minimum 30 A contactor to energize cable or close other contactors.
  - 5. Ground-fault protection.
  - 6. Single-point control of heat tracing for freeze protection.

## **2.03 ACCESSORIES**

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Warning Labels: See Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
  - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install electric heating cable at locations indicated and in accordance with NFPA 70.
- B. Install electric heating cable across expansion, construction, and control joints in accordance with manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.
- C. Install electric heating cables after piping has been tested and before insulation is installed.
- D. Install electric heating cables in accordance with IEEE 515.1.
- E. Install insulation over piping with electric cables in accordance with Section 22 07 19 "Plumbing Piping Insulation."
- F. Install warning tape on piping insulation where piping is equipped with electric heating cables.

- G. Set field-adjustable switches and circuit-breaker trip ranges.
- H. Install temperature-control units in an accessible location and in accordance with manufacturer's written instructions. Locate sensing bulbs to sense outside air temperature in a location where it will not be affected by direct sunlight or other heat sources.
- I. Install control panels and distribution panels where indicated and in accordance with manufacturer's written instructions.
- J. Install and connect outside air and pipe temperature sensors.

### **3.02 ELECTRICAL CONNECTIONS**

- A. Ground equipment in accordance with Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Connect temperature-control unit for freeze protection to interrupt power supply to electric heating cable when outside air is above set point.
- D. Connect remote electronic temperature sensors.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Perform tests after cable installation but before application of coverings, such as insulation, wall or ceiling construction, or concrete.
  - 2. Test cables for electrical continuity and insulation integrity before energizing.
  - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- C. Cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### **3.04 PROTECTION**

- A. Protect installed heating cables, including nonheating leads, from damage.
- B. Remove and replace damaged heat-tracing cables.

**END OF SECTION**

**SECTION 22 05 53**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 EQUIPMENT LABELS**

- A. Plastic Labels for Equipment:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Craftmark Pipe Markers.
    - c. Seton Identification Products; a Brady Corporation company.
  - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
  - 3. Letter Color: Black.
  - 4. Background Color: White.
  - 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  - 8. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

**2.02 WARNING SIGNS AND LABELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.

2. Craftmark Pipe Markers.
  3. Seton Identification Products; a Brady Corporation company.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

## **2.03 PIPE LABELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. Craftmark Pipe Markers.
  3. Seton Identification Products; a Brady Corporation company.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: Size letters according to ASME A13.1 for piping.

## **PART 3 - EXECUTION**

### **3.01 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.

- B. Locate equipment labels where accessible and visible.

### **3.02 PIPE LABEL INSTALLATION**

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
  - 1. Low-Pressure Compressed Air Piping:
    - a. Background: Safety blue.
    - b. Letter Colors: White.
  - 2. High-Pressure Compressed Air Piping:
    - a. Background: Safety blue.
    - b. Letter Colors: White.
  - 3. Domestic Water Piping
    - a. Background: Safety green.
    - b. Letter Colors: White.
  - 4. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Safety black.
    - b. Letter Color: White.

**END OF SECTION**



**SECTION 22 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR PLUMBING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. TAB of domestic water system.
  - 2. TAB of plumbing equipment:
    - a. Domestic hot-water in-line circulation pumps.
    - b. Pipe-leakage test verification.

**1.02 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.
- C. Sample report forms.
- D. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

**1.04 QUALITY ASSURANCE**

- A. TAB Specialists Qualifications, Certified by AABC:
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC.
- B. TAB Specialists Qualifications, Certified by NEBB or TABB:
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
  - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.

- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE 188 Compliance: Comply with balancing and report requirements, Section 8.3 "Balancing."
- E. Code and Authorities Having Jurisdiction Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

#### **1.05 FIELD CONDITIONS**

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

### **PART 2 - PRODUCTS (Not Applicable)**

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, and balancing valves and fittings. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine approved submittals for plumbing systems and equipment.
- D. Examine equipment performance data, including pump curves.
  - 1. Relate performance data to Project conditions and requirements, including pump system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate pump system-effect factors to reduce performance ratings of plumbing equipment when installed under conditions different from the conditions used to rate equipment performance. Compare results with the design data and installed conditions.
- E. Examine system and equipment installations, and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. Examine plumbing equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- H. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
- I. Examine system pumps to ensure absence of entrained air in the suction piping.
- J. Examine operating safety interlocks and controls on plumbing equipment.

- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### **3.02 PREPARATION**

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of plumbing systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Domestic Water System:
    - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed in accordance with applicable code and authority having jurisdiction.
    - b. Water heaters are installed and functioning.
    - c. Piping is complete and all points of outlet are installed.
    - d. Water treatment is complete.
    - e. Systems are flushed, filled, and air purged.
    - f. Strainers are clean.
    - g. Control valves are functioning in accordance with the sequence of operation.
    - h. Shutoff and balance valves are 100 percent open.
    - i. Booster- and hot-water circulating pumps are operational and proper rotation is verified.
    - j. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
    - k. Variable-frequency controllers' startup is complete and safeties are verified.
    - l. Suitable access to balancing devices and equipment is provided.

### **3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING**

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. Where holes for probes are required in piping or equipment, install pressure and temperature test plugs to seal systems.
  - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 22 07 19 "Plumbing Piping Insulation."
- C. Mark equipment and balancing devices, including valve position indicators and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in units.

### **3.04 GENERAL PROCEDURES FOR PLUMBING EQUIPMENT**

- A. Test, adjust, and balance plumbing equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Domestic water in-line pumps.
3. Domestic water heaters.

### **3.05 PROCEDURES FOR DOMESTIC WATER SYSTEMS**

- A. Prepare test reports for pumps and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required equipment flow rates with system design flow rates.
- B. Prepare schematic diagrams of systems' Record drawings piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare domestic water systems for testing and balancing as follows:
  1. Check expansion tank for proper setting.
  2. Check water heater for proper discharge temperature setting.
  3. Check remotest point of outlet for adequate pressure.
  4. Check flow-control valves for proper position.
  5. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
  6. Verify that motor controllers are equipped with properly sized thermal protection.
  7. Check that air has been purged from the system.
- D. Measure and record upstream and downstream pressure of each piece of equipment.
- E. Measure and record upstream and downstream pressure of pressure-reducing valves.
- F. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- G. Check settings and operation of each safety valve. Record settings.

### **3.06 PROCEDURES FOR WATER HEATERS**

- A. Electric Water Heaters:
  1. Measure and record entering- and leaving-water temperatures.
  2. Measure and record water flow.
  3. Measure and record pressure drop.
  4. Record relief valve(s) pressure setting.
  5. Capacity: Calculate in Btu/h of heating output.
  6. Efficiency: Calculate operating efficiency for comparison to submitted equipment.
- B. Gas- and Oil-Fired Water Heaters:
  1. Measure and record entering- and leaving-water temperatures.
  2. Measure and record water flow.
  3. Measure and record pressure drop.
  4. Record relief valve(s) pressure setting.
  5. Capacity: Calculate in Btu/h of heating output.
  6. Fuel Consumption: If fuel supply is equipped with flow meter, measure and record consumption.
  7. Efficiency: Calculate operating efficiency for comparison to submitted equipment.
  8. Fan, motor, and motor controller operating data.

### **3.07 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS**

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record flows, temperatures, and pressures of each piece of equipment. Compare the values to design or nameplate information, where information is available.
  2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
  3. Check the condition of filters.
  4. Check bearings and other lubricated parts for proper lubrication.
  5. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. TAB After Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:
1. New filters are installed.
  2. Bearings and other parts are properly lubricated.
  3. Deficiencies noted in the preconstruction report are corrected.

### **3.08 TOLERANCES**

- A. Set plumbing system's flow rates within the following tolerances:
1. Domestic Water Flow Rate: Plus or minus 10 percent.

### **3.09 FINAL REPORT**

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
  3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Manufacturers' test data.
  2. Field test reports prepared by system and equipment installers.
  3. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB specialist.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents, including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Notes to explain why certain final data in the body of reports vary from indicated values.

14. Test conditions for pump performance forms, including the following:
  - a. Variable-frequency controller settings for variable-flow hydronic systems.
  - b. Settings for pressure controller(s).
  - c. Other system operating conditions that affect performance.
- D. Electric Water Heater Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
  1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Model number and unit size.
    - d. Manufacturer's serial number.
    - e. Output capacity in Btu/h.
    - f. Number of stages.
    - g. Connected volts, phase, and hertz.
    - h. Rated amperage.
  2. Test Data (Indicated and Actual Values):
    - a. Heat output in Btu/h.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. High-temperature-limit setting in deg F.
    - e. Operating set point in deg F.
    - f. Voltage at each connection.
    - g. Amperage for each phase.
- E. Instrument Calibration Reports:
  1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### **3.10 ADDITIONAL TESTS**

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

**END OF SECTION**

**SECTION 22 07 19**  
**PLUMBING PIPING INSULATION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Supplies and drains for handicap-accessible lavatories and sinks.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at pipe expansion joints for each type of insulation.
  - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 4. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 5. Detail application of field-applied jackets.
  - 6. Detail application at linkages of control devices.
- C. Samples: For each type of insulation and jacket indicated.

**1.03 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

**1.04 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## **1.05 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## **PART 2 - PRODUCTS**

### **2.01 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Pittsburgh Corning Corporation.
  - 2. Preformed Pipe Insulation: Type II, Class 1, without jacket.
  - 3. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ jacket.
  - 4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
  - 5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. K-Flex USA.
- H. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.



- b. Knauf Insulation.
  - c. Manson Insulation Inc.
  - d. Owens Corning.
- 2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
- 3. 850 deg F.
- 4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
- 5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## **2.02 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
- C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
  - 1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
  - 2. Wet Flash Point: Below 0 deg F.
  - 3. Service Temperature Range: 40 to 200 deg F.
  - 4. Color: Black.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- E. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.

## **2.03 MASTICS AND COATINGS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller Construction Products.
    - c. Knauf Insulation.
  - 2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
  - 3. Service Temperature Range: 0 to plus 180 deg F.
  - 4. Color: White.

## **2.04 SEALANTS**

- A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
  - 1. Permanently flexible, elastomeric sealant.
  - 2. Service Temperature Range: Minus 58 to plus 176 deg F.
  - 3. Color: White or gray.

- C. FSK and Metal Jacket Flashing Sealants:
  - 1. Fire- and water-resistant, flexible, elastomeric sealant.
  - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 3. Color: Aluminum.
- D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
  - 1. Fire- and water-resistant, flexible, elastomeric sealant.
  - 2. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 3. Color: White.

## **2.05 FACTORY-APPLIED JACKETS**

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

## **2.06 FIELD-APPLIED FABRIC-REINFORCING MESH**

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

## **2.07 FIELD-APPLIED JACKETS**

- A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: White.
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
  - 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.

- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

- E. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.

## **2.08 TAPES**

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
1. Width: 3 inches.
  2. Thickness: 11.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Width: 3 inches.
  2. Thickness: 6.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches.
  2. Thickness: 6 mils.
  3. Adhesion: 64 ounces force/inch in width.
  4. Elongation: 500 percent.
  5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
  2. Thickness: 3.7 mils.
  3. Adhesion: 100 ounces force/inch in width.
  4. Elongation: 5 percent.
  5. Tensile Strength: 34 lbf/inch in width.

## **2.09 SECUREMENTS**

- A. Bands:
1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
  2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

## **2.10 PROTECTIVE SHIELDING GUARDS**

- A. Protective Shielding Pipe Covers,:
  - 1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures,:
  - 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

### **3.02 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### **3.03 PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

### **3.04 GENERAL PIPE INSULATION INSTALLATION**

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### **3.05 INSTALLATION OF CELLULAR-GLASS INSULATION**

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  - 2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of cellular-glass insulation to valve body.
  - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.

### **3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION**

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.



- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### **3.07 INSTALLATION OF MINERAL-FIBER INSULATION**

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
  2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  4. Install insulation to flanges as specified for flange insulation application.

### **3.08 INSTALLATION OF POLYOLEFIN INSULATION**

- A. Insulation Installation on Straight Pipes and Tubes:
1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of polyolefin pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
  - 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### **3.09 FIELD-APPLIED JACKET INSTALLATION**

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
  - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

### **3.10 FINISHES**

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless steel jackets.

### **3.11 FIELD QUALITY CONTROL**

- A. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Owner or Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- B. All insulation applications will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.12 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### **3.13 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Cold Water:
  - 1. NPS 1 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
  - 2. NPS 1-1/4 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

- C. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

### **3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

- A. Domestic Water Piping:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Cellular Glass: 2 inches thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

### **3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. PVC: 20 mils thick.
- D. Piping, Exposed:
  - 1. PVC: 20 mils thick.

### **3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.024 inch thick.

### **3.17 UNDERGROUND, FIELD-APPLIED INSULATION JACKET**

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

**END OF SECTION**

**SECTION 22 11 16  
DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Copper tube and fittings.
  - 2. Ductile-iron pipe and fittings.
  - 3. Galvanized steel pipe and fittings.
  - 4. Piping joining materials.
  - 5. Transition fittings.
  - 6. Dielectric fittings.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.

**PART 2 - PRODUCTS**

**2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

**2.02 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- G. Copper, Brass, or Bronze Pressure-Seal-Joint Fittings:
  - 1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal.
  - 2. Minimum 200-psig working-pressure rating at 250 deg F.

**2.03 GALVANIZED-STEEL PIPE AND FITTINGS**

- A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
  2. Include ends matching joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.
- C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Malleable-Iron Unions:
1. ASME B16.39, Class 150.
  2. Hexagonal-stock body.
  3. Ball-and-socket, metal-to-metal, bronze seating surface.
  4. Threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.

#### **2.04 PIPING JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

#### **2.05 TRANSITION FITTINGS**

- A. General Requirements:
1. Same size as pipes to be joined.
  2. Pressure rating at least equal to pipes to be joined.
  3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

#### **2.06 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Standard: ASSE 1079.
  2. Pressure Rating: 125 psig minimum at 180 deg F.
  3. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
1. Standard: ASSE 1079.
  2. Factory-fabricated, bolted, companion-flange assembly.

3. Pressure Rating: 125 psig minimum at 180 deg F.
  4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. Nonconducting materials for field assembly of companion flanges.
  2. Pressure Rating: 150 psig.
  3. Gasket: Neoprene or phenolic.
  4. Bolt Sleeves: Phenolic or polyethylene.
  5. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
1. Standard: IAPMO PS 66.
  2. Electroplated steel nipple complying with ASTM F 1545.
  3. Pressure Rating and Temperature: 300 psig at 225 deg F.
  4. End Connections: Male threaded or grooved.
  5. Lining: Inert and noncorrosive, propylene.

### **PART 3 - EXECUTION**

#### **3.01 EARTHWORK**

- A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

#### **3.02 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."
- F. Install domestic water piping level and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### **3.03 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."



- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.04 TRANSITION FITTING INSTALLATION**

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### **3.05 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### **3.06 INSTALLATION OF HANGERS AND SUPPORTS**

- A. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for copper and galvanized steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping within 12 inches of each fitting.
- D. Support vertical runs of copper galvanized steel and to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### **3.07 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### **3.08 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### **3.09 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    - f. Prepare reports for tests and for corrective action required.

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.10 ADJUSTING**

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.11 CLEANING**

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.12 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
  - 1. soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and solder joints.
- G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed joints.

**END OF SECTION**

**SECTION 22 11 19**  
**DOMESTIC WATER PIPING SPECIALTIES**

**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. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Temperature-actuated, water mixing valves.
  - 4. Strainers.
  - 5. Wall hydrants.
  - 6. Drain valves.
  - 7. Water-hammer arresters.
  - 8. Trap-seal primer valves.
- B. Related Requirements:
  - 1. Section 22 05 19 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 2. Section 22 11 16 "Domestic Water Piping" for water meters.
  - 3. Section 22 47 16 "Pressure Water Coolers" for water filters for water coolers.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
  - 1. Include diagrams for power, signal, and control wiring.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS**

**2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.
- B. Comply with NSF 372 for low lead.

**2.02 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

## **2.03 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Standard: ASSE 1001.
  - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 3. Body: Bronze.
  - 4. Inlet and Outlet Connections: Threaded.
  - 5. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
  - 1. Standard: ASSE 1011.
  - 2. Body: Bronze, nonremovable, with manual drain.
  - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  - 4. Finish: Chrome or nickel plated.

## **2.04 BACKFLOW PREVENTERS**

- A. Reduced-Pressure-Principle Backflow Preventers:
- B. Manufacturers: Manufacturers: As indicated on drawings.
  - 1. Standard: ASSE 1013.
  - 2. Operation: Continuous-pressure applications.
  - 3. Pressure Loss: 12 psig maximum, through middle third of flow range.
  - 4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
  - 5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 6. Configuration: Designed for horizontal, straight-through flow.
  - 7. Accessories:
    - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    - b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

## **2.05 TEMPERATURE-ACTUATED, WATER MIXING VALVES**

- A. Primary, Thermostatic, Water Mixing Valves:
  - 1. Manufacturers: As indicated on drawings.
  - 2. Standard: ASSE 1017.
  - 3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
  - 5. Material: Bronze body with corrosion-resistant interior components.
  - 6. Connections: Threaded union inlets and outlet.
  - 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  - 8. Valve Finish: Rough bronze.
  - 9. Piping Finish: Copper.
  - 10. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

## **2.06 STRAINERS FOR DOMESTIC WATER PIPING**

- A. Y-Pattern Strainers:
  - 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Factory-installed, hose-end drain valve.

## **2.07 WALL HYDRANTS**

- A. Nonfreeze Wall Hydrants:
  1. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
  2. Pressure Rating: 125 psig.
  3. Operation: Loose key.
  4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
  5. Inlet: NPS 1/2.
  6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
  7. Box: Deep, flush mounted with cover.
  8. Box and Cover Finish: Chrome plated.
  9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
  10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
  11. Operating Keys(s): Two with each wall hydrant.

## **2.08 DRAIN VALVES**

- A. Ball-Valve-Type, Hose-End Drain Valves:
  1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
  2. Pressure Rating: 400-psig minimum CWP.
  3. Size: NPS 3/4.
  4. Body: Copper alloy.
  5. Ball: Chrome-plated brass.
  6. Seats and Seals: Replaceable.
  7. Handle: Vinyl-covered steel.
  8. Inlet: Threaded or solder joint.
  9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## **2.09 WATER-HAMMER ARRESTERS**

- A. Water-Hammer Arresters:
  1. Standard: ASSE 1010 or PDI-WH 201.
  2. Type: Metal bellows.
  3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## **2.10 TRAP-SEAL PRIMER DEVICE**

- A. Drainage-Type, Trap-Seal Primer Device:
  1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
  2. Size: NPS 1-1/4 minimum.
  3. Material: Chrome-plated, cast brass.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
- B. Balancing Valves: Install in locations where they can easily be adjusted.
- C. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Y-Pattern Strainers: For water, install on supply side of each solenoid valve and pump.
- E. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- F. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

### **3.02 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.
- C. Comply with requirements for grounding equipment in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

### **3.03 IDENTIFICATION**

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Reduced-pressure-principle backflow preventers.
  - 2. Carbonated-beverage-machine backflow preventers.
  - 3. Calibrated balancing valves.
  - 4. Primary, thermostatic, water mixing valves.
  - 5. Manifold, thermostatic, water mixing-valve assemblies.
  - 6. Outlet boxes.
  - 7. Hose stations.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."



### **3.04 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.05 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

**END OF SECTION**

**SECTION 22 13 16**  
**SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
  - 2. PVC pipe and fittings.
  - 3. Specialty pipe fittings.

**1.02 ACTION SUBMITTALS**

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

**1.03 WARRANTY**

- A. Listed manufacturers to provide labeling and warranty of their respective products.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

**2.02 PIPING MATERIALS**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

**2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Charlotte Pipe and Foundry Company.
  - 2. Tyler Pipe; a part of McWane family of companies.
- B. Pipe and Fittings: ASTM A 74, Service class.
- C. Gaskets: ASTM C 564, rubber.
- D. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## **2.04 PVC PIPE AND FITTINGS**

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

## **2.05 SPECIALTY PIPE FITTINGS**

- A. Transition Couplings:
  - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 2. Shielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1460.
    - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.

## **PART 3 - EXECUTION**

### **3.01 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

### **3.02 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.

- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
  - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Install underground PVC piping according to ASTM D 2321.
- P. Plumbing Specialties:
  - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
  - 2. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### **3.03 JOINT CONSTRUCTION**

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

### **3.04 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

### **3.05 VALVE INSTALLATION**

- A. Comply with requirements in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and Section 22 05 23.14 "Check Valves for Plumbing Piping" for general-duty valve installation requirements.
- B. Shutoff Valves:
  - 1. Install shutoff valve on each sewage pump discharge.
  - 2. Install full-port ball valve for piping NPS 2 and smaller.
  - 3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

### **3.06 INSTALLATION OF HANGERS AND SUPPORTS**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.

6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
  - C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
  - D. Support vertical runs of cast iron soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### **3.07 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
  1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  5. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### **3.08 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### **3.09 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
    - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    - d. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### **3.10 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing exposed to sunlight with two coats of water-based latex paint.

- E. Repair damage to adjacent materials caused by waste and vent piping installation.

### **3.11 PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
  - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
  - 3. Cast Iron Pipe and Fittings: ASTM A 74, Service class, Gaskets: ASTM C 564, rubber. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.
- G. Underground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
  - 3. Cast Iron Pipe and Fittings: ASTM A 74, Service class, Gaskets: ASTM C 564, rubber. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

**END OF SECTION**



**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
  - 2. Section 07 72 00 "Roof Accessories" for preformed flashings.

**1.02 ACTION SUBMITTALS**

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

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.01 ASSEMBLY DESCRIPTIONS**

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

**2.02 CLEANOUTS**

- A. Cast-Iron Exposed Cleanouts:
  - 1. Standard: ASME A112.36.2M.
  - 2. Size: Same as connected drainage piping
  - 3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 4. Closure: Countersunk, plastic plug.
  - 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Exposed Floor Cleanouts:
  - 1. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
  - 2. Size: Same as connected branch.
  - 3. Type: Adjustable housing Cast-iron soil pipe with cast-iron ferrule Threaded, adjustable housing.
  - 4. Body or Ferrule: Cast iron.
  - 5. Clamping Device: Required.
  - 6. Outlet Connection: Inside calk Spigot.
  - 7. Closure: Plastic plug.
  - 8. Adjustable Housing Material: Cast iron with threads.
  - 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

10. Frame and Cover Shape: Round.
11. Top-Loading Classification: Heavy Duty.
12. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:
  - a. Brass.
  - b. Countersunk or raised head.
  - c. Drilled and threaded for cover attachment screw.
  - d. Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
6. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

## 2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch-minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Assemble open drain fittings and install with top of hub 2 inches above floor.
- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- H. Install vent caps on each vent pipe passing through roof.
- I. Install wood-blocking reinforcement for wall-mounting-type specialties.
- J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.02 PIPING CONNECTIONS**

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, to allow service and maintenance.

### **3.03 LABELING AND IDENTIFYING**

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
  1. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### **3.04 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work. Place plugs in ends of uncompleted piping at end of each day or when work stops.

## **END OF SECTION**

**SECTION 22 13 19.13  
SANITARY DRAINS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Floor drains.

**1.02 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene styrene.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene.
- D. PE: Polyethylene.
- E. PP: Polypropylene.
- F. PVC: Polyvinyl chloride.

**1.03 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS**

**2.01 DRAIN ASSEMBLIES**

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

**2.02 FLOOR DRAINS**

- A. Cast-Iron Floor Drains:
  - 1. Standard: ASME A112.6.3.
  - 2. Pattern: Floor drain.
  - 3. Body Material: Gray iron.
  - 4. Seepage Flange: Required.
  - 5. Outlet: Bottom.
  - 6. Backwater Valve: Not required.
  - 7. Coating on Interior and Exposed Exterior Surfaces: Not required.
  - 8. Sediment Bucket: Not required.
  - 9. Top or Strainer Material: Bronze.
  - 10. Top of Body and Strainer Finish: Rough bronze.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  - 3. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
    - a. Maintain integrity of waterproof membranes where penetrated.
  - 5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install open drain fittings with top of hub 2 inches above floor.

### **3.02 CONNECTIONS**

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 22 13 19 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### **3.03 LABELING AND IDENTIFYING**

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### **3.04 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

## **END OF SECTION**

**SECTION 22 33 00**  
**ELECTRIC, DOMESTIC-WATER HEATERS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Commercial, electric, storage, domestic-water heaters.
  - 2. Thermostat-control, electric, tankless, domestic-water heaters.
  - 3. Domestic-water heater accessories.

**1.02 ACTION SUBMITTALS**

- A. Shop Drawings:
  - 1. Include diagrams for power, signal, and control wiring.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.04 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

**1.05 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Electric, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Three years.
      - 2) Controls and Other Components: Three years.
    - b. Electric, Tankless, Domestic-Water Heaters: Five year(s).
    - c. Expansion Tanks: Five years.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. Seismic Performance: Commercial, electric, domestic-water heaters to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Component Importance Factor: 1.0.
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

- D. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

## **2.02 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS**

- A. Commercial, Electric, Storage, Domestic-Water Heaters:
  - 1. Manufacturers: As indicated on drawings.
  - 2. Standard: UL 1453
  - 3. Storage-Tank Construction: ASME-code, steel vertical arrangement.
    - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing. DN 50 and Smaller: Threaded ends in accordance with ASME B1.20.1. DN 65 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges, and in accordance with ASME B16.24 for copper and copper-alloy flanges.
    - b. Pressure Rating: 150 psig
    - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
  - 4. Factory-Installed, Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
    - c. Insulation: Comply with ASHRAE/IES 90.1.
    - d. Jacket: Steel with enameled finish or high-impact composite material.
    - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
    - f. Temperature Control: Adjustable thermostat.
    - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    - h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

## **2.03 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS**

- A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:
  - 1. Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.
  - 2. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
    - a. Connections: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig.
    - c. Heating Element: Resistance heating system.
    - d. Temperature Control: Thermostat.
    - e. Safety Control: High-temperature-limit cutoff device or system.
    - f. Jacket: Aluminum or steel with enameled finish or plastic.
  - 3. Support: Bracket for wall mounting.

## **2.04 DOMESTIC-WATER HEATER ACCESSORIES**

- A. Domestic-Water Expansion Tanks:
  - 1. Manufacturers: As indicated on drawings.

2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
  - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
  - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Air-Charging Valve: Factory installed.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than DN 20 with ASME B1.20.1 pipe threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 125-psig-maximum outlet pressure unless otherwise indicated.
- F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
- G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.
- H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## **2.05 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.



## **PART 3 - EXECUTION**

### **3.01 DOMESTIC-WATER HEATER INSTALLATION**

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on wall-mounted structural shelf.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.
- B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters on wall bracket.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping."
- D. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."
- H. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- I. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

- J. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping" and comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- K. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 22 11 19 "Domestic Water Piping Specialties."
- L. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- M. Fill electric, domestic-water heaters with water.
- N. Charge domestic-water expansion tanks with air to required system pressure.
- O. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water to contain less than 0.25 percent of lead by weight.
- P. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### **3.02 PIPING CONNECTIONS**

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### **END OF SECTION**

**SECTION 22 42 13.13  
COMMERCIAL WATER CLOSETS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Floor-mounted, bottom-outlet water closets.
  - 2. Toilet seats.
  - 3. Supports.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Standards:
  - 1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
  - 2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
  - 3. Comply with ASSE 1037/ASME A112.1037/CSA B125.37 for flush valves.
  - 4. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
  - 5. Comply with ASME A112.6.1M for water-closet supports.
  - 6. Comply with ICC A117.1 for ADA-compliant water closets.
  - 7. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous china water closets to sanitary drainage systems.
  - 8. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.

**2.02 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS**

- A. Water Closets - Floor Mounted, Bottom Outlet, Close-Coupled Flushometer Tank:
  - 1. Manufacturers: As indicated on drawings.
  - 2. Bowl:
    - a. Material: Vitreous china.
    - b. Type: Siphon jet.
    - c. Style: Flushometer tank,.
    - d. Height: Standard and ADA compliant.
    - e. Rim Contour: Elongated.
    - f. Water Consumption: 1.28 gal. per flush.
    - g. Color: White.

**2.03 TOILET SEATS**

- A. Toilet Seats: .

1. Manufacturers: As indicated on drawings.
2. Material: Plastic.
3. Type: Commercial (Heavy duty).
4. Shape: Elongated rim, open front.
5. Hinge: Check .
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White.

## **2.04 SUPPORTS**

- A. Water-Closet Carrier:
  1. Manufacturers: As indicated on drawings.
  2. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Water-Closet Installation:
  1. Install level and plumb according to roughing-in drawings.
  2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
  3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
  1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
  2. Use carrier supports with waste-fitting assembly and seal.
  3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- C. Install toilet seats on water closets.
- D. Wall Flange and Escutcheon Installation:
  1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
  1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  2. Match sealant color to water-closet color.
  3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

### **3.02 CONNECTIONS**

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

### **3.03 ADJUSTING**

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

### **3.04 CLEANING AND PROTECTION**

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

**SECTION 22 42 16.13  
COMMERCIAL LAVATORIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Lavatories.
  - 2. Faucets.
  - 3. Supports.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
    - a. Servicing and adjustments of automatic faucets.

**PART 2 - PRODUCTS**

**2.01 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES**

- A. Lavatory: Vitreous china, wall mounted, with back.
  - 1. Manufacturers: As indicated on drawings.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: For wall hanging.
    - c. Nominal Size: Oval, 22 by 14 inches.
    - d. Faucet-Hole Punching: Three holes, 4-inch centers.
    - e. Faucet-Hole Location: Top.
    - f. Color: White.
    - g. Mounting Material: Chair carrier.
  - 3. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.
  - 4. Lavatory Mounting Height: Standard Handicapped/elderly according to ICC A117.1.

**2.02 SOLID-BRASS, MANUALLY OPERATED FAUCETS**

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, single-control mixing two-handle mixing, commercial, solid-brass valve.
  - 1. Manufacturers: As indicated on drawings.
  - 2. Standard: ASME A112.18.1/CSA B125.1.
  - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
  - 4. Body Type: Centerset.

5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Maximum Flow: 0.25 gal. per metering cycle.
9. Mounting Type: Deck, exposed.
10. Valve Handle(s): Single lever Push button.
11. Spout: Rigid type.
12. Spout Outlet: Laminar flow.

## **2.03 SUPPORTS**

- A. Type II Lavatory Carrier:
  1. Manufacturers: As indicated on drawings.
  2. Standard: ASME A112.6.1M.

## **2.04 SUPPLY FITTINGS**

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  1. NPS 3/8.
  2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

## **2.05 WASTE FITTINGS**

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  1. Size: NPS 1-1/2 by NPS 1-1/4.
  2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
  3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine walls for suitable conditions where lavatories will be installed.

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

### **3.02 INSTALLATION**

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

### **3.03 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

### **3.04 ADJUSTING**

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.05 CLEANING AND PROTECTION**

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

### **END OF SECTION**



**SECTION 26 51 00  
LIGHTING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Interior lighting fixtures.
  - 2. Exterior fixtures, mounted on or in close proximity to the building structure.
  - 3. Emergency lighting units.
  - 4. Exit signs.
  - 5. Lighting fixture supports.
- B. Related Sections:
  - 1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including wall-box dimmers, occupancy sensors, time switches, contactors, and photocells.
  - 3. Section 26 27 26 "Wiring Devices" for manual switches.

**1.03 DEFINITIONS**

- A. BF: Ballast factor.
  - 1. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. LED: Light Emitting Diode

**1.04 ACTION SUBMITTALS**

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Driver.
  - 4. Energy-efficiency data.
  - 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for fixtures.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Wiring Diagrams: For power, signal, and control wiring.
- C. Installation instructions.

#### **1.05 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- B. Product Certificates: For each type of ballast for dimmer-controlled fixtures, from manufacturer.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

#### **1.06 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### **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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
  2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  3. Fixture-mounted, emergency battery pack: One for every 20 emergency lighting unit.
  4. Drivers: One for every 100 of each type and rating installed. Furnish at least one of each type.
  5. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### **1.08 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. Mockups: Where required by architect during construction, provide interior lighting fixtures for room or module mockups, complete with power and control connections.
  1. Obtain Architect's approval of fixtures for mockups before starting installations.
  2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **1.09 COORDINATION**

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

## **1.10 WARRANTY**

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
  - 2. Warranty Period for Emergency Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

### **2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS**

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    - b. UV stabilized.
    - c. Glass: Annealed crystal glass unless otherwise indicated.
- F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp and ballast/driver characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. CCT and CRI for all luminaires.
- G. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

### **2.03 LED DRIVERS**

- A. LED drivers shall meet the following requirements:
  - 1. Drivers shall have a minimum efficiency of 85%.

2. Starting Temperature: -40° F.
3. Input Voltage: 120 to 480 ( $\pm 10\%$ ) V.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50  $\mu$ s, 10kA/8 x 20  $\mu$ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C. Units shall be serviceable in-place by owner.
6. Power Factor (PF): = 0.90.
7. Total Harmonic Distortion (THD): = 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

## **2.04 EXIT SIGNS**

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

## **2.05 INTERNALLY LIGHTED SIGNS**

- A. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
- B. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  1. Battery: Sealed, maintenance-free, nickel-cadmium type.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

## **2.06 EMERGENCY LIGHTING UNITS**

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
  1. Battery: Sealed, maintenance-free, lead-acid type.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

## **2.07 LED SOURCES**

- A. Operating temperature rating shall be between -40° F and 120° F.
- B. Correlated Color Temperature (CCT): as noted on Drawings.

- C. Color Rendering Index (CRI): greater than or equal to 65.
- D. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

## **2.08 LIGHTING FIXTURE SUPPORT COMPONENTS**

- A. Comply with Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- H. Aircraft Cable Support: Cable, anchorages, and intermediate supports recommended by luminaire manufacturer.

## **2.09 TEMPORARY LIGHTING**

- A. Provide temporary lighting for all trades. Temporary lighting shall consist of festoon Metal-Halide Lamps. Minimum average light level shall be 10 footcandles. The use of permanent luminaires for temporary lighting is not allowed.

# **PART 3 - EXECUTION**

## **3.01 INSTALLATION**

- A. Lighting fixtures:
  - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
  - 2. Install lamps in each luminaire.
- B. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 4. Install at least two (2) independent support rods or wires from structure to a tab on lighting fixture. Wire or rod shall have a minimum breaking strength safety factor of 3 times the weight of the fixture.
- D. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
  4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### **3.02 IDENTIFICATION**

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### **3.03 FIELD QUALITY CONTROL**

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### **3.04 STARTUP SERVICE**

- A. Burn-in all fixtures that require specific aging period to operate properly, prior to occupancy by Owner.

### **3.05 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
1. Adjust aimable luminaires in the presence of Architect.

**END OF SECTION**

**SECTION 23 05 29**  
**HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

**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. Fastener systems.
  - 2. Equipment supports.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Section 23 05 48.13 "Vibration Controls for HVAC" for vibration isolation devices.
  - 3. Section 23 31 13 "Metal Ducts" for duct hangers and supports.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Fiberglass strut systems.
  - 4. Pipe stands.
  - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Include design calculations for designing trapeze hangers.

**1.04 QUALITY ASSURANCE**

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment.

## **2.02 FASTENER SYSTEMS**

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## **2.03 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## **2.04 MATERIALS**

- A. Aluminum: ASTM B221.
- B. Carbon Steel: ASTM A1011/A1011M.
- C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A240/A240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.
- F. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 28-day compressive strength.

# **PART 3 - EXECUTION**

## **3.01 APPLICATION**

- A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus.



### **3.02 HANGER AND SUPPORT INSTALLATION**

- A. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- C. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

### **3.03 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### **3.04 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### **3.05 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### **3.06 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### **3.07 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- E. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  - 6. C-Clamps (MSS Type 23): For structural shapes.
  - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- F. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- G. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- H. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

#### **END OF SECTION**

**SECTION 23 05 48.13**  
**VIBRATION CONTROLS FOR HVAC**

**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. Elastomeric isolation pads.
  - 2. Elastomeric isolation mounts.
  - 3. Restrained elastomeric isolation mounts.
  - 4. Open-spring isolators.
  - 5. Housed-spring isolators.
  - 6. Restrained-spring isolators.
  - 7. Housed-restrained-spring isolators.
  - 8. Elastomeric hangers.
  - 9. Spring hangers.
  - 10. Vibration isolation equipment bases.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
- B. Shop Drawings:
  - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For each vibration isolation device.
  - 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For restrained-air-spring mounts to include in operation and maintenance manuals.

**1.05 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## **PART 2 - PRODUCTS**

### **2.01 ELASTOMERIC ISOLATION PADS**

- A. Elastomeric Isolation Pads:
  - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
  - 2. Size: Factory or field cut to match requirements of supported equipment.
  - 3. Pad Material: Oil and water resistant with elastomeric properties.
  - 4. Surface Pattern: Ribbed pattern.
  - 5. Infused nonwoven cotton or synthetic fibers.
  - 6. Load-bearing metal plates adhered to pads.
  - 7. Sandwich-Core Material: Resilient and elastomeric.
    - a. Surface Pattern: Ribbed or Waffle pattern.
    - b. Infused nonwoven cotton or synthetic fibers.

### **2.02 ELASTOMERIC ISOLATION MOUNTS**

- A. Double-Deflection, Elastomeric Isolation Mounts:
  - 1. Mounting Plates:
    - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
    - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
  - 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

### **2.03 RESTRAINED ELASTOMERIC ISOLATION MOUNTS**

- A. Restrained Elastomeric Isolation Mounts:
  - 1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
    - a. Housing: Cast-ductile iron or welded steel.
    - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

### **2.04 OPEN-SPRING ISOLATORS**

- A. Freestanding, Laterally Stable, Open-Spring Isolators:
  - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
  - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

### **2.05 HOUSED-SPRING ISOLATORS**

- A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
  - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
  - b. Top housing with threaded mounting holes and internal leveling device and elastomeric pad.

## **2.06 RESTRAINED-SPRING ISOLATORS**

- A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
  1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
    - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    - b. Top plate with threaded mounting holes and elastomeric pad.
    - c. Internal leveling bolt that acts as blocking during installation.
  2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
  3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## **2.07 HOUSED-RESTRAINED-SPRING ISOLATORS**

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
  1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## **2.08 ELASTOMERIC HANGERS**

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
  1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## **2.09 SPRING HANGERS**

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
  1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
  7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
  8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

## **2.10 VIBRATION ISOLATION EQUIPMENT BASES**

- A. Steel Rails: Factory-fabricated, welded, structural-steel rails.
  1. Design Requirements: Lowest possible mounting height with not less than clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
    - a. Include supports for suction and discharge elbows for pumps.
  2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails shall have shape to accommodate supported equipment.
  3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- B. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
  1. Design Requirements: Lowest possible mounting height with not less than clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
    - a. Include supports for suction and discharge elbows for pumps.
  2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment.
  3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
- C. Concrete Inertia Base: field-fabricated welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
  1. Design Requirements: Lowest possible mounting height with not less than clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
    - a. Include supports for suction and discharge elbows for pumps.
  2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Bases shall have shape to accommodate supported equipment.
  3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
  4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 VIBRATION CONTROL DEVICE INSTALLATION**

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

### **3.03 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION**

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."

**END OF SECTION**



**SECTION 23 05 53**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**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. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Duct labels.
  - 4. Stencils.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

**PART 2 - PRODUCTS**

**2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, stainless steel, or anodized aluminum, minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: White or Yellow
  - 3. Background Color: Black.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on A4 bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## **2.02 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White or Yellow
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## **2.03 DUCT LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White or Yellow
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

## **2.04 STENCILS**

- A. Stencils for Ducts:
  - 1. Lettering Size: Minimum letter height of 1-1/2 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
  - 2. Stencil Material: Fiberboard or metal.
  - 3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
  - 4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- B. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
  - 1. Lettering Size: Minimum letter height of 1-1/2 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
  - 2. Stencil Material: Fiberboard or metal.
  - 3. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
  - 4. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### **3.02 GENERAL INSTALLATION REQUIREMENTS**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### **3.03 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.

- B. Locate equipment labels where accessible and visible.

### **3.04 DUCT LABEL INSTALLATION**

- A. Install plastic-laminated or self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Blue: For cold-air supply ducts.
  - 2. Yellow For hot-air supply ducts.
  - 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
- C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 25 ft in each space where ducts are exposed or concealed by removable ceiling system.

**END OF SECTION**

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**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. Testing, Adjusting, and Balancing of Air Systems:

**1.03 DEFINITIONS.**

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

**1.04 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.
- C. Certified TAB reports.
- D. Sample report forms.
- E. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

**1.05 QUALITY ASSURANCE**

- A. TAB Specialists Qualifications, Certified by AABC or NEBB:
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB.

- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

## **1.06 FIELD CONDITIONS**

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## **PART 2 - EXECUTION**

### **2.01 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data, including fan curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

- I. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

## **2.02 PREPARATION**

- A. Prepare a TAB plan that includes the following:
  1. Equipment and systems to be tested.
  2. Strategies and step-by-step procedures for balancing the systems.
  3. Instrumentation to be used.
  4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  1. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Windows and doors are installed.
    - j. Suitable access to balancing devices and equipment is provided.

## **2.03 GENERAL PROCEDURES FOR TESTING AND BALANCING**

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
  1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
  3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

## **2.04 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT**

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Fans and ventilators.
2. Unit heaters.

## **2.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' Record drawings duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- E. Verify that motor starters are equipped with properly sized thermal protection.
- F. Check for airflow blockages.
- G. Check for proper sealing of air-handling-unit components.

## **2.06 DUCT LEAKAGE TESTS**

- A. Witness the duct leakage testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified limits.
- C. Report deficiencies observed.

## **2.07 TOLERANCES**

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  1. Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
  2. Air Outlets and Inlets: Plus or minus 10 percent
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

## **2.08 PROGRESS REPORTING**

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.



## 2.09 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB specialist.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents, including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 15. Test conditions for fans performance forms, including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Heating coil, dry-bulb conditions.
    - e. Face and bypass damper settings at coils.
    - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
    - g. Other system operating conditions that affect performance.
- D. Fan Test Reports: For exhaust fans, include the following:
  - 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.

- h. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, frame type, and size.
    - b. Horsepower and speed.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan speed.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- E. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

## **2.10 VERIFICATION OF TAB REPORT**

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
- B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 25 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
  - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
  - 2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.
- F. Prepare test and inspection reports.

## **2.11      ADDITIONAL TESTS**

- A.    Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

**END OF SECTION**

## **SECTION 23 31 13 METAL DUCTS**

### **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. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Duct liner.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
- B. Related Sections:
  - 1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### **1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of the following products:
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
- B. Delegated-Design Submittal:
  - 1. Sheet metal thicknesses.
  - 2. Joint and seam construction and sealing.
  - 3. Reinforcement details and spacing.
  - 4. Materials, fabrication, assembly, and spacing of hangers and supports.

### **PART 2 - PRODUCTS**

#### **2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

- E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

## **2.02 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## **2.03 SINGLE-WALL ROUND AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## **2.04 SHEET METAL MATERIALS**

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
  - 1. Galvanized Coating Designation: Z180.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Aluminum Sheets: Comply with ASTM B209M Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- D. Factory- or Shop-Applied Antimicrobial Coating:
  - 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
  - 2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  - 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
  - 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
  - 5. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- E. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

## **2.05 DUCT LINER**

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
  - 2. Maximum Thermal Conductivity:
    - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
    - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  - 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA Inc.
    - b. Armacell LLC.
    - c. Rubatex International, LLC
  2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
  3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
    - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
  7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.
    - b. Intervals of lined duct preceding unlined duct.
    - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
  9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
    - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
  10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.06 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 4 inches
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Base: Synthetic rubber resin.
  3. Solvent: Toluene and heptane.
  4. Solids Content: Minimum 60 percent.
  5. Shore A Hardness: Minimum 60.
  6. Water resistant.
  7. Mold and mildew resistant.
  8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  9. VOC: Maximum 395 g/L.
  10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
  11. Service: Indoor or outdoor.
  12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.



6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
  1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## **2.07 HANGERS AND SUPPORTS**

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1M, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## **PART 3 - EXECUTION**

### **3.01 DUCT INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
  - 1. Fabricate 90-degree rectangular mitered elbows to include single thickness turning vanes.
  - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

### **3.02 INSTALLATION OF EXPOSED DUCTWORK**

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### **3.03 DUCT SEALING**

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-inch wg and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-inch wg: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

### **3.04 HANGER AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1M, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 ft.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### **3.05 CONNECTIONS**

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### **3.06 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 Painting Sections.

### **3.07 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Leakage Tests:
  - 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 2. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
  - 3. Test for leaks before applying external insulation.
  - 4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  - 5. Give 7 days' advance notice for testing.
- C. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
  - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### **3.08 DUCT CLEANING**

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use duct cleaning methodology as indicated in NADCA ACR.
- C. Use service openings for entry and inspection.
  - 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Air Duct Accessories" for access panels and doors.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.
- D. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- E. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
  7. Dedicated exhaust and ventilation components and makeup air systems.
- F. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
  5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
  6. Provide drainage and cleanup for wash-down procedures.
  7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

### **3.09 STARTUP**

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

### **3.10 DUCT SCHEDULE**

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 1-inch wg.

- b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round: 12.
  - 2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- C. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel.
- D. Liner:
  - 1. Supply Air Ducts: Fibrous glass, Type I or Flexible elastomeric, 1-1/2 inches thick.
  - 2. Return Air Ducts: Fibrous glass, Type I or Flexible elastomeric, 1-1/2 inches thick.
  - 3. Exhaust Air Ducts: Fibrous glass, Type I or Flexible elastomeric, 1 inch thick.
  - 4. Supply Fan Plenums: Fibrous glass, Type II or Flexible elastomeric, 1-1/2 inches thick.
  - 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II or Flexible elastomeric, 2 inches thick.
  - 6. Transfer Ducts: Fibrous glass, Type I or Flexible elastomeric, 1 inch thick.
- E. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
  - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
  - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 fpm to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

- 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
    - 4) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 inches and Larger in Diameter: Standing seam or Welded.
- F. Branch Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
  - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 fpm to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.

**END OF SECTION**

**SECTION 23 33 00  
AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

Section Includes:

1. Manual volume dampers.
2. Flexible connectors.
3. Flexible Ducts

**1.03 ACTION SUBMITTALS**

Product Data: For each type of product.

Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
  - a. Special fittings.
  - b. Manual volume damper installations.
  - c. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
  - d. Include diagrams for power, signal, and control wiring.

**1.04 CLOSEOUT SUBMITTALS**

Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

Comply with NFPA 90A and NFPA 90B.

Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

**2.02 MANUAL VOLUME DAMPERS**

Standard, Steel, Manual Volume Dampers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
  - a. Air Balance Inc.; a division of Mestek, Inc.



- b. American Warming and Ventilating; a division of Mestek, Inc.
  - c. Flexmaster U.S.A., Inc.
  - d. McGill AirFlow LLC.
  - e. Nailor Industries Inc.
  - f. Pottorff.
  - g. Ruskin Company.
  - h. Trox USA Inc.
  - i. Vent Products Company, Inc.
- 2. Standard leakage rating, with linkage outside airstream.
- 3. Suitable for horizontal or vertical applications.
- 4. Frames:
  - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
  - a. Molded synthetic.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.

## 2.03 FLEXIBLE CONNECTORS

Manufacturers:

- 1. Ventaire.
- 2. Z-Flex.
- 3. Ductmate Industries, Inc.

General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Select metal compatible with ducts.

Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

- 4. Minimum Weight: 26 oz/sq. yd.
- 5. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
- 6. Service Temperature: Minus 40 to plus 200 deg F.

## 2.04 FLEXIBLE DUCTS

Manufacturers:

- 1. Ductmate Industries, Inc.
- 2. Flexmaster U.S.A., Inc.
- 3. Hart & Cooley, Inc.
- 4. McGill AirFlow Corporation.

Insulated-Duct Connectors: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.

- 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.

Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

Set dampers to fully open position before testing, adjusting, and balancing.

Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

Install flexible connectors to connect ducts to equipment.

Install duct test holes where required for testing and balancing purposes.

### **3.02 FIELD QUALITY CONTROL**

Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
3. Operate remote damper operators to verify full range of movement of operator and damper.

**END OF SECTION**

**SECTION 23 34 23**  
**HVAC POWER VENTILATORS**

**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. Ceiling-mounted ventilators.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
  - 2. Rated capacities, operating characteristics, and furnished specialties and accessories.
  - 3. Certified fan performance curves with system operating conditions indicated.
  - 4. Certified fan sound-power ratings.
  - 5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 6. Material thickness and finishes, including color charts.
  - 7. Dampers, including housings, linkages, and operators.
  - 8. Prefabricated roof curbs.
  - 9. Fan speed controllers.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and 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.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

## **2.02 CEILING-MOUNTED VENTILATORS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
- D. Back-draft damper: Integral.
- E. Grille: Plastic or painted aluminum, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
  - 1. Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
  - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
  - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
  - 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless steel springs, and fusible link.
  - 6. Filter: Washable aluminum to fit between fan and grille.
  - 7. Isolation: Rubber-in-shear vibration isolators.
  - 8. Manufacturer's standard roof jack or wall cap, and transition fittings.

## **2.03 MOTORS**

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

## **2.04 SOURCE QUALITY CONTROL**

- A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.
- B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.
- C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION, GENERAL**

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:

1. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

- C. Install units with clearances for service and maintenance.

### **3.02 DUCTWORK CONNECTIONS**

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

### **3.03 ELECTRICAL CONNECTIONS**

- A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

### **3.04 CONTROL CONNECTIONS**

- A. Install control and electrical power wiring to field-mounted control devices.

### **3.05 STARTUP SERVICE:**

- A. Engage a factory-authorized service representative to perform startup service.
  1. Complete installation and startup checks in accordance with manufacturer's written instructions.
  2. Verify that shipping, blocking, and bracing are removed.
  3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  4. Verify that cleaning and adjusting are complete.
  5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
  6. Adjust damper linkages for proper damper operation.
  7. Verify lubrication for bearings and other moving parts.
  8. Remove and replace malfunctioning units and retest as specified above.

### **3.06 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.
- B. Lubricate bearings.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

### **3.07 CLEANING**

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

**3.08 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

**END OF SECTION**

**SECTION 23 37 23**  
**HVAC GRAVITY VENTILATORS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Hooded ventilators.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For gravity ventilators.
  - 1. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
  - 2. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
- C. Samples: For each exposed product and for each color and texture specified.

**1.03 COORDINATION**

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

**PART 2 - PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.
- B. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment" and Section 7, "Construction and System Start-up."
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
- D. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

**2.02 FABRICATION**

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

## **2.03 HOODED VENTILATORS**

- A. Description: Hooded round penthouse for intake and relief air.
- B. Construction:
  - 1. Material, Aluminum: Thickness required to comply with structural performance requirements, but not less than 0.063-inch-thick base and 0.050-inch-thick hood; suitably reinforced.
  - 2. Bird Screening: Aluminum, 1/2-inch-square mesh or flattened, expanded aluminum, 3/4-inch diamond mesh wire.
- C. Galvanized-Steel Finish:
  - 1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas, and repair galvanizing according to ASTM A780/A780M. Apply a conversion coating suited to the organic coating to be applied over it.
- D. Dampers:
  - 1. Location: Hood neck.
  - 2. Tray: Provide damper tray or shelf with opening 3 inches of size indicated.
- E. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
  - 1. Overall Height: 12 inches.

## **2.04 SOURCE QUALITY CONTROL**

- A. AMCA Certification for Hooded Ventilators: Test, rate, and label gravity ventilators in accordance with AMCA 511.

## **2.05 MATERIALS**

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.
- D. Stainless-Steel Sheet: ASTM A666, Type 304, with No. 4 finish.
- E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
  - 1. Use types and sizes to suit unit installation conditions.
  - 2. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
- F. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times



the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION, GENERAL**

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure gravity ventilators to roof curbs with zinc-plated hardware. Use concealed anchorages where possible. Refer to Section 07 72 00 "Roof Accessories."
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during installation.
- F. Label gravity ventilators according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes, so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- I. Refer to Section 07 72 00 "Roof Accessories" for flashing and counterflashing of roof curbs.

#### **3.02 DUCT CONNECTIONS**

- A. Duct installation and connection requirements are specified in Section 23 31 13 "Metal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

**END OF SECTION**

**SECTION 23 82 39.19  
WALL AND CEILING UNIT HEATERS**

**PART 1 -**

**1.1 SUMMARY**

- A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include details of anchorages and attachments to structure and to supported equipment.
  - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
  - 5. Wiring Diagrams: Power, signal, and control wiring.

**1.3 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

**2.2 DESCRIPTION**

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

**2.3 CABINET**

- A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

**2.4 COIL**

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-

steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

## **2.5 FAN AND MOTOR**

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated. Comply with requirements in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."

## **2.6 CONTROLS**

- A. Controls: Unit-mounted thermostat.
- B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Install wall and ceiling unit heaters to comply with NFPA 90A.
- B. Install wall and ceiling unit heaters level and plumb.
- C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

**END OF SECTION**

**SECTION 26 05 00**  
**GENERAL PROVISIONS FOR ELECTRICAL WORK**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. The work included in this Contract is shown on the drawings and described in these specifications. It consists of furnishing all labor, material, services, supervision and connection of all systems shown and/or specified including the requirements of:
  - 1. Division 00 – Bidding and Contract Requirements.
  - 2. Division 01 – General Requirements.
  - 3. Division 26 – Electrical Work.
- B. Contractor is responsible to review and understand all drawings and all work of all trades to ensure a complete and thorough project.
- C. Provide all labor, tools, materials, equipment, coordination, and plans necessary for installation and proper operation of the electrical systems.
- D. Contract drawings and specifications are complementary and must be so used to ascertain all requirements of the work.

**1.02 DEFINITIONS**

- A. Provide, furnish, install, and furnish and install shall have the same meaning. That is, the Contractor shall purchase, transport to the site and install all required components of the work unless specifically stated otherwise in the contract documents.
- B. Wiring pertains to raceway, fittings, conductors, terminations, hangers, supports, etc. as required to form a complete system.

**1.03 DRAWINGS AND SPECIFICATIONS**

- A. The plans are diagrammatic and indicate only the sizes and general arrangement of conduit, devices, and equipment; exact locations of all elements shall be determined as work progresses, in cooperation with the work of other trades. It is not intended to show every item of work or minor piece of equipment, but every item shall be furnished and installed without additional remuneration as necessary to complete the system in accordance with the best practice of the trade.
- B. As previously stated, the exact locations of electrical devices and equipment are diagrammatic. The owner may request for any devices or equipment to be installed at different locations than what is indicated on the drawings in a specific area or room. It is the responsibility of the Electrical Contractor to coordinate the locations of devices in all areas prior to installation.

**1.04 APPLICABLE STANDARDS**

- A. All equipment shall bear the UL label.
- B. The latest edition of the following minimum standards shall apply wherever applicable:
  - 1. ASA American Standards Association
  - 2. ASTM American Society for Testing Materials
  - 3. ETL Electrical Testing Laboratories, Inc.
  - 4. IEEE Institute of Electrical and Electronic Engineers
  - 5. IPCEA Insulated Power Cable for Engineers Association
  - 6. OSHA Occupational Safety and Health Act
  - 7. NEC National Electrical Code
  - 8. NEMA National Electrical Manufacturers Association
  - 9. NESC National Electrical Safety Code
  - 10. NFPA National Fire Protection Association
  - 11. UL Underwriters Laboratories, Inc.

- 12. Power company standards and regulations.
  - 13. Local and state codes.
- C. In the event there are conflicts between specifications and standards, standards shall govern unless specifications are in excess of standards.

#### **1.05 PERMITS AND INSPECTIONS**

- A. Permits: The Contractor shall apply for and pay the cost for any local permits necessary for the work of this contract.
- B. Inspections: The Contractor shall be responsible for obtaining all electrical inspections of and the certificate by the approved inspection authority having jurisdiction for the entire electrical system.
- C. The undertaking of periodic inspections by the Owner or Engineer shall not be construed as supervision of actual construction. The Owner or Engineer is not responsible for providing a safe place of work for the Contractor, Contractor's employees, suppliers or subcontractors for access, visits, use, work, travel or occupancy by any person.

#### **1.06 CODES AND REGULATIONS**

- A. Comply with all applicable rules and regulations of the municipal laws and ordinances and latest revisions thereof. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Modifications required by the above authorities will be made without additional charges to the Owner. Where alterations to and/or deviations from the Contract Documents are required by the authorities, report the requirements to the Engineer and secure approval before work is started.
- B. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Obtain all permits, licenses, and inspections and pay all legal and proper fees and charges in this connection.
- C. Should any work shown or specified be of lighter or smaller material than Code requires, same shall be executed in strict accordance with the regulations.
- D. Heavier or larger size material than Code requires shall be furnished and installed, if required by the Plans and Specifications.
- E. This Contractor shall have the electrical work inspected from time to time by authorized inspectors. At the completion of the work, the Contractor shall furnish a Certificate of Approval, in triplicate, indicating full approval of the work furnished and installed in this Contract from the local authority having jurisdiction.
- F. Equipment and components parts thereof shall bear manufacturer's nameplate, giving manufacturer's name, size, type and model number or serial number, electrical characteristic to facilitate maintenance and replacements. Nameplates of distributors or contractors are not acceptable.
- G. Engineer will have privilege of stopping any work or use of any material that in his opinion is not being properly installed and each Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed by the Engineer, at no additional cost to Owner.
- H. If equipment or materials are installed before proper approvals have been obtained, each Contractor shall be liable for their removal and replacement including work of other trades affected by such work, at no additional cost to Owner, if such items do not meet intent of the Drawings and Specifications.

### **1.07 RECORD DRAWINGS**

- A. The Electrical Contractor shall keep an accurate location record of all underground and concealed piping, and of all changes from the original design. He is required to furnish this information to the Engineer prior to his application for final payment.
  - 1. Submit prior to final acceptance inspection, one complete marked-up set of reproducible engineering design drawings in PDF format.
    - a. Fully illustrate all revisions made by all crafts in course of work.
    - b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders.
    - c. Exact location of raceways, equipment and devices.
    - d. Exact size and location of underground and under floor raceways and duct banks.
  - 2. These drawings shall be for record purposes for Owner's use and are not considered shop drawings.
- B. At completion of the project, all changes and deviations from the Contract Documents shall be recorded by the Contractor.
- C. Four (4) corrected sets of all operating and maintenance instructions and complete parts lists bound in hard covers and in PDF format shall be furnished to the Owner.

### **1.08 SLEEVES**

- A. Sleeves: furnished, set in Electrical Work; built-in under General Construction Work.
- B. Sleeves shall be as follows:
  - 1. Sleeves in floors and partitions shall be galvanized steel with lock seam joints or a manufactured conduit floor seal.
  - 2. Sleeves of extra heavy cast iron pipe or galvanized steel pipe shall be used in outside walls, foundations, and footing or manufactured compression-type wall seal (waterproof).
  - 3. Conduit sleeves shall be two (2) sizes larger than the conduit passing through it.
  - 4. Terminate sleeves flush with walls, partitions, and ceilings. Sleeves in floor shall terminate 1/4" above floors.
  - 5. Fill space between sleeve and conduit in foundation walls with oakum and caulk with lead on both sides of wall. When using pipe sleeves, fill space between sleeve and pipe with fiberglass blanket insulation when sleeve does not occur in a foundation wall.
  - 6. An approved fire stop seal shall be used when conduits penetrate fire stopping walls and floors (between fire zones).
- C. Set sleeves and obtain review of their locations in ample time to permit pouring of concrete or progressing of other construction work as scheduled.

### **1.09 CLEANING CONDUIT, EQUIPMENT**

- A. Conduit, equipment: thoroughly cleaned of dirt, cuttings, other foreign substances. Should any conduit, other part of systems be stopped by any foreign matter, disconnect, clean wherever necessary for purpose of locating, removing obstructions. Repair work damaged in course of removing obstructions.

### **1.010 VIBRATION ISOLATION**

- A. Vibration isolators shall prevent, as far as practicable, transmission of vibration, noise or hum to any part of building.
- B. Design isolators to suit vibration frequency to be absorbed; provide isolator units of area, distribution to obtain proper resiliency under machinery load, impact.

- C. Wiring and other electrical connections to equipment mounted on vibration isolators; made flexible with minimum 180 degree loop of "greenfield" in order to avoid restraining equipment and short circuiting vibration isolator.

#### **1.011 BALANCED LOAD**

- A. It is intended that design and features of the work as indicated will provide balanced load on the feeders and main service. Contractor shall provide material and installation to provide this balance load insofar as possible.
- B. Contractor shall take current and voltage measurements at all panels of at least 1/2 hour. Reconnections of loads shall be made when deemed necessary by the Engineer or when required to comply with adjusting requirements of Section 262416 "Panelboards."

#### **1.012 JOB CONDITIONS**

- A. Examine site related work and surfaces before starting work of any Section. Failure to do so shall in no way relieve the Contractor of the responsibility to properly install the new work.
  - 1. Report to the Engineer, in writing, conditions which will prevent proper provision of this work ten (10) days prior to bid date, in time for an addendum to be issued.
  - 2. Beginning work of any Section without reporting unsuitable conditions to the Engineer constitutes acceptance of conditions by the Contractor.
  - 3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.
  - 4. The Contractor is responsible for performing routine maintenance and cleaning of any existing equipment where he is making connections to new work and to the building where his work adds debris.

#### **1.013 SPECIAL TOOLS AND LOOSE ITEMS**

- A. Furnish to Owner at completion of work:
  - 1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.
  - 2. "Special Tools": Those not normally found in possession of mechanics or maintenance personnel.
  - 3. Keys
  - 4. Redundant components and spare parts.
- B. Deliver items to Owner and obtain receipt prior to approval of final payment.

#### **1.014 REVIEW OF CONSTRUCTION**

- A. Work may be reviewed at any time by representative of the Engineer.
- B. Advise Architect and Engineer that work is ready for review at following times:
  - 1. Prior to backfilling buried work.
  - 2. Prior to concealment of work in walls and above ceilings.
  - 3. When all requirements of contract have been completed.
- C. Neither backfill nor conceal work without Engineer's consent.

#### **1.015 SHOP DRAWING SUBMITTALS**

- A. Submit required shop drawings, samples and product information in accordance with Division 01 requirements and as required in the various sections of these specifications.
- B. Submittals shall show evidence of checking by the Contractor for accuracy. Product information (catalog sheets) shall indicate complete catalog number, color, accessories, etc., as well as name of manufacturer and local distributor or manufacturer's representative.
- C. Incomplete submittals will be rejected.
- D. Additionally, the Contractor will submit data on the following:

1. All electrical equipment including all panelboards and switching devices (disconnects, switches, occupancy sensors, etc.); refer to submittal requirements of each section.
  2. Any proposed variation in specified wiring plans and circuitry.
  3. All special items and panels, made or constructed specifically for this project, including wiring diagrams, component layout and component data or materials list.
  4. All settings of installed equipment, such as overcurrent protection, overload settings, temperature settings, time settings, etc. This includes equipment provided by other contractors or subcontractors and connected and tested by this Contractor.
- E. All submittals of NON-SPECIFIED equipment and components will be reviewed. It is the submitting Contractor's responsibility to prove compliance and not the Architect/Engineer to prove non-compliance. The submitting Contractor will be charged the prevailing wage of the reviewing Engineer for all submittals requiring over one (1) hour to review that were not originally specified.
- F. It is the Contractor's responsibility to provide submittals in an organized and timely manner so as not to delay the project schedule and hamper the work of other trades.

#### **1.016 OPERATING INSTRUCTIONS**

- A. It shall be the Contractor's responsibility to ensure that the Owner's representative is given adequate instruction on the operation of all equipment prior to final payment.

#### **1.017 TEMPORARY POWER**

- A. The Contractor shall coordinate all temporary power to all trades throughout all phases of construction throughout the duration of this project with the construction manager. This will include but not be limited to temporary lighting, power outlets, temporary elevator operation, controls for temporary heating, and job trailers. Contractor shall be responsible for coordinating temporary power via adjacent building(s) and/or a temporary diesel fired generator and associated fuel costs. Contractor shall coordinate temporary power source with construction manager prior to demolition. Contractor is responsible for all costs associated with temporary power.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. All materials and equipment shall be new and as specified or of equal or better quality.
- B. Basic hardware and miscellaneous items shall meet existing trade standards of quality and shall carry UL or FM listings where applicable.
- C. All equipment supplied shall be the standard equipment of the manufacturer.
- D. Multiple items such as raceways, wiring devices, etc., shall be from the same manufacturer.
- E. Drawings and specifications are based on specific manufacturer's equipment. Therefore, the Contractor shall assume all responsibility, cost and coordination involved in making any necessary revisions to apply another manufacturer's equipment, even though it may be approved as an "equal" item by the Engineer.

### **PART 3 - EXECUTION**

#### **3.01 COORDINATION OF WORK**

- A. All work shall be executed in accordance with recognized standards of workmanship. All work shall be installed in a neat and orderly manner.



- B. The Contractor shall exchange information with other Contractors and the Owner in order to ensure orderly progress of the work.
- C. The Contractor must contact the Owner's representative and schedule all work ten (10) days prior to start.
- D. The Contractor shall check for possible interference before installing any items. If any work is installed, and later develops interference with other features of the design, the Contractor will be responsible for making such changes to eliminate the interference.

**END OF SECTION**

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**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. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

**1.03 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

**1.04 ACTION SUBMITTALS**

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

**1.05 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

**PART 2 - PRODUCTS**

**2.01 CONDUCTORS AND CABLES**

- 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. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. General Cable Corporation.
  - 4. Senator Wire & Cable Company.
  - 5. Southwire Company.
  - 6. Encore Wire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

**2.02 CONNECTORS AND SPLICES**

- 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. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.
  5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## **PART 3 - EXECUTION**

### **3.01 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### **3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- B. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway. Armored Cable Type AC may be used only for whips to lighting fixtures above accessible ceilings; whips limited to 6 feet long.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

### **3.03 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. For stranded conductors, install crimp on fork terminals for device terminations if device does not have pressure terminals. Do not place bare stranded conductors directly under screws unless device has pressure terminals.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems".
- G. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems".

### **3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior wall assemblies. Comply with requirements in Section 260500 "General Provisions for Electrical Work".

### **3.05 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### **3.06 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to an approved UL-listed method.

### **3.07 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION**

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes: Grounding systems and equipment.

**1.03 ACTION SUBMITTALS**

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

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Ground rods, grounding bars, grounding clamps, and accessories:
  - 1. Erico.
  - 2. Harger.
  - 3. Southern Grounding.
  - 4. Galvan.
- B. Exothermic welding systems:
  - 1. Cadweld.
  - 2. Thermoweld.
  - 3. Ultrashot.

**2.02 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## **2.03 CONNECTORS**

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## **2.04 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

## **PART 3 - EXECUTION**

### **3.01 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, size as shown on Drawings minimum.
  - 1. Bury at least 30 inches below grade.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Exothermically welded connectors except as otherwise indicated.
  - 3. Connections to Structural Steel: Exothermically welded connectors.

### **3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS**

- A. Comply with IEEE C2 grounding requirements.
- B. Install two parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds maximum resistance specified herein.

### **3.03 EQUIPMENT GROUNDING**

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

### **3.04 INSTALLATION**

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Where metal duct is directly connected to unit, check continuity and bond as required. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

### **3.05 LABELING**

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

### **3.06 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural

- drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
- b. Perform tests by fall-of-potential method according to IEEE 81.
- 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
  - D. Prepare test and inspection reports.
  - E. Report measured ground resistances that exceed the following values:
    - 1. Electrical Service Disconnect: 15 ohms.
  - F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

**END OF SECTION**



**SECTION 26 05 29  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

**1.05 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel slotted support systems.

**1.06 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

**1.07 COORDINATION**

- A. Coordinate installation of equipment supports.

**PART 2 - PRODUCTS**

**2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 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. Allied Tube & Conduit.
- b. Cooper B-Line, Inc.; a division of Cooper Industries.
- c. ERICO International Corporation.
- d. GS Metals Corp.
- e. Thomas & Betts Corporation.
- f. Unistrut; Tyco International, Ltd.
- g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - 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) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - 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) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## **2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## **PART 3 - EXECUTION**

### **3.01 APPLICATION**

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### **3.02 SUPPORT INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To New Concrete: Bolt to concrete inserts.
  2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  3. To Existing Concrete: Expansion anchor fasteners.
  4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts and Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  6. To Light Steel: Sheet metal screws.

- 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount pull and junction boxes, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### **3.03 INSTALLATION OF FABRICATED METAL SUPPORTS**

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.04 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 Section "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**

**SECTION 26 05 33**  
**RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Nonmetal conduits, tubing, and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Boxes.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. RMC: Rigid metal conduit (galvanized steel).
- C. FMC: Flexible metal conduit.
- D. LFMC: Liquid-tight flexible metal conduit.

**1.04 ACTION SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor, wall, and ceiling A/V boxes.

**PART 2 - PRODUCTS**

**2.01 METAL CONDUITS, TUBING, AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 3. Anamet Electrical, Inc.
  - 4. Electri-Flex Company.
  - 5. O-Z/Gedney; a brand of EGS Electrical Group.
  - 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
  - 7. Republic Conduit.
  - 8. Robroy Industries.
  - 9. Southwire Company.
  - 10. Thomas & Betts Corporation.
  - 11. Western Tube and Conduit Corporation.
  - 12. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RMC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Compression.
  - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- H. Joint Compound for RMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## **2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Anamet Electrical, Inc.
  - 3. Arnco Corporation.
  - 4. CANTEX Inc.
  - 5. CertainTeed Corp.
  - 6. Condux International, Inc.
  - 7. Electri-Flex Company.
  - 8. Kraloy.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Niedax-Kleinhuis USA, Inc.
  - 11. RACO; a Hubbell company.
  - 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. PVC: Type EPC-40-PVC and 80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for PVC: Comply with NEMA TC 3; match to conduit or tubing type and material.

## **2.03 METAL WIREWAYS AND AUXILIARY GUTTERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman; a Pentair company.
  - 3. Mono-Systems, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## **2.06 BOXES**

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

1. Adalet .
  2. Cooper Technologies Company; Cooper Crouse-Hinds.
  3. EGS/Appleton Electric.
  4. Erickson Electrical Equipment Company.
  5. FSR Inc.
  6. Hoffman; a Pentair company.
  7. Hubbell Incorporated; Killark Division.
  8. Kraloy.
  9. Milbank Manufacturing Co.
  10. Mono-Systems, Inc.
  11. O-Z/Gedney; a brand of EGS Electrical Group.
  12. RACO; a Hubbell Company.
  13. Robroy Industries.
  14. Spring City Electrical Manufacturing Company.
  15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
  16. Thomas & Betts Corporation.
  17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
  - C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
  - D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
  - E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
  - F. Floor, Wall, and Ceiling A/V Boxes: refer to applicable specification section.
  - G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
  - H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
    1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
  - J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
  - K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
  - L. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep unless otherwise noted.
  - M. Gangable boxes are allowed.

## **PART 3 - EXECUTION**

### **3.01 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed Conduit: RMC.
  2. Concealed Conduit, Aboveground: RMC.
  3. Underground Conduit: PVC, Type EPC-40-PVC.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage (above 8'-0" AFF): EMT.
  3. Exposed and Subject to Severe Physical Damage (below 8'-0" AFF): RMC.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: RMC.
  7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use compression, expansion gland type, steel fittings. Comply with NEMA FB 2.10.
  3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### **3.02 INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.

### **3.03 RACEWAYS EMBEDDED IN SLABS**

- A. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
- B. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- C. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.



- D. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- E. Change from PVC to EMT before rising above floor within walls, change from PVC to RMC at all other locations.
- F. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- I. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
  - 6. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
  - 7. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- J. Cut conduit perpendicular to the length required. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- M. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- N. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service raceway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- O. Comply with manufacturer's written instructions for solvent welding PVC and fittings.
- P. Expansion-Joint Fittings:
  - 1. Install in each run of aboveground PVC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.

3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC in damp or wet locations not subject to severe physical damage.
  3. Flexible Conduit Connections for vibration isolation: Provide connections as follows:
    - a. For conduit greater than 1" O.D., make electrical connections to vibrating equipment via a flexible expansion/deflection conduit coupling. Coupling shall have flexible and watertight outer jacket, internal grounding strap, plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit.
    - b. For conduit less than 1" O.D., utilize flexible conduit with slack shape or provide a flexible coupling as defined above. Install flexible conduit in a 360° slack loop or in a "U" shape with a depth of the U shape equal to 20 times the diameter of the conduit. Conduit slack shapes must not exceed manufacturer's recommended minimum bending radius and the metal corrugations must not bind against one another and thus provide a rigid vibration path.
- R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- U. Sound Insulating Partitions: Where individual back boxes are installed on either side of a sound insulating partition, the boxes shall be staggered a minimum of 2 feet. Back boxes shall be covered with either a fire or sound putty pad.
- V. Locate boxes so that cover or plate will not span different building finishes.
- W. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Y. Set metal floor boxes level and flush with finished floor surface.

### **3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 00 "General Provisions for Electrical Work."

### **3.05 FIRESTOPPING**

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies using an approved UL-listed method.

### **3.06 PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

**END OF SECTION**

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Identification for wiring devices.
  - 5. Underground-line warning tape.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.

**1.04 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

**1.05 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

**PART 2 - PRODUCTS**

**2.01 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

- C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

## **2.02 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

## **2.03 CONDUCTOR IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

## **2.04 WIRING DEVICE LABELS**

- A. Embossed adhesive tape, with ¼-inch black-filled letters on clear background.

## **2.05 UNDERGROUND-LINE WARNING TAPE**

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
  - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
  - 2. Inscriptions for Yellow-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
  - 3. Inscriptions for Orange-Colored Tapes: COMMUNICATIONS AND SIGNAL CABLES.
- C. Type:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 8 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 34 lb/1000 sq. ft.
5. 3-Inch Tensile According to ASTM D 882: 300 lbf, and 12,500 psi.

## **2.06 EQUIPMENT IDENTIFICATION LABELS**

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed. Minimum letter height shall be 3/8 inch (10 mm). Refer to detail on drawings.

## **2.07 FLOOR MARKING TAPE**

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

## **2.08 CABLE TIES**

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
  3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
  3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  4. Color: Black.
- C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.
  1. Minimum Width: 3/16 inch (5 mm).
  2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
  3. UL 94 Flame Rating: 94V-0.
  4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
  5. Color: Black.

## **2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Verify identity of each item before installing identification products.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

### 3.02 IDENTIFICATION SCHEDULE

- A. Accessible Conduits and Raceways within Buildings:
  - 1. Identify the covers of each junction and pull box with self-adhesive vinyl labels or permanent marker with the panel and circuit number and system voltage.
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in pull and junction boxes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 120/240-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
    - c. Neutral conductors shall be White. When two or more neutrals are located in one conduit, individually identify each with the circuit number with which it is associated. Sharing of Neutral Conductors is not permitted.
    - d. Equipment Grounding Conductors:
      - 1) 6 AWG and smaller: Green
      - 2) 4 AWG and larger: Identify with green tape at both ends and at visible points including junction and pull boxes.
    - e. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install wire marker for each conductor at panelboard, gutters, pull boxes, outlet and junctions boxes, and at each load connected. Mark with panel and circuit number.
- E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

- G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  - 2. Equipment to Be Labeled: Equipment label shall be engraved, laminated acrylic or melamine label. Label all electrical equipment. Refer to Detail on Drawings.
    - a. Label Colors and Contents: Refer to Detail on Drawings.
    - b. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Label with panel name, voltage, and source where fed from. Label each circuit breaker with manufacturer provided circuit number following NEMA standard numbering. Panel directory shall match numbering of breakers.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
  - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

**END OF SECTION**



**SECTION 26 09 23**  
**LIGHTING CONTROL DEVICES**

**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. Indoor occupancy sensors.
  - 2. Wall-box dimmers.
- B. Related Requirements:
  - 1. Section 26 27 26 "Wiring Devices" for manual light switches, and color/finish of devices.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy sensors.
  - 1. Interconnection diagrams showing field-installed wiring.
  - 2. Include diagrams for power, signal, and control wiring.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.01 INDOOR OCCUPANCY SENSORS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Industries, Inc.
  - 2. Lightolier Controls.
  - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 4. Lutron Electronics Co., Inc.
  - 5. Sensor Switch, Inc.
  - 6. Square D; a brand of Schneider Electric.
  - 7. Watt Stopper.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
  - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
  - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  - 5. Mounting:

- a. Sensor: Suitable for mounting in any position on a standard outlet box.
  - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  - d. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  - e. Bypass Switch: Override the "on" function in case of sensor failure.
  - f. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
  - g. Dual Relay Units: Shall have provisions for setting both relays to turn on when occupancy is detected. Units that allow only one relay to default to "on" are not acceptable.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
- 1. Sensitivity Adjustment: Separate for each sensing technology.
  - 2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  - 3. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
  - 4. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
  - 5. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.

## **2.04 SWITCHBOX-MOUNTED OCCUPANCY SENSORS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 1. Cooper Industries, Inc.
  - 2. Leviton Mfg. Company Inc.
  - 3. Lightolier Controls.
  - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 5. Lutron Electronics Co., Inc.
  - 6. Sensor Switch, Inc.
  - 7. Square D; a brand of Schneider Electric.
  - 8. Watt Stopper.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
- 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
  - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
  - 4. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
  - 5. Sensing Technology: Dual technology (PIR and ultrasonic).
  - 6. Switch Type: Single-relay or dual-relay, as indicated on drawing.
    - a. Dual-Relay Units: Shall have provisions for setting both relays to turn on when occupancy is detected. Units that allow only one relay to default to "on" are not acceptable.

- b. Voltage: Match the circuit voltage.
- c. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
- d. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
- e. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
- f. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
- g. Color/finish shall match that of other wiring devices in the project.

## **2.05 WALL-BOX DIMMERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Industries, Inc.
  - 2. Leviton Mfg. Company Inc.
  - 3. Lightolier Controls.
  - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 5. Lutron Electronics Co., Inc.
  - 6. Sensor Switch, Inc.
  - 7. Watt Stopper.
- B. Dimmer Switches: Specification grade, modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- C. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472. Standard toggle-type switch with small adjacent slider is not acceptable.
- D. Coordinate dimmer type with lighting fixtures being controlled. Provide compatible type of dimmer (e.g., 0-10V, forward phase control, etc.) as required.
- E. Power rating: Match load on drawings; 600 watts minimum.

## **2.06 CONDUCTORS AND CABLES**

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Sensors: Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Sensors: Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- C. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

### **3.02 WIRING INSTALLATION**

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### **3.03 IDENTIFICATION**

- A. Identify components and power and control wiring according to Section 26 05 53 "Identification for Electrical Systems."

### **3.04 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  1. Operational Test: After installing and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.

### **3.05 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

### **3.06 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

## **END OF SECTION**

## **SECTION 26 24 16 PANELBOARDS**

### **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. Lighting and appliance branch-circuit panelboards.
  - 2. Food truck/RV power pedestals.

#### **1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of panelboard, switching and 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. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.

#### **1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### **1.05 MAINTENANCE MATERIAL SUBMITTALS**

- C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Two spares for each type of panelboard cabinet lock.
  - 2. Circuit Breakers Including GFCI Types: Two spares for each panelboard.

#### **1.06 QUALITY ASSURANCE**

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

#### **1.08 PROJECT CONDITIONS**

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than ten days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Owner's written permission.
  - 3. Comply with NFPA 70E.

#### **1.09 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

#### **1.10 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 18 months from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.01 GENERAL REQUIREMENTS FOR PANELBOARDS**

- A. Enclosures: Flush or Surface-mounted cabinets as indicated on drawings.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 3R.

- c. Front: Secured to box with with bolts (trim clamps not allowed). For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - d. Hinged Front Cover: Entire front trim hinged to box and with piano-hinged door within piano-hinged trim cover.
  - e. Skirt for Surface-Mounted Panelboards: Provide where indicated on Drawings. Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  - f. Gutter Extension and Barrier: Provide where indicated on Drawings. Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  - g. Finishes:
    - 1) Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - 2) Back Boxes: Galvanized steel.
  - h. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom as indicated on Drawings.
- C. Phase, Neutral, and Ground Buses:
- 1. Material: Phase- and Neutral-Bus Material: Copper or Tin-plated, high-strength, electrical-grade aluminum alloy.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box or manufacturer's standard bolted ground bar.
  - 3. Extra-Capacity Neutral Bus: Provide where indicated on Drawings. Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
- 1. Material: Tin-plated aluminum circuit-breaker line connections.
  - 2. Main and Neutral Lugs: Mechanical type.
  - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  - 4. Provide where indicated on Drawings:
    - a. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
    - b. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
    - c. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated. Series-rating is not allowed.

## **2.01 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; a brand of Schneider Electric.
  - 2. Eaton.
  - 3. Siemens.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

- E. Doors: Door-in-door with full piano-hinged front; secured with flush latch with tumbler lock; keyed alike.

## **2.02 FOOD TRUCK/RV PEDESTALS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. Leviton.
  - 3. General Electric.
  - 4. Midwest.
  - 5. Milbank.
  - 6. Siemens Talon.
  - 7. Valid Manufacturing.
- B. Shall be tested and certified to be in compliance with ANSI/UL 231 entitled "power outlets."
- C. Shall be certified to meet all sections of NFPA 70 National Electrical Code Article 551 Part VI.
- D. Shall meet 406.8(B)(2)(a) of NFPA 70 with an enclosure that is weatherproof with the attachment plug cap inserted or removed.
- E. The power pedestal shall be completely pre-wired at the factory to the load side of the compression lug assembly.
- F. Loop Feed Buss Bar System: Single and double barrel mechanical buss bars - rated for copper or aluminum available in sizes ranging from 8 AWG to 350 KCMIL.
- G. All exposed metallic parts must have an integral ground that is a part of the equipment grounding system.
- H. Receptacles:
  - 1. All receptacles shall be mounted behind a lockable weatherproof, hinged door that is under tension to ensure proper closing pressure when the receptacle is or is not in use.
  - 2. All receptacles shall be mounted at least 24" above the ground datum.
  - 3. All receptacles under 60 amps shall be of the corrosion resistant type.
  - 4.. 20 Amp, 125 Volt, straight blade receptacles shall be listed weather resistant type and shall be GFI protected.
  - 5. 30 Amp, 125 Volt, receptacles shall be 2 pole, 3 wire (NEMA TT-30).
  - 6. 50 Amp, 125/250 Volt, receptacles shall be 3 pole, 4 wire (NEMA 14-50).
- I. Circuit breakers located under lockable weatherproof door and shall comply with requirements below.

## **2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; a brand of Schneider Electric.
  - 2. Eaton.
  - 3. Siemens.
- B. Molded-Case Circuit Breaker (MCCB): Comply with 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing where indicated on Drawings; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
  - a. Instantaneous trip.
  - b. Long- and short-time pickup levels.
  - c. Long- and short-time time adjustments.
  - d. Ground-fault pickup level, time delay, and I<sub>2t</sub> response.
  - e. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - f. Molded-Case Circuit-Breaker (MCCB) Features and Accessories
    - 1) Standard frame sizes, trip ratings, and number of poles.
    - 2) Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - 3) Application Listing: Appropriate for application. All circuit breakers shall be HACR rated.
    - 4) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - 5) Shunt Trip: 120 or 24 as required-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    - 6) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    - 7) Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    - 8) Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    - 9) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    - 10) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## **2.04 ACCESSORY COMPONENTS AND FEATURES**

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install panelboards and accessories according to NECA 407.
- B. Equipment Mounting: Install distribution panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
  2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  4. Install anchor bolts to elevations required for proper attachment to panelboards.
  5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Comply with manufacturer's instructions to achieve seismic restraint of panelboard.
- E. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
- H. Install filler plates in unused spaces.
- I. For flush-mounted panelboards, panelboards in finished spaces, or panelboards serving areas with raised floors: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- K. Comply with NECA 1.

### **3.03 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### **3.04 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
1. Manufacturer's Field Service: As required, engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Document and certify all testing performed.

### **3.05 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as required.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
1. Measure as directed during period of normal system loading.
  2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### **3.06 PROTECTION**

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

**END OF SECTION**

## **SECTION 26 27 26 WIRING DEVICES**

### **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. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. USB receptacles.
  - 3. Twist-locking receptacles.
  - 4. Tamper-resistant receptacles.
  - 5. Weather-resistant receptacles.
  - 6. Snap switches, including motor-rated switches.
  - 7. Cord and plug sets.

#### **1.03 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.

#### **1.05 ACTION SUBMITTALS**

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

#### **1.06 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers' Names:
  - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand (Pass & Seymour).

- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## **2.02 GENERAL WIRING-DEVICE REQUIREMENTS**

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.

## **2.03 STRAIGHT-BLADE RECEPTACLES**

- A. Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and FS W-C-596.
  - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Screw terminal guards.

## **2.04 GFCI RECEPTACLES**

- A. General Description:
  - 1. Straight blade, feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
  - 4. Screw terminal guards.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and FS W-C-596.
- C. Weather-Resistant GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement se, and FS W-C-596. Provide for all receptacles located in damp or wet locations.

## **2.05 TAMPER-RESISTANT RECEPTACLES**

- A. Tamper-Resistant, Duplex (125 V, 20 A)
  - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
  - 2. Line Voltage Receptacles: Two pole, three wire, and self-grounding, NEMA Configuration 5-20R.
  - 3. Standards: Comply with NEMA WD 1, UL 1310, and FS W-C-596.

## **2.06 USB RECEPTACLES**

- A. Dual USB Type A/C, 5 V dc, and 3.1 A per receptacle (minimum).
  - 1. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, UL 1310, and FS W-C-596.

## **2.07 TWIST-LOCKING RECEPTACLES**

- A. Single Receptacles, NEMA type required for equipment or as noted on Drawings. Comply with NEMA WD 1, NEMA WD 6, and UL 498.
  - 1. Products : Subject to compliance with requirements, provide one of the following:
    - a. Cooper.
    - b. Hubbell.

- c. Leviton
- d. Pass & Seymour

## **2.08 CORD AND PLUG SETS**

- A. Description:
  - 1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
  - 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## **2.09 SNAP SWITCHES**

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Heavy-duty, quiet type, AC snap switch with green hex head grounding screw.
  - 1. Provide configurations and ratings noted on drawings. Minimum shall be 120/277 V, 20 A devices.
  - 2. Motor rated switches: rated for 1 hp at 120VAC, 2hp at 240V-277V, with stainless steel cover plate and lockout guard/bracket.
- C. Products: Subject to compliance with requirements, provide products from one of the following:
  - a. Cooper.
  - b. Hubbell.
  - c. Leviton.
  - d. Legrand.

## **2.10 WALL PLATES**

- A. Single and combination types shall match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Satin-finished 302 stainless steel.
  - 3. Material for Unfinished Spaces: 302 stainless steel.
- B. Damp and Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weatherproof while-in-use, die-cast aluminum with lockable cover. Nonmetallic covers are not acceptable.

## **2.11 FINISHES**

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: 302 stainless steel.
- C. Final normal power device color and wall plate finish to be determined by Architect during submittal review.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

### **3.02 GFCI RECEPTACLES**

- A. Install non-feed-through-type GFCI receptacles only. Do not protect other downstream receptacles with upstream GFCI receptacle unless noted otherwise on the Drawings.

### **3.03 IDENTIFICATION**

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use white self-adhesive machine-printed label on face of plate, and durable wire markers or tags inside outlet boxes.

### **3.04 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.

**END OF SECTION**



**SECTION 31 20 01**  
**SITE GRADING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Cut, fill, excavate, backfill, compact and grade the site as necessary to bring the roads, drives, paved areas and open areas to the lines and grades shown on the drawings.
1. The work includes, but is not necessarily limited to:  
Excavations and formations of embankments.  
Dressing of graded areas, shoulders and ditches.  
Roadway, parking area, drive and walk subgrade preparation.  
Construction and lining of treatment basins.
  2. Classification: All excavation is unclassified and excavation of every description, regardless of material encountered within the grading limits of the project, shall be performed to the lines and grades indicated.
- B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in other divisions of these specifications.
  2. Site Clearing and Grubbing.
  3. Trenching, Backfilling for Utilities.
  4. Erosion and Sediment Control.
  5. Storm Drainage System.
- C. Definitions:
1. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way and parking areas.
  2. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
  3. Optimum moisture: Percentage of water in a specific material at maximum density.
  4. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.
  5. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be removed by dragline, dredge or other special equipment, are designated as muck. No extra payment will be made for muck removal.
  6. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technician. In addition to organic matter, sod, muck, roots and rubbish, highly plastic clay soils of the CH and MH descriptions, and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
  7. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for

their intended use by soils technicians or the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CL or as designated in these specifications.

8. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW or GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2" in diameter.
9. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C-33.
10. Excavation: Excavation is defined as unclassified excavation of every description regardless of materials encountered.

- D. The Contractor must determine for himself the volume of material required by the site.

## 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with requirements of governmental agencies having jurisdiction.
- C. A testing laboratory retained by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts of fill material and shall keep the laboratory informed of his progress. The cost of the initial tests shall be paid for by the Owner. Subsequent tests required as a result of improper compaction shall be paid for by the Contractor.

## 1.3 PRODUCT HANDLING

- A. Comply with pertinent provisions of the contract documents.

## 1.4 JOB CONDITIONS

- A. Notification of intent to excavate:
  1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
  2. Notification of intent to excavate may be given by calling this toll free number: 1-800-922-0983.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Soil material used as fill, backfill, subgrade for structures or pavements, embankments, or site grading shall consist of suitable material as found available on site until such supply of on-site material is depleted.
  - 1. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over 6" in greatest dimension, and with not more than 15% of the rocks or lumps larger than 2-1/2" in their greatest dimension.
  - 2. Do not permit rocks having a dimension greater than 1" in the upper 6" of fill or embankment.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, suitable borrow material as approved by the Engineer shall be provided by the Contractor at no additional expense to the Owner.
- C. Select materials may be provided from on-site if acceptable material as approved by the Engineer is available on site. Otherwise approved select material shall be provided by the Contractor from an off-site source.

### 2.2 TOPSOIL

- A. Use topsoil consisting of material removed from the top 3" to 6" of existing on-site soils.
- B. Use topsoil containing no stones, roots or large clods of soil.
- C. Stockpile topsoil separate from other excavated material.

### 2.3 WEED KILLER

- A. Provide a dry, free-flowing, dust free chemical compound, soluble in water, capable of inhibiting growth of vegetation and approved for use on this work by governmental agencies having jurisdiction.

### 2.4 EQUIPMENT

- A. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner without undue waste or damage of material.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. Clearing and grubbing: Clear and grub areas to be graded prior to commencement of the grading operations.
- B. Where so directed by the Owner, protect and leave standing designated desirable trees.
- C. Complete any demolition and/or removal work as may be required prior to grading operations.
- D. Dispose of all clearing, grubbing and demolition debris and other deleterious material off the project site. Vegetation, roots, brush, rubbish, stumps, etc. may be burned on-site where permitted by local authorities and regulations and approved by the Engineer.
- E. Topsoil: Strip topsoil to a depth of 3" to 6" without contamination from the subsoil and stockpile topsoil separate from other excavated materials.
  - 1. Transport and deposit topsoil in storage piles convenient to areas that are to receive topsoil or in other locations as indicated or approved by the Engineer.
  - 2. Deposit topsoil in areas that are already graded and will not be disturbed by on-going construction.
  - 3. Dispose of unsuitable or unusable stripped material off-site or as otherwise directed by the Engineer.
- F. Sampling and preliminary testing:
  - 1. Prior to beginning the grading operations, the Contractor shall submit to the Engineer his proposed sequence of excavation operations.
  - 2. Based upon the sequence of excavation, samples of the fill materials will be obtained as excavation proceeds and tested for grain size permeability and moisture density relationship using the Standard Proctor Method (ASTM D698, Method A).
  - 3. Allow sufficient time for completion of laboratory tests before any fill operations begin, using the soils being tested.

### 3.3 FINISH ELEVATIONS AND LINES

- A. Construct areas outside of building or structure lines true to grades shown.
  - 1. Where no grade is indicated, shape finish surface to drain away from buildings or structures, as approved by the Engineer.
- B. Degree of finish shall be that ordinarily obtainable from blade grader, supplemented with hand raking and finishing.
- C. Finish surfaces to within 0.10' above or below the established grade or approved cross section.

### 3.4 GENERAL PROCEDURES

- A. Existing utilities:
  - 1. Unless shown to be removed, locate and protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.

2. If active utility lines are encountered and are not shown on the drawings or otherwise made known to the Contractor, promptly notify the Engineer and take necessary steps to assure that service is not interrupted.
  3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
  4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
  5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Protection of persons and property:
1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.
  2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
  3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
- C. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.
- D. Maintain access to adjacent areas at all times.
- E. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

### 3.5 EXCAVATING (CUTS)

- A. Perform excavating of every type of material encountered within the limits of the Work to the lines, grades and elevations indicated and specified herein.
- B. Provide sloping, sheeting, shoring, and bracing for excavations conforming with 29CFR1926 Subpart P-Excavations and the Contract Documents.
- C. Suitable excavated materials:
1. Use all suitable materials removed from the excavation as far as practicable in the formation of the embankments, subgrades, shoulders, building sites and other places as directed.
  2. Surplus suitable materials from excavations shall be wasted on the site as indicated, spreading and leveling as directed.
- D. Unsuitable excavated material: Remove from the site and dispose of all unsuitable material unless otherwise approved by the Engineer.
- E. Rock excavation:
1. Notify the Engineer upon encountering rock or similar material which cannot be removed or excavated by conventional earth moving or ripping equipment.
  2. Do not use explosives without written permission from the Engineer.

3. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
  4. The Contractor shall be solely responsible for any damage resulting from the use of explosives.
  5. The Contractor is responsible for securing all permits required in performing this work.
- F. Unauthorized excavation:
1. Excavation of material to depths below the grades indicated unless so directed by the Engineer will be deemed unauthorized excavation.
  2. Unauthorized overexcavation shall be backfilled and compacted without any additional expense to the Owner.
- G. Authorized overexcavation:
1. In the event that it is necessary to remove unsuitable material to a depth greater than that shown on the drawings or otherwise specified, the Contractor shall remove, replace and compact such material with suitable material as directed by the Engineer at no additional expense by the Owner.

### 3.6 FILLING AND BACKFILLING

- A. Use fills formed of suitable material placed in layers of not more than 8" in depth measured loose and rolled and/or vibrated with suitable equipment until compacted.
- B. Do not place rock that will not pass through a 6" diameter ring within the top 12" of the surface of the completed fill or rock that will not pass through a 3" diameter ring within the top 6" of the completed fill.
- C. Do not use broken concrete or asphaltic pavement in fills.
- D. Selection of borrow material:
1. Material in excess of that available on the site shall be suitable material furnished by the Contractor from private sources selected by the Contractor. The material shall be approved by the Engineer before use. All expenses involved in securing, developing, transporting and placing the material shall be borne by the Contractor.
- E. Placing and compacting:
1. Place backfill and fill materials in layers not more than 8" in loose depth.
  2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
  3. Compact each layer to required percentage of maximum density for the area.
  4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
  6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.

- F. Moisture control:
1. Do not use soil material that is either too dry or too wet to achieve proper compaction.
  2. Where subgrade or layer of soil material is too dry to achieve proper compaction, uniformly apply water to surface of soil material such that free water does not appear on the surface during or subsequent to compacting operations.
  3. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
  4. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the Engineer.
- G. Compaction requirements (where a geotechnical report is supplied, the more stringent requirements shall apply):
1. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
  2. Fill beneath roadway:
 

Top 12" of subgrade	100%
All other fill material	95%
  3. Embankments:
 

Top 12" of subgrade	98%
All other fill material	95%
  4. Fill beneath walkways:
 

Top 12" of subgrade	95%
All other fill material	90%
  5. Lawn and unpaved open areas:
 

All other fill material	90%
-------------------------	-----

### 3.7 FINISH GRADING

- A. General:
1. Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas.
  2. Smooth the finished surfaces within specified tolerance.
  3. Grade with uniform levels or slopes between points where elevations are shown on the drawings, or between such points and existing grades.
  4. Where a change of slope is indicated on the drawings, construct a rolled transition section having a minimum radius of approximately 8'0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.
- B. Grading adjacent to structures: Grade areas adjacent to buildings to achieve drainage away from the structures and to prevent ponding.
- C. Ditches and gutters and swales:
1. Cut accurately to the cross sections, grades and elevations shown.
  2. Maintain excavations free from detrimental quantities of leaves, sticks, trash and other debris until completion of the work.

3. Dispose of excavated materials as specified herein; do not in any case deposit materials within 3'0" of the edge of a ditch.

### 3.8 FIELD QUALITY CONTROL

- A. Secure the Engineer's construction review and observation and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- B. Field density determinations will be made, at no cost to the Contractor, to ensure that the specified densities are being obtained. Field density tests will be performed as determined by the Engineer, considering the following:
  1. At areas to receive paving, at least one field density test for every 5,000 sq. ft. of subgrade area, but not less than three tests.
  2. In each compacted fill layer, one field density test for every 5,000 sq. ft. of overlaying paved area, but not less than three tests.
  3. In fill beneath structures, one field density test for every 2,500 sq. ft. in each layer.
  4. Other tests as deemed necessary by the Engineer.
- C. If, in the Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing until specified requirements are met.
  1. Additional testing will be provided by the Owner's selected testing laboratory and all costs for the additional testing will be borne by the Contractor.
- D. Proofrolling:
  1. The Contractor shall proofroll subgrade of areas to receive paving, structures on fill or impervious lining material.
    - a. Make not less than 3 passes of a 25 to 50 ton rubber tired roller over the full area.
    - b. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory materials, compacted as specified herein.

### 3.9 PLACING TOPSOIL

- A. Upon completion of site grading and other related site work, topsoil shall be uniformly spread over the graded or improved areas. Topsoil shall be evenly distributed to conform to final grade elevations shown on the plans.
- B. Place, level and lightly compact topsoil to a depth of not less than 3".
- C. Maintain topsoil free of roots, rocks, debris, clods of soil and any other objectionable material which might hinder subsequent grassing or mowing operations.
- D. Any surplus materials shall be removed from the site, unless the owner approves areas on-site for disposal.

### 3.10 MAINTENANCE

- A. Protection of newly graded areas:



1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
  2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

### 3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

**SECTION 31 30 02**  
**TRENCHING, BACKFILLING FOR UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in other divisions of these Specifications.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

**1.3 JOB CONDITIONS**

- A. Existing utilities:
  - 1. There now exists in the construction areas, waterworks, storm drainage, sanitary sewers, gas mains and other utilities.
  - 2. Approximate location of certain underground lines and structures are shown on the plans for information only, other underground lines or structures are not shown.
  - 3. Locate these and other possible unknown utility lines using electronic pipe finder, or other approved means.
  - 4. Locate, excavate and expose all existing underground lines in advance of trenching operations.
  - 5. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these utilities in the execution of his work under this Section.
  - 6. The Contractor shall familiarize himself with the existing conditions and be prepared to adequately care for and safeguard himself and the Owner from damage.
- B. Notification of intent to excavate:
  - 1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
  - 2. Notification of intent to excavate may be given by calling this toll free number: 1-888-721-7877.

- C. Protecting trees, shrubbery and lawns:
  - 1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Engineer.
    - a. Any such trees and shrubbery necessary to be removed shall be heeled in and replanted.
  - 2. Where trenches cross private property through established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replacement is approved by the Engineer.
    - a. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials.
- D. Clearing:
  - 1. Perform all clearing necessary for installation of the complete work.
  - 2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the rights-of-way obtained for the Work.
  - 3. All timber of merchantable size shall remain the property of the Owner and shall be trimmed and cut in such lengths as directed and stacked along the edge of the right-of-way.
  - 4. All other material, including trimmings from above, shall be completely disposed of in a satisfactory manner.
- E. Removing and resetting fences:
  - 1. Where existing fences must be removed to permit construction of utilities:
    - a. Remove such fences and, as the Work progresses, reset the fences in their original location and condition, unless otherwise shown on the plans.
    - b. Provide temporary fencing or other safeguards as required to prevent stock and cattle from wandering to other lands.
- F. Restoration of disturbed areas:
  - 1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.
    - a. For existing areas with sod type grasses, replace with new sod. Existing sod may be reused where properly removed and stored.
  - 2. Do not interpret this as requiring replacement of trees and undergrowth in undeveloped sections of the rights-of-way.
- G. Minimizing silting and bank erosion during construction:
  - 1. During construction, protective measures shall be taken and maintained to minimize silting and bank erosion of creeks and rivers adjacent to the work being performed during construction.
- H. Blasting is not permitted.

## PART 2 - PRODUCTS

### 2.1 EXCAVATED MATERIALS

- A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.
- B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.
- C. Remove and deposit unsuitable or excess materials as directed by the Engineer.

### 2.2 BACKFILL MATERIALS

- A. Provide from materials excavated for installation of utility.
  - 1. Select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2" in greatest dimension for backfill up to 12" above top of utility being covered.
  - 2. Do not permit rocks larger than 2" in greatest dimension in top 6" of backfill.

### 2.3 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material as approved by the Engineer at no additional expense to the Owner.
- C. Provide select materials from on-site if acceptable material as approved by the Engineer is available on-site. Otherwise, provide approved select material from an off-site source.

## PART 3 - EXECUTION

### 3.1 PROCEDURES

- A. Existing utilities:
  - 1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.
  - 2. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
  - 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
  - 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
  - 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.

- B. Locations within streets or highways:
1. Comply with South Carolina Department of Transportation's (SCDOT) "Encroachment Permit" issued for the Work, and the South Carolina Department of Transportation's (SCDOT) *"A Policy for Accommodating Utilities on Highway Rights-of-Way"*.
  2. Take all precautions and comply with all requirements as may be necessary to protect the improvements, including barricades for protection of traffic.
  3. Keep minimum of one lane open to traffic at all times where utility crosses street or highway.
- C. Protection of persons and property:
1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
  2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
  3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
- D. Dewatering:
1. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.
  2. Maintain the ground water level a minimum of 3-feet below the trench bottom during excavation, installation and backfilling.
    - a. Material disturbed below the invert elevation due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.
    - b. Use sumps, pumps, drains, trenching, wells, vacuum or well point system as necessary to maintain the ground water level a minimum of 3-feet below the trench bottom and maintain a dry excavation.
    - c. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.
    - d. Provide monitoring wells sufficient in size, location, number and depth to monitor the ground water level in the construction area during excavation and backfill operations.
    - e. Maintain dewatering operations until backfilling and compaction operations are complete.
  3. Water pumped or drained from trenches must be treated by an appropriately sized sediment and erosion control device prior to leaving the site. Discharging untreated or contaminated dewatering effluent is prohibited.
    - a. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.
    - b. Prevent flooding of streets, roadways, or private property.
    - c. Prevent onsite erosion that can be caused by concentrated discharges related to dewatering pumping, drains, or trenching.
    - d. Provide engines driving dewatering pumps with residential type mufflers.
- E. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

- F. Maintain access to adjacent areas at all times.

### 3.2 TRENCH EXCAVATION (Unclassified)

- A. Provide sloping, sheeting, shoring, and bracing for excavations conforming with 29CFR1926 Subpart P-Excavations and the Contract Documents.
- B. Remove all materials of whatever substance encountered.
- C. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.
- D. Open cut:
  - 1. Excavate for utilities by open cut.
  - 2. If conditions at the site prevent such open cut, and if approved by the Engineer, tunneling may be used.
  - 3. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.
  - 4. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.
  - 5. Remove wet or otherwise unstable soil incapable of properly supporting the utility, as determined by the Engineer, to depth required and backfill to proper grade with stone bedding material, at no additional cost to the Owner.
  - 6. Excavating for appurtenances:
    - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
    - b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the Owner.
- E. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.
- F. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.
  - 1. Remove in units when level of backfilling has reached the elevation necessary to protect the utility work and adjacent property.
  - 2. Sheeting at the bottom of trenches over 10' deep for sewers 15" and larger in size, shall remain in place and be cut off no less than 2" above top of pipe, at no additional cost to the Owner.
- G. Depressions:
  - 1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
  - 2. Except where rock is encountered, do not excavate below the depth indicated or specified.

3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified, and to provide 6" clearance in any horizontal direction from all parts of the utility and appurtenances.
- H. Special requirements relating to excavation for specific types of utilities shall comply with the following:
1. Electrical conduit:
    - a. Provide depth of cover shown or minimum cover of 36", whichever is greater.
    - b. Where minimum cover only is required, carry excavations to depths necessary to properly grade the conduit on tangents and vertical curves as directed by the Engineer.
    - c. Provide minimum clearance of 12" between conduit and trench wall or sheeting and bracing lines.
    - d. If minimum cover of 36" cannot be provided, then thermoplastic piping may not be used. Use ductile iron piping or other Engineer-approved material.
- I. Comply with pertinent OSHA regulations in regards to the excavation of utilities.

### 3.3 BACKFILLING

- A. General:
1. Backfill trenches and excavations immediately after the pipes are laid, unless other protection is directed or indicated.
  2. Select and deposit backfill materials with special reference to the future safety of the pipes.
  3. Reopen trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the Engineer.
  4. Surplus material shall be disposed of as directed by the Engineer.
  5. Original surface shall be restored to the approval of the Engineer.
  6. Maintain proper dewatering during backfill and compaction operations.
- B. Lower portion of trench:
1. Deposit approved backfill and bedding material in layers of 6" maximum thickness, and compact with suitable tampers to the density of the adjacent soil until there is a cover of not less than 24" over sewers and 12" over other utility lines.
  2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.
- C. Remainder of trench:
1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6" or 1/2 the layered thickness, whichever is smaller, in any dimension.
  2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the soil engineer.
- D. Adjacent to buildings: Mechanically compact backfill in 6" layers within ten (10') feet of buildings.

- E. Under roads, streets and other paved areas:
  - 1. Mechanically tamp in 6" layers using heavy duty pneumatic tampers or equal.
  - 2. Tamp each layer to a density equivalent of not less than 100% of an ASTM D 698 Proctor Curve.
  - 3. Provide additional compaction by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone.
  - 4. Refill any settlement with crushed stone and continue such maintenance until replacement of pavement is authorized by the Engineer.
- F. Undeveloped areas:
  - 1. Backfill in wooded, swampy or undeveloped areas shall be as specified hereinbefore, except that tamping of the backfill above a level 2' over the top of the pipe will not be required.
  - 2. Mound excavated material neatly over the ditch to provide for future settlements.

### 3.4 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

### **END OF SECTION**



**SECTION 31 40 01**  
**EROSION AND SEDIMENT CONTROL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

**1.2 GENERAL**

- A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to South Carolina Department of Health and Environmental Control regulations.

**PART 2 - PRODUCTS**

**2.1 CRUSHED STONE**

- A. Provide No. 1 aggregate (ASTM C 33) as defined in Section 815 of the SCDOT Standard Specifications for Highway Construction, Latest Edition, for the stabilized construction entrance and exit.
- B. Provide #57 crushed stone for temporary sediment barriers around inlets and for temporary stone check dams.

**2.2 GRASSING**

- A. Comply with Section 32 92 02 – Grassing for Stabilization.

**2.3 SILT FENCE**

- A. All posts to be self-fastener angle steel, 5' in length.
  - 1. Wooden posts are not acceptable.
- B. Woven wire shall conform to the requirements of ASTM A 116, Class I zinc coating for wire. Each woven square shall measure 5.33" X 12". The top and bottom wires shall be 10 gauge. All other wires shall be 12-1/2 gauge.
  - 1. Securely attach woven wire to posts with wire ties.
- C. Provide filter fabric meeting the requirements of the South Carolina Department of Health and Environmental Control (SCDHEC), complying with the most current edition of the SCDOT Standard Specifications for Highway Construction and appearing on the SCDOT Approved Materials Sheet #34.
  - 1. Limit splices in filter fabric using continuous rolls whenever possible.

2. Whenever splices are necessary a minimum overlap of 6" is required and all splices must occur at a post so that the integrity of the fence is not compromised.
  3. Securely attach filter fabric to top of woven wire and at posts with wire ties.
- D. Silt fences should be continuous and transverse to the flow. The silt fence should follow the contours of the site as closely as possible. Place the fence such that the water cannot runoff around the end of the fence.

#### 2.4 EROSION CONTROL BLANKET

- A. Use erosion control blanket S150, from North American Green or approved equal.
1. Use Biostakes where staples are required or indicated on the drawings for stabilization.
    - a. Staple in pattern recommended by blanket manufacturer.
  2. Staple locations must be clearly marked on the blanket when stakes are used.

#### 2.5 RIP-RAP

- A. Comply with Section 31 40 02 - Rip-Rap.

#### 2.6 FILTER FABRIC (Temporary Stone Check Dam)

- A. Use Stablenka Filter Fabric (T-140N), Mirafil (140N) or approved equal.

#### 2.7 SEDIMENT TUBES

- A. Use sediment tubes as designated on the plans to control erosion along contours, around inlets, and in drainage conveyance swales.
- B. Use sediment tubes manufactured by an experienced manufacturer producing tubes for erosion control.
- C. Tube fill is to be composed of 100% weed free materials consisting of a mix of some or all of the following: curled excelsior wood, natural coconut fibers, hardwood mulch and agricultural straw.
- D. Tubular netting is to be constructed of a flexible outer netting that will contain the fill materials and sediment. Netting is to be constructed from seamless high density polyethylene, polyester, and/or ethyl vinyl acetate, photodegradable materials, treated with ultraviolet stabilizers.
- E. Tubes are to be minimum 20-inches in diameter with minimum weight of 3.2 lbs per foot +/- 10%. Minimum tube length is 10-feet. Netting weight is to be 0.35 oz/foot minimum.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Construct and maintain all erosion control measures until the substantial completion of the project.

### 3.2 TEMPORARY CONSTRUCTION ENTRANCE/EXIT

- A. Construct a gravel area or pad at points where vehicles enter and leave a construction site.
- B. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade and place gravel to the grade and dimensions shown on the plans.
- C. Construct drainage channels to carry water to a sediment trap or other suitable outlet.
- D. Use geotextile fabrics to improve stability of the foundation in locations subject to seepage or high water table.
- E. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site by periodic top dressing with two inches of stone.
- F. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary.
- G. Immediately remove objectionable materials spilled, washed, or tracked onto public roadways.

### 3.3 TEMPORARY GRASSING

- A. Provide a temporary cover for erosion control on disturbed areas that will remain unstabilized for a period of more than 30 days in accordance with Section 32 92 02.
- B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles where vegetation is needed for less than 1 year.
- C. Provide grassing on slope 5% or greater within 14 days of disturbance. Comply with Section 32 92 02.

### 3.4 SILT FENCE

- A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.
- B. Place at the extreme limits of the area to be disturbed as shown.
- C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.

- D. Space posts 10'-0" on center, maximum or as indicated on the drawings.
- E. Remove sediment deposits prior to reaching one-third height of the fence.
- F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on plan.

### 3.5 INLET PROTECTION

- A. Construct temporary sediment barriers around storm drain curb inlets using block and gravel as indicated on the drawings.
- B. Construct metal frame barriers around grate and frame of drop inlets as indicated on the drawings.
- C. Inspect structure after each rainfall and repair as required.
- D. Remove sediment when trap reaches one-half capacity.
- E. Remove structure when protected areas have been stabilized.

### 3.6 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the plans or on all embankments with slopes equal to or steeper than 2-1/2:1.

### 3.7 TEMPORARY STONE CHECK DAMS

- A. Utilize temporary stone check dams as indicated on the plans or directed by Engineer.
- B. Provide temporary stone check dams constructed of both rip-rap and #57 stone, as illustrated on the plans.

### 3.8 SEDIMENT TUBES

- A. Construct small U-shaped trench that is 20% of depth of tube perpendicular to stormwater flow pattern.
- B. Anchor tube in trench according to manufacturers recommendations.
- C. Compact the upstream soil surface adjacent to the tube.
- D. Backfill sediment tube with coarse filter material on the upstream side.
- E. Follow manufactures recommendation on installation.
- F. Maintain, repair and/or replace sediment tubes as required to maintain their effectiveness throughout the project

### 3.9 MAINTENANCE

- A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.
- B. Inspect erosion control devices and clean or otherwise remove silt buildup as necessary once a week or 24-hours following a rain event of  $\geq 0.1$ ".

### 3.10 REMOVAL

- A. Remove temporary structures after protected areas have been stabilized.

### 3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

**SECTION 31 40 03**  
**FABRIC UNDERLAY MATERIAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide stabilization fabric underlay material on existing grade under paving as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these Specifications.
  - 2. Section 31 20 01 - Site Grading.
  - 3. Section 32 12 17 - Stone Base Course.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

**1.3 SUBMITTALS**

- A. Not Used.
- B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Certificates, signed by the materials producer and the asphalt paving subcontractor, stating that the materials meet or exceed the specified requirements.

**1.4 PRODUCT HANDLING**

- A. Not Used.

**PART 2 - PRODUCTS**

**2.1 PROPERTIES**

- A. Provide fabric woven from isolactic polypropylene monofilaments, non-biodegradable, resistant to chemicals and treated to withstand exposure to ultraviolet degradation.

- B. Fabric shall have the following properties:

1.	Grab Tensile Strength	315 lb.
2.	Grab Elongation	15%
3.	Mullen Burst Strength	600 psi
4.	Trapezoid Tear Strength	120 lb.
5.	Apparent Opening Size (AOS)	.425 mm      40 (U.S. Sieve)
6.	Permitivity	0.05 Sec <sup>-1</sup>
7.	Flow Rate	4.0 gal/min/ft <sup>2</sup>
8.	Thickness	25 mils
9.	Weight	6.0 oz./sq. yd.
10.	Ultraviolet Stability	70% @ 500 hours

- C. Fabric underlay material shall be Mirafi 600X or approved equal.

### PART 3 - EXECUTION

#### 3.1 EQUIPMENT AND CONSTRUCTION METHODS

- A. Equipment and construction methods shall conform with the requirements of the South Carolina State Highway Department Standard Specifications for Highway Construction, Edition of 2004, Section 305.06 through 305.15, entitled "Construction Requirements", and latest revisions and supplements.

#### 3.2 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the lump sum price bid for the project.

### END OF SECTION

## **SECTION 32 12 16 ASPHALT PAVING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

A. Work included: Provide asphaltic concrete paving where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these Specifications.
2. Section 31 20 01 - Site Grading.
3. Section 32 12 17 - Stone Base Course.
4. Section 32 17 23 - Pavement Marking and Signage.
5. Section 32 12 20 - Milling, Cutting, and Replacing Pavements.

#### **1.2 QUALITY ASSURANCE**

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

#### **1.3 SUBMITTALS**

A. Not Used.

B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.
2. Certificates, signed by the materials producer and the asphalt paving Subcontractor, stating that materials meet or exceed the specified requirements.

#### **1.4 PRODUCT HANDLING**

A. Not Used.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications for Highway Construction" and latest revisions and supplements.



## 2.2 ASPHALTIC CONCRETE MIXTURE (INTERMEDIATE COURSE)

- A. Materials and composition of mixture shall comply with Section 402 of the SCDOT's "Standard Specifications for Highway Construction" and latest revisions and supplements.
- B. Provide hot plant mixed asphaltic concrete paving materials.
  - 1. Temperature leaving the plant: 290°F minimum, 320°F maximum.
  - 2. Temperature at time of placing: 280°F minimum.

## 2.3 ASPHALTIC CONCRETE MIXTURE (SURFACE COURSE)

- A. Materials and composition of mixture shall comply with Section 403 of the SCDOT's "Standard Specifications for Highway Construction" and latest revisions and supplements.
- B. Provide hot plant mixed asphaltic concrete paving materials.
  - 1. Temperature leaving the plant: 290°F minimum, 320°F maximum.
  - 2. Temperature at time of placing: 280°F minimum.

## 2.4 EQUIPMENT

- A. Comply with requirements of Section 401 of SCDOT's "Standard Specifications" and latest revisions and supplements.

# PART 3 - EXECUTION

## 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
  - 1. Sweep primed surfaces if needed.
  - 2. Adjust frames and covers if needed.

## 3.2 WEATHER RESTRICTIONS

- A. Do not apply asphalt mixtures to a wet or frozen surface or when air temperature is below 40°F in the shade and falling, or below 35°F in the shade and rising.

## 3.3 SPREADING AND FINISHING

- A. On arrival at point of use, dump directly into mechanical spreader.
- B. Immediately spread and strike off true to the line, grade and cross section indicated, to such loose depth that when work is completed, the indicated thickness or weight per square yard will be secured.

- C. Correct irregularities while the mixture is still hot.
- D. At locations not readily accessible to mechanical spreaders, acceptable hand spreading methods may be used.
- E. Finished surfaces placed adjacent to curbs, gutters, manholes, etc., shall be approximately 1/4" above the edges of these structures.

#### 3.4 COMPACTION

- A. Perform initial rolling with 3-wheel steel roller or a steel wheel 2-axle tandem roller.
- B. Follow initial rolling with at least four complete coverages by a pneumatic tired roller.
- C. Complete rolling with steel wheel 2-axle tandem roller.
- D. Rolling shall start longitudinally at the sides and proceed gradually toward the center of the pavement, overlapping on successive trips approximately 1/2 the width of the roller.
- E. Use hand or mechanical tampers in areas not accessible to powered rollers.
- F. Surface mixture after compaction shall be smooth and true to the established crown and grade.
- G. Finished paving smoothness tolerance:
  - 1. Free from birdbaths.
  - 2. No deviations greater than 1/8" in 6'.

#### 3.5 PROTECTION OF SURFACE

- A. Allow no traffic on surface until the mixture has hardened sufficiently to prevent distortion.

#### 3.6 FLOOD TEST

- A. Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.
- B. If a depression is found where water ponds to a depth of more than 1/8" in 6', fill or otherwise correct to provide proper drainage.
- C. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

#### 3.8 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the lump sum price bid for the project.

### END OF SECTION

**SECTION 32 12 17**  
**STONE BASE COURSE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide crushed stone base (with prime) constructed on the compacted subgrade where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these Specifications.
  - 2. Section 31 20 01 - Site Grading.
  - 3. Section 32 12 16 - Asphalt Paving.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

**1.3 SUBMITTALS**

- A. Not Used.
- B. Certificates, signed by materials producer, stating that materials meet the specified requirements.

**1.4 PRODUCT HANDLING**

- A. Not Used.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications For Highway Construction," latest edition with revisions and supplements.

**2.2 FINE AGGREGATE**

- A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications For Highway Construction," latest edition with revisions and supplements.

## 2.3 COARSE AGGREGATE

- A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications For Highway Construction," latest edition with revisions and supplements.

## 2.4 COMPOSITE MIXTURE

- A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications For Highway Construction," latest edition with revisions and supplements.

## 2.5 PRIME ASPHALT

- A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications For Highway Construction," latest edition with revisions and supplements.
- B. Provide prime coat from a supplier listed on the most recent edition of SCDOT Qualified Product List 38.

# PART 3 - EXECUTION

## 3.1 PREPARATION OF SUBGRADE

- A. Proofroll all areas to receive crushed stone paving.
  - 1. Make not less than three passes over the full area, using a 35 to 50 ton rubber tired roller.
- B. Remove all soft, unstable or unsuitable material that will not compact readily.
  - 1. Remove to full depth of unsuitable material, or to a depth of 30", whichever is less.
  - 2. Replace with satisfactory materials.
- C. Fill all holes, ruts or depressions which develop in the subgrade with approved on-site material, bringing subgrade to indicated line and grades.
- D. Compact subgrade using suitable construction procedures to provide not less than 95% Standard Proctor Maximum Dry Density.
- E. Seal roll the subgrade surface with a steel wheel roller, sealing the surface against excessive water infiltration.

## 3.2 PLACING AND MIXING OF PAVING MATERIAL

- A. Place aggregates using spreader boxes or other approved spreaders uniformly on one operation.

- B. Take care to avoid segregation of the fine from the coarse aggregate during handling, spreading or shaping operations.
- C. Mix, while at proper moisture, with motor grader or other equipment and maintain to required section and grade until thoroughly compacted.

### 3.3 ROLLING AND COMPACTING

- A. Perform using 3-wheel steel wheel roller weighing not less than 10 tons, tandem roller weighing at least 8 tons, or other rollers approved by the Engineer.
- B. Start rolling at edges and proceed toward the center, continue rolling until aggregates are firmly keyed or set.
- C. When initial compaction is completed, should voids remain, place fine aggregates on the surface in an amount only sufficient to fill the voids.
- D. Broom, wet and roll until coarse aggregate is set, bonded and thoroughly compacted for full width and depth.
- E. Compact stone base course to provide not less than 100% Modified Proctor Maximum Dry Density.

### 3.4 ALLOWABLE TOLERANCES

- A. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 1/2".
  - 1. Depth measurements will be made by digging through the base at intervals no closer than 250', nor greater than 500' apart.
  - 2. Where thickness is less than depth specified minus 1/2", it shall be corrected as directed by the Engineer.
- B. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/8" in 10', parallel to the center line of the roadway nor more than 1/2" from a template conforming to the cross sections shown on the plans.
- C. Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required.

### 3.5 PLACING PRIME COAT

- A. Allow base course to season sufficiently to permit uniform penetration.
- B. Do not apply to wet surfaces or when the temperature is below 60°F in the shade and falling, or below 55°F in the shade and rising.
- C. Clean surfaces of all dust, dirt, clay, etc. using mechanical brooms, etc.
- D. Apply prime material, using pneumatic mounted distributors, at a rate of 0.25 to 0.30 gallon per square yard.

- E. Permit no traffic on primed surfaces until bituminous material has penetrated and dried sufficiently that it does not pick up under traffic.

### 3.6 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for this work and all costs for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

**SECTION 32 12 20**  
**MILLING, CUTTING AND REPLACING PAVEMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Milling, cutting and replacement of existing pavements for installation of utility lines, as specified herein, and as needed for a complete and proper installation of transitions to existing pavement at project boundaries.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these specifications.
  - 2. Section 31 30 02 - Trenching, Backfilling for Utilities.
  - 3. Section 32 12 16 - Asphalt Paving.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of this Section.

**1.3 SUBMITTALS**

- A. Not Used.

**1.4 PRODUCT HANDLING**

- A. Not Used.

**1.5 WARRANTY**

- A. All remove and replace pavement work shall be warranted for two years beginning on the date of acceptance by the Owner.

**PART 2 - PRODUCTS**

**2.1 CONCRETE**

- A. Comply with Section 03 30 00, using strength specified herein.

**2.2 ASPHALTIC CONCRETE**

- A. Comply with Section 32 12 16.

**2.3 AGGREGATE BASE COURSE WITH PRIME**

- A. Comply with Sections 32 12 16 and 32 12 17.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Remove to neat lines and dispose of as directed.
- B. Replace with bases and pavements as required by Sections 32 12 16 and 32 12 17 and the Construction Plans.

#### 3.2 CUTTING

- A. Asphalt pavement or base:
  - 1. Cut on straight and true lines, to a minimum depth of 2", using powered concrete saw.
  - 2. Shear off remaining depth with pneumatic tools.
- B. Concrete sidewalks shall be removed back to the nearest joint on each side of the crossing.
- C. Cut to straight and true lines with powered concrete saw.

#### 3.3 MILLING

- A. Use self-propelled milling equipment capable of maintaining accurate cut depth and slope and providing smooth cut edges.
- B. Ensure the equipment can accurately and adequately establish profile grade and control cross slope.
- C. Equip the milling machine with integral material pickup and truck discharges.
- D. Ensure the milling machine has effective means for dust control.
- E. Material size to comply with SCDOT specifications.
- F. All asphalt pavement designated for milling, unless otherwise provided, must be disposed of by the Contractor at no additional cost to the Owner.

#### 3.4 REPLACEMENT

- A. Concrete sidewalks:
  - 1. Replace with 4000 psi concrete.
  - 2. Depth shall be equal to existing section removed, but not less than 4".
  - 3. Finish surface to match existing sidewalk.
- B. Flexible pavements:
  - 1. Compact subgrade according to Section 31 10 01.
  - 2. Undercut each edge 6" to form a shelf.
  - 3. Reconstruct roadway according to details shown on the Construction Plans.



4. Taper resurfacing to existing pavement evenly for a distance of 50 feet beyond repaired area, or as shown on the Construction Plans.
5. Comply with Section 32 12 16.

### 3.7 MEASUREMENT AND PAYMENT

- A. No separate measurement or payment will be made for the work under this section and all costs for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

SECTION 32 13 13  
CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete sidewalks.
2. Concrete integral curbs and gutters.
3. Concrete median barriers.
4. Concrete base and surface for parking areas and roads.
5. Small miscellaneous slabs.

B. Related Sections:

1. Section 31 23 16 - Excavation and Fill: Compacted subgrade for paving.
2. Section 32 11 23 - Aggregate Base Courses: Compacted base for paving.
3. Section 32 12 16 - Asphalt Paving: Asphalt wearing course.
4. Section 32 17 23 - Pavement Markings.
5. Section 33 05 61 - Concrete Manholes: Frames and lids in paving.

1.2 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO)

1. AASHTO M 31 – Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. AASHTO M 32 – Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
3. AASHTO M 148 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
4. AASHTO M 282 – Standard Specification for Joint Sealants, Hot Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.

B. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. [ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.]

C. ASTM International:

1. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
2. ASTM A 497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
3. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

5. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
6. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
7. ASTM D3406 – Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.

D. SCDOT Standard Specifications:

1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals
- B. Concrete Mix Design: Submit concrete mix design 30 days prior to use of concrete.
- C. Product Data: Submit data on joint materials, admixtures, and curing compounds.
- D. Manufacturer's Certification: Certify products are produced at a plant approved by SCDOT and that products meet or exceed specified requirements.
- E. Installer Certification: Certify installer is on list of SCDOT prequalified contractors with an approved Quality Control Plan.
- F. Process Control Plan: Submit process control plan for delivering and placing concrete.
- G. Samples: Submit two sample panels, 2 inch x 12 inch in size, illustrating exposed aggregate finish.

### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with SCDOT Standard Specifications, except as modified herein.
- B. Maintain one copy of document on site.
- C. Obtain cementitious materials from same source throughout.

### 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section and prequalified by SCDOT.
- B. Installer: Company specializing in performing Work of this Section and prequalified by SCDOT.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Instructions to Bidders: Environmental conditions affecting products on site.
- B. Do not place concrete when base surface temperature or air temperature in the shade is 40 degrees F and falling or surface is wet or frozen.
- C. Do not place concrete when air temperature in the shade is 95 degrees F and rising or when concrete temperature is greater than 95 degrees F.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

- A. Slip Form Methods: Use slip form methods wherever possible.
- B. Fixed Form Materials: Metal conforming to SCDOT Standard Specifications.

### 2.2 JOINT MATERIALS

- A. General: Conform to SCDOT Standard Specifications.
- B. Joint Filler: Sponge rubber or cork type conforming to ASTM D1751 (AASHTO M213) or bituminous, non-extruding, resilient type conforming to ASTM D1752 (AASHTO M153), Type 1; thickness as indicated on Drawings.
- C. Silicone Sealant: Low modulus, cold applied, single component, chemically curing silicone material.
  - 1. Type NS: Non-sag silicone, toolable.
  - 2. Type SL: Self-leveling silicone, tooling not required.
- D. Rubber Asphalt Sealant: Hot poured rubber asphalt joint sealer conforming to AASHTO M282 (ASTM D3406).
- E. Bond Breaker:
  - 1. General: Product that does not stain or adhere to the sealant and is chemically inert and resistant to oils, gasoline, solvents, and primer.
  - 2. For On-Grade Pavements: Circular backer rod, diameter 25 percent larger than joint width.
    - a. Type L, For Cold Pour Sealants Only: Closed cell expanded polyethylene foam. Use with Type NS silicone only.
    - b. Type M, For Cold or Hot Pour Sealants: Closed cell polyolefin with closed skin over an open cell core.
  - 3. For Bridge Decks Only: Bond breaking tape, extruded polyethylene with pressure sensitive adhesive on one side, minimum 0.005 inches thick.

## 2.3 REINFORCEMENT

- A. General: Conform SCDOT latest edition Standard Specifications.
- B. Reinforcing Steel: ASTM A615 (AASHTO M 31); 60 ksi yield grade; deformed billet steel bars; epoxy coated finish.
- C. Dowels and Tie Bars: ASTM A615 (AASHTO M 31); 60 ksi yield grade, plain steel, epoxy coated finish.
- D. Welded Wire Fabric Steel: Deformed type, ASTM A497; unfinished.

## 2.4 CONCRETE MATERIALS

- A. Concrete Materials: Provide fine aggregate, coarse aggregate, Portland Cement, fly ash, ground granulated blast furnace slag, water, air entraining agent, and chemical admixtures in accordance with SCDOT Standard Specifications.

## 2.5 ACCESSORIES

- A. Curing Compound: ASTM C309 (AASHTO M-148), Type 1 clear or translucent or Type 2 white pigmented.

## 2.6 CONCRETE MIX

- A. Mix and deliver concrete in accordance with SCDOT Standard Specifications.
- B. Roadway and Area Pavement concrete: Air entrained conforming to the following criteria:
  - 1. Flexural Strength: 650 psi at 28 days.
  - 2. Slump: 1.5 inch maximum for slip form method, 3 inches maximum for fixed form hand methods.
  - 3. Minimum Cement Content: 526 pounds/cubic yard.
  - 4. Maximum Water/Cement Ratio: 0.559.
  - 5. Air Entrainment: Between 4.5 and 5.5 percent.
- C. Class A Concrete for sidewalk, curb, curb and gutter, and other incidental site concrete: Air entrained, vibrated conforming to the following criteria:
  - 1. Compressive Strength: 3,000 psi at 28 days.
  - 2. Maximum Slump Vibrated: 3.5 inches.
  - 3. Minimum Cement Content: 564 pounds/cubic yard.
  - 4. Maximum Water/Cement Ratio for Angular Aggregate: 0.532.
  - 5. Maximum Water/Cement Ratio for Rounded Aggregate: 0.488.
  - 6. Air Entrainment: 6.0 percent plus or minus 1.5 percent.
- D. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
- E. Use calcium chloride only when approved by the Engineer in writing.

F. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

## 2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services.

B. Submit proposed mix design of each class of concrete to independent firm for review prior to commencement of Work.

C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

D. Test samples in accordance with ACI 301 for compressive strength (cylinders) and flexural strength (beams.)

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify compacted base course is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify utility structure frames and lids are installed in correct position and elevation.

### 3.2 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole, catch basin, and other utility structure frames with oil to prevent bond with concrete pavement.

C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

### 3.3 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### 3.4 REINFORCEMENT

- A. Place reinforcement as indicated on Drawings.
- B. Interrupt reinforcement at contraction and expansion joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.
- D. Provide doweled joints 18 inches on center at transverse joints with one end of dowel set in capped sleeve to allow longitudinal movement.

### 3.5 PLACING CONCRETE

- A. Place concrete in accordance with SCDOT Standard Specifications.
- B. Place concrete using the slip form technique wherever possible.
- C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Place concrete to pattern indicated on Drawings.

### 3.6 PAVEMENT JOINTS

- A. Provide expansion, contraction, and construction joints as indicated on Drawings.
- B. Place expansion joints at 60 foot maximum intervals. Place contraction joints at 20-foot maximum intervals. Align pavement joints with curb, gutter, and sidewalk joints.
- C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/2 inch for backer rod and sealant placement.
- D. Saw cut contraction joints 3/16 inch wide or as indicated at an optimum time after finishing. Cut 1/3 into depth of slab.

### 3.7 SIDEWALK, CURB, AND CURB AND GUTTER JOINTS

- A. Provide sawn joints at 5-foot intervals. Provide 3/4 inch expansion joint at 30 feet maximum and between sidewalks and curbs and structures.
- B. Align sidewalk, curb and gutter joints with pavement joints.

### 3.8 FINISHING

- A. Area Paving: Heavy broom.

- B. Sidewalk Paving: Light broom. [Brush to 6 inch radius with smooth trowel joint edges.]
- C. Median Barrier: Light broom and trowel joint edges.
- D. Curbs and Gutters: Light broom.
- E. Inclined Vehicular Ramps: V-grooves with mechanical equipment and spring tines, perpendicular to slope.

### 3.9 EXPOSED AGGREGATE

- A. Apply surface retarder where exposed aggregate finish is indicated.
- B. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate to match sample panel.
- C. Sand blast concrete surfaces to achieve aggregate exposure surface to match sample panel.

### 3.10 CURING

- A. Place curing compound on concrete surfaces immediately after finishing.
- B. Cover with burlap or polyethylene film to protect from cold weather and rain.

### 3.11 JOINT SEALING

- A. Separate pavement from vertical surfaces with 1/2 inch thick joint filler.
- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- C. Extend joint filler from bottom of pavement to within 1/2 inch of finished surface.

### 3.12 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
- B. Maximum Variation From True Position: 1/2 inch.
- C. Maximum Variation in thickness: 1/2 inch.

### 3.13 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Prepare three concrete test beams for every 1,333 or less square yards of pavement for each class of concrete placed each day.



- C. Prepare one additional test beam during cold weather and cured on site under same conditions as concrete it represents.
- D. One slump test will be taken for each set of test cylinders taken.
- E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- F. Take one 4-inch diameter core for every 1,333 square yards or less of pavement for each class of concrete placed each day.

### 3.14 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

### 3.15 SCHEDULES

- A. Concrete Sidewalks: Class A Concrete, compressive strength of 4,000 psi at 28 days, 4 inches thick, buff color Portland cement, light broom finish.
- B. Roadway Pavement Concrete: Non-reinforced, flexural strength of 650 psi at 28 days, 8 inches thick, wood float finish.
- C. Propane Tank Slab: Class AA Concrete, 4,500 psi 28 day concrete, 6 inches thick, , 6/6 - 6 x 6 inch mesh reinforcement, light broom finish.

END OF SECTION

SECTION 32 17 13  
PARKING BUMPERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Precast concrete parking bumpers.
  - 2. Parking bumper anchors.
- B. Related Sections:
  - 1. Section 32 12 16 - Asphalt Paving.
  - 2. Section 32 13 13 - Concrete Paving.
- C. Parking Bumpers:
  - 1. Basis of Measurement: By each.
  - 2. Basis of Payment: Includes bumper unit and dowels installed.

1.2 REFERENCES

- A. ASTM International:
  - 1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals
- B. Product Data: Submit unit configuration, dimensions.

1.4 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- B. Coordinate the Work with pavement placement and parking striping.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
  - 1. Gage Brothers Concrete Products.
  - 2. Southern Cast Stone Co., Inc.
  - 3. Parking Bumper Co.
  - 4. Substitutions: Equal per Section 00 21 13 - Instructions to Bidders..

## 2.2 CONCRETE BUMPERS

- A. Precast Reinforced Concrete Mix: Minimum compressive strength of 5,000 psi at 28 days, air entrained to five to seven percent.
- B. Use rigid molds constructed to maintain precast units uniform in shape, size, and finish. Maintain consistent quality during manufacture.
- C. Embed reinforcing steel and drill or sleeve for two dowels.
- D. Cure units to develop concrete quality and to minimize appearance blemishes including non-uniformity, staining, or surface cracking.
- E. Minor patching in plant is acceptable providing appearance of units is not impaired.

## 2.3 CONFIGURATION

- A. Nominal Size: Six inches high, eight inches wide, six feet long.
- B. Profile: Manufacturer's standard cross section with sloped vertical faces, square ends, and drainage slots.

## 2.4 ACCESSORIES

- A. Dowels: Steel, unfinished, 1/2 inch diameter, 24 inches long, pointed tip conforming to ASTM A615.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install units without damage to shape or finish. Replace or repair damaged units.
- B. Install units in alignment with adjacent work.
- C. Fasten units in place with two dowels for each unit bumper.
- D. Core drill concrete pavement 1/8 inch larger than dowel. Seal annular space around hole with grout or sealant.

END OF SECTION

SECTION 32 91 19  
LANDSCAPE GRADING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Final grade topsoil for finish landscaping.
  - 2. Testing Topsoil.
  - 3. Supplying Topsoil.
  - 4. Scarifying substrate surface.
  - 5. Placing and lightly compacting topsoil.
  - 6. Removing excess topsoil from site.
- B. Related Sections:
  - 1. Section 31 20 01 - Excavation and Fill: Cutting and filling to site subgrade.
  - 2. Section 31 23 16.13 - Trenching: Backfilling trenches to subgrade.
  - 3. Section 32 92 02 – Grassing for Stabilization.
  - 4. Section 32 93 00 - Plants: Topsoil fill for trees, plants and ground cover.

1.2 REFERENCES

- A. SCDOT Standard Specifications:
  - 1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Test Results: Submit results of topsoil tests to determine soil amendments required.
- C. Samples: Submit to testing laboratory for independent test, in air-tight containers, 10 pound sample of topsoil.
- D. Materials Source: Submit name and location of imported materials source.

1.4 QUALITY ASSURANCE

- A. Furnish each topsoil material from single source throughout the Work.
- B. Perform Work in accordance with applicable portions of SCDOT Standard Specifications for Highway Construction, latest edition, published by SC Department of Transportation.
- C. Maintain one copy on site.

## PART 2 PRODUCTS

### 2.1 MATERIAL

- A. Topsoil: Original surface soil typical of the area, which is capable of supporting native plant growth; free of large stones, roots, waste, debris, contamination, or other unsuitable material, which may be detrimental to plant growth; pH value of 5.4 to 7.0.
- B. Suitable material excavated from site, amended per requirements of tests is acceptable.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify building and trench backfilling have been inspected.
- C. Verify substrate base has been contoured and compacted.

### 3.2 PREPARATION

- A. Protect landscaping and other features remaining as final Work.
- B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

### 3.3 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove contaminated subsoil.
- C. Scarify surface to depth of 6 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

### 3.4 PLACING TOPSOIL

- A. Place topsoil in areas where seeding, sodding, and planting is required to thickness as scheduled. Place topsoil during dry weather.
- B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- C. Remove roots, weeds, rocks, and foreign material while spreading.
- D. Manually spread topsoil close to plant material, buildings, and pavement to prevent damage.

- E. Lightly compact placed topsoil.
- F. Remove surplus subsoil and topsoil from site.
- G. Leave stockpile area and site clean and raked, ready to receive landscaping.

### 3.5 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Top of Topsoil: Plus or minus 1/2 inch.

### 3.6 PROTECTION OF INSTALLED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Prohibit construction traffic over topsoil. Scarify and regrade disturbed areas.

### 3.7 SCHEDULES

- A. Compacted topsoil thicknesses:
  - 1. Seeded Areas: 6 inches.
  - 2. Sodded Areas: 4 inches.
  - 3. Shrub Beds: 18 inches.
  - 4. Flower Beds: 12 inches.
  - 5. Planter Boxes: To within 3 inches of box rim.
  - 6. Trees: As indicated on Drawings.

END OF SECTION

**SECTION 32 92 02**  
**GRASSING FOR STABILIZATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide grassing of the areas specified herein, or as indicated, for a complete and proper installation.
  - 1. All cleared areas and areas disturbed by the construction operation not stabilized by field turf.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in other divisions of these Specifications.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.
  - 1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, origin, and lot number.
- C. Fertilizer: Conform to State fertilizer law.

**1.3 SUBMITTALS**

- A. Comply with pertinent provisions of the contract documents.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Complete materials list of items proposed to be provided under this Section.

**1.4 PRODUCT HANDLING**

- A. Comply with pertinent provisions of the contract documents.
- B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.
- C. Immediately remove from the site materials that do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

## PART 2 - PRODUCTS

### 2.1 FERTILIZER

- A. Provide commercial balanced 16-4-12 or 12-4-8 fertilizer delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

### 2.2 GRASS SEED

- A. Provide grass seed that is:
  - 1. Free from noxious weed seeds, and recleaned.
  - 2. Grade A recent crop seed.
  - 3. Treated with appropriate fungicide at time of mixing.
  - 4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

### 2.3 LIME

- A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.
- B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

### 2.4 WOOD CELLULOSE FIBER

- A. Provide wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer.
- B. Material to be heat processed so as to contain no germination or growth inhibiting factors.
- C. It shall be dyed (non-toxic) an appropriate color to facilitate metering.

### 2.5 STRAW MULCH

- A. Provide straw or hay material.
  - 1. Straw to be stalks of wheat, rye, barley or oats.
  - 2. Hay to be timothy, peavine, alfalfa, or coastal bermuda.
- B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion and other noxious weeds.

### 2.6 EXCELSIOR FIBER MULCH

- A. To consist of 4" to 6", average length, wood fibers cut from sound, green timber.
- B. Make cut in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood.



## 2.7 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the plans.
- B. Provide Erosion Control Blanket S150, from North American Green, or approved equal.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Seed these areas immediately upon completion of grading or construction and clean-up operations.
  - 1. Slopes greater than four horizontal to one vertical.
  - 2. Utility rights-of-way adjacent to stream banks.
- B. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for planting Schedule No. 1, the turf shall be destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.
- C. Use Rate A lbs. per 1000 sq. ft. on slopes over 5' horizontal to 1' vertical in height and use Rate B lbs. per 1000 sq. ft. on slopes less than 5' horizontal to 1' vertical.

### 3.2 SEEDING SCHEDULES (See Plans)

- A. Mixtures of different types of seed for the various schedules shall be weighed and mixed in proper proportions in the presence of the Engineer.
- B. Schedule No. 1 - Planting dates March 1 to August 15:

<u>Common Name of Seed</u>	<u>Rate A</u>	<u>Rate B</u>
Rye Grain	1	1
Common Bermuda (hulled)	0	1.5
Sericea Lespedeza (clay soils)	1	0
Weeping Love Grass (sandy soils)	1	0
Centipede	0.5	0.5

- C. Schedule No. 2 - Planting dates August 16 - February 28:

<u>Common Name of Seed</u>	<u>Rate A</u>	<u>Rate B</u>
Rye Grain	0	1
Common Bermuda (hulled)	0	1.5
Brown Top Millet	5	0
Common Bermuda (unhulled)	0	2.0

### 3.3 GROUND PREPARATION

- A. Bring all areas to proper line, grade and cross section indicated on the plans.
- B. Repair erosion damage prior to commencing seeding operations.
- C. Loosen seed bed to minimum depth of 3".
- D. Provide and prepare topsoil in accordance with Section 329119.
- E. Conduct soil test to determine pH factor.
  - 1. If pH is not in the range of 6.0 to 6.5, adjust.

### 3.4 APPLICATION OF FERTILIZER

- A. Spread uniformly over areas to be seeded at:
  - 1. Rate of 18 lbs. per 1000 sq. ft. when using 16-4-12.
  - 2. Rate of 25 lbs. per 1000 sq. ft. when using 12-4-8.
  - 3. Use approved mechanical spreaders.
- B. Mix with soil to depth of approximately 3".

### 3.5 SOWING METHODS

- A. General:
  - 1. Perform seeding during the periods and at the rates specified in the seeding schedules.
  - 2. Do not conduct seeding work when ground is frozen or excessively wet.
  - 3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.
- B. Seeding, slopes less than four horizontal to one vertical:
  - 1. Shall conform to Methods EA, WF or WCF as specified hereinafter.
  - 2. Method EA (Emulsified Asphalt):
    - a. Sow seed not more than 24 hours after application of fertilizer.
    - b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.
    - c. Cover seed and lightly compact with cultipacker if seed drill does not.
    - d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.
  - 3. Method WF:
    - a. Sow seed as specified for Method EA.
    - b. Within 24 hours following covering of seeds, uniformly apply excelsior fiber at the rate of 100 lbs. per 1000 sq. ft.
    - c. Apply material hydraulically.
    - d. Seeded areas to be lightly rolled to form a tight mat of the excelsior fibers.
  - 4. Method WCF:
    - a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment.

- b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water.
  - c. Minimum capacity of slurry tank: 1000 gallons.
  - d. Apply fiber mulch at rate of 35 lbs. per 1000 sq. ft.
  - e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
  - f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other.
  - g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.
- C. Seeding, slopes greater than four horizontal to one vertical:
- 1. Sow seed as specified for Method EA, unmulched.
  - 2. Cover seeded area with erosion control blanket.

### 3.6 SECOND APPLICATION OF FERTILIZER

- A. When plants are established and showing satisfactory growth, apply nitrogen at the rate of 1.0 lb. per 1000 sq. ft.
- B. Apply in dry form unless otherwise directed by the Engineer.
- C. Do not apply to stands of temporary grasses.

### 3.7 MAINTENANCE

- A. Maintain all seeded areas in satisfactory condition until final acceptance of the Work.
- B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or mulched.
- C. Repair any eroded areas.
- D. Mow as necessary to maintain healthy growth rate until final acceptance of the Work.

### 3.8 ACCEPTANCE

- A. Permanently seeded areas (Schedule No. 1) will be accepted when the grass attains a height of 2".
- B. No acceptance will be made of temporary seeded areas (Schedule No. 2). Rework and seed with Schedule No. 1.

### 3.9 MEASUREMENT AND PAYMENT

- A. No measurement and payment will be made for the work under this Section and all costs for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

SECTION 32 93 00  
PLANTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Trees, plants, and ground cover.
  - 2. Mulch.
  - 3. Fertilizer.
  - 4. Pruning.
  - 5. Maintenance.
- B. Related Sections:
  - 1. Section 32 91 19 - Landscape Grading: Preparation and placement of topsoil in preparation for the Work of this Section.

1.2 REFERENCES

- A. American National Standards Institute:
  - 1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
  - 2. ANSI Z60.1 - Nursery Stock.
- B. National Arborist Association:
  - 1. NAA - Certification documentation for tree pruning Qualifications.
- C. SCDOT Standard Specifications:
  - 1. Standard Specifications for Highway Construction, latest edition, published by the South Carolina Department of Transportation.

1.3 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy, Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.
- B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.
- C. Submit minimum 10 ounce sample of mulch.
- D. Planting Schedule: Indicate dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from Date of Substantial Completion.

- E. Operation and Maintenance Data: Include maintenance instructions recommending procedures to be established by Owner for maintenance of landscape work during one full year.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Operation and Maintenance Data: Include pruning objectives, types and methods; types, application frequency, and recommended coverage of fertilizer.

#### 1.6 QUALITY ASSURANCE

- A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.
- B. Perform Work in accordance with SCDOT Standard Specifications for Highway Construction, latest edition, published by the SC Department of Transportation.
- C. Maintain one copy of document on site.

#### 1.7 QUALIFICATIONS

- A. Nursery: Company specializing in growing and cultivating plants with 3 years documented experience.
- B. Installer: Company specializing in installing and planting plants 5 years documented experience.
- C. Tree Pruner: Company specializing in performing work of this Section with person certified by National Arborist Association.
- D. Maintenance Services: Performed by installer.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect and maintain plant life until planted.
- C. Deliver plant life materials immediately prior to placement. Keep plants moist.
- D. Plant material damaged as a result of delivery, storage or handling will be rejected.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.
- B. Do not install plant life when wind velocity exceeds 30 mph.

#### 1.10 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- B. Furnish one year warranty for trees, plants and ground cover.

- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

#### 1.11 MAINTENANCE SERVICE

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.
- B. Maintain plant life immediately after placement and continue for maintenance period after date of substantial completion.
- C. Maintenance Time Period: Warranty period. 12 months.
- D. Maintenance includes:
  - 1. Cultivating and weeding plant beds and tree pits.
  - 2. Applying herbicides for weed control. Remedying damage resulting from use of herbicides.
  - 3. Remedying damage from use of insecticides.
  - 4. Irrigating sufficient to saturate root system.
  - 5. Pruning, including removal of dead or broken branches.
  - 6. Disease control.
  - 7. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.
  - 8. Replacing mulch.

### PART 2 PRODUCTS

#### 2.1 TREES, PLANTS, AND GROUND COVER

- A. Planting Stock:
  - 1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
  - 2. Identification: Label individual plants or each bundle of plants when tied in bundles.
  - 3. Plants: No. 1 Grade conforming to "American Standard for Nursery Stock" of American Association of Nurserymen (AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broken branches, decay and other defects.
  - 4. Trees: Furnish with reasonably straight trunks, well balanced tops, and single leader.
  - 5. Deciduous Plants: Furnish in dormant state, except those specified as container grown.
- B. Trees, Plants, and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

#### 2.2 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; phosphorus to exceed 150 units; potassium to exceed 120 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/cm in soil.
- B. Plant Soil Mix: Uniform mixture of 1 part peat and 3 parts topsoil by volume.

#### 2.3 SOIL AMENDMENT MATERIALS

- A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.

1. Tree Fertilizer: Containing 50 percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis or as shown on Drawings.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.
- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- E. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

## 2.4 MULCH MATERIALS

- A. Mulching Material: Composted, shredded hardwood bark, dark brown in color.

## 2.5 ACCESSORIES

- A. Wrapping Materials: Burlap.
- B. Stakes: Softwood lumber, pointed end. Mild steel angle, galvanized, pointed end.
- C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify prepared subsoil and planters are ready to receive work.
- C. Saturate soil with water to test drainage.

## 3.2 PREPARATION OF SUBSOIL AND TOPSOIL

- A. Conform to Section 32 91 19 - Landscape Grading.

## 3.3 PLANTING

- A. Place plants for best appearance.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers.
- D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth as indicated on Drawings under each plant. Loosen and remove burlap, ropes, and wires, from top half of root ball.



E. Place bare root plant materials so roots lay in natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.

F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

#### 3.4 PLANT RELOCATION AND RE-PLANTING

A. Relocate plants as indicated on Drawings or directed by Engineer.

B. Ball or pot removed plants when temporary relocation is required.

C. Replant plants in pits or beds, as described for new plants above.

#### 3.5 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
1 inch	1 stake with one tie
1 – 2 inches	2 stakes with two ties
2 – 4 inches	3 guy wires with eye bolts and turn buckles
Over 4 inches	4 guy wires with eye bolts and turn buckles

#### 3.6 TREE PRUNING

A. When pruning trees is required, lightly prune trees in accordance with ANSI A300 Maintenance Pruning Type: Crown Cleaning.

#### 3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Plants will be rejected when balls of earth surrounding roots has been disturbed or damaged prior to or during planting.

#### 3.8 SCHEDULE

A. Plant Schedule: See plant schedule provided in landscaping plans.

END OF SECTION

**SECTION 33 05 01**  
**WATER DISTRIBUTION SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide water distribution system as shown on the Drawings, specified herein, and needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
  - 2. Section 31 30 02 - Trenching, Backfilling for Utilities.
  - 3. Section 33 05 03 - Disinfection of Potable Water Lines.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be 100% manufactured in the United States.

**1.3 SUBMITTALS**

- A. Not Used.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

**1.4 PRODUCT HANDLING**

- A. Not Used.
- B. Shipment of pipe:
  - 1. Protect pipe with tarp or other means during shipment to prevent truck exhaust from damaging pipe.
- C. Storage of PVC pipe:
  - 1. Store in unit packages as received from manufacturer until just prior to use.
  - 2. Stack units in such manner as to prevent deformation to pipe barrel and bells.
  - 3. Protect from direct sunlight by covering with opaque material if storage period will exceed six weeks.
- D. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Use any pipe material and associated fittings as specified herein, except where use of a particular material is indicated on the plans or specified herein.

### 2.2 PIPE AND FITTINGS

A. General:

1. Pipe sizes 3" and larger: Use ductile iron or plastic pipes unless otherwise indicated. No asbestos cement pipe allowed.
2. Pipe less than 3" size: Use plastic pipe.
3. Any pipe, solder, or flux used shall be lead free (lead free is defined as less than 0.2% lead in solder or flux and less than 8.0% lead in pipes and fittings).
4. Gaskets are to be factory-installed and integral with the pipe.
5. All pipe 4" and larger shall be National Sanitary Foundation (NSF) approved and shall be third party certified as meeting the specifications of ANSI/NSF Standard 61.
6. All materials and products that contact potable water shall be third party certified as meeting the specifications of ANSI/NSF Standard 61.
7. All chemical or products added to the public water supply must be third party certified as meeting the specifications of ANSI/NSF Standard 60.
8. For valves cast all markings integral on the valve body with the size of valve, year of manufacture and the class working pressure.
  - a. Certifications to rate a 150B valve body to a Class 250 valve will not be acceptable.
9. For valves spray coat all interior wetted ferrous surfaces with two-component epoxy applied to a nominal thickness of 3 to 4 mils.
  - a. Coating material to be AWWA and U.S. Food and Drug Administration approved for use with potable water.
10. Exterior Coatings: For ductile iron pipe
  - a. For buried service provide bituminous coating.

B. Pipe:

1. Ductile iron pipe (DIP):
  - a. Comply with ANSI/AWWA C150/A21.50 or AWWA C151/A21.51, latest revision.
  - b. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.
  - c. Wall thickness in accordance with Table 50.5 of ANSI/AWWA C150/A21.50, depth of cover indicated and Type 3 bedding conditions, minimum Pressure Class (Choose pressure rating) as follows:
    - 4" – 12" Pressure Class 350
    - 14" – 20" Pressure Class 350
    - 24" Pressure Class 350

- 30" – 64" Pressure Class 350
  - d. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
- 2. Plastic pipe (PVC):
  - a. General:
    - 1) Marked with National Sanitation Foundation approval at 18" intervals.
    - 2) Gaskets to comply with ASTM F 477.
      - a) Natural rubber gaskets are not acceptable.
  - b. 4" - 12": Comply with ANSI/AWWA C900, Table 2, Pressure Class 150 (DR18).
  - c. 14" and above: Comply with ANSI/AWWA C905, Table 2, Pressure Class 165 (DR 25).
  - d. Plastic pipe 3" and smaller: Comply with ASTM D 2241 for PVC 1120, SDR 21. (200 psi).
  - e. Color of pipe to be blue.

C. Joints:

- 1. Ductile iron pipe:
  - a. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
  - b. Use gaskets and lubricant complying with ANSI/AWWA C111/A21.11. Natural rubber gaskets are not acceptable.
  - c. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints.
    - 1) NSF approved.
  - d. Exposed pipe:
    - 1) Class 53 minimum.
    - 2) Use flanged joints complying with ANSI/AWWA C115/A21.11, latest revision; and
      - i) Provide solid type flanges with country where cast stamped or cast into the flange."
      - ii) Use full face, red rubber, factory cut, 1/16" thick for pipe up to 10" diameter and 1/8" thick for larger sizes.
      - iii) Bolts and nuts shall be standard carbon steel machine bolts, hex head complying with ANSI A21.11/AWWA C111.
- 2. Plastic pipe:
  - a. Use integral bell or coupling type with elastomeric gaskets.
  - b. Integral bells to comply with ASTM D2672.
  - c. Couplings to comply with ANSI/AWWA C900.
  - d. Gaskets to comply with ASTM F477.
    - 1) Natural rubber gaskets are not acceptable.
  - e. Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents. Vegetable shortening shall not be used to lubricate joints.
    - 1) NSF approved.

D. Fittings and specials:

- 1. Ductile iron pipe:

- a. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
- b. Clearly cast the manufacturer's mark, country where cast, year in which the fitting was produced, and the letters "DI" or "Ductile" on the fitting."
- c. Compact fittings for piping 3" - 16" may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.
- d. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
- e. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
- f. The maximum phosphorous level in the casting will be 0.08%.
- g. The fitting surface finish will conform to MSS SP-112 Quality Standard for Evaluation of Cast Surface Finishes.
- h. The manufacturer shall be ISO 9000 certified.
- i. Markings

\* Each fitting shall have the following markings cast integrally to the fitting:

1. Manufacturer's Name or Logo
2. "MJ"
3. Country of origin
4. Manufacturer's Foundry Mark
5. AWWA C-153 or C110
6. Pressure Rating
7. Nominal Diameter (each leg)
8. "DI" or "Ductile"
9. No. of Degrees (bends)

2. Plastic pipe 4" and larger:

- a. Use 150 psi pressure rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10.
- b. Compact fittings for piping 3" - 16" may be provided in accordance with ANSI/AWWA C153/A21.53.88.b.
- c. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
- d. Provide adapter glands, gaskets, etc. as required to accommodate any differences in pipe and fitting dimensions.
- e. Use cement mortar lining complying with ANSI/AWWA C104/A21.4, standard thickness.
- f. The maximum phosphorous level in the casting will be 0.08%.
- g. The fitting surface finish will conform to MSS SP-112 Quality Standard for Evaluation of Cast Surface Finishes.
- h. The manufacturer shall be ISO 9000 certified.
- i. Markings: Each fitting shall have the following markings cast integrally to the fitting:
  - 1) Manufacturer's Name or Logo
  - 2) "MJ"
  - 3) Country of origin
  - 4) Manufacturer's Foundry Mark
  - 5) AWWA C-153 or C110
  - 6) Pressure Rating
  - 7) Nominal Diameter (each leg)

- 8) "DI" or "Ductile"
- 9) No. of Degrees (bends)
3. Plastic pipe 3" and smaller: Use PVC fittings, 160 psi at 73°F pressure rating, joint design to conform to pipe joints.

E. Couplings:

1. Provide couplings where needed to make piping connections and where located on the plans.
2. Provide mechanical joint ductile iron sleeve, full length, minimum 12".
3. Provide cutting-in sleeve where installing fittings in an existing line.
  - a. Provide ductile iron with mechanical joint.
4. Provide restrained joint couplings where restrained joints are indicated on the plans.

F. Restrained joint pipe and fittings:

1. Provide restrained joint pipe and fittings on all piping at each fitting, including valve and fire hydrant connections, and on the pipe joints to a distance of 18' each side of the fitting for 12" piping and smaller and to a distance of 36' each side of the fitting for piping over 12".
  - a. Ductile iron pipe:
    - 1) Provide retainer glands for use with mechanical joint pipe and fittings.
    - 2) Provide wedge type.
    - 3) Provide ductile iron gland conforming to ASTM A 536-80. Provide split gland where standard gland cannot be installed.
    - 4) Provide ductile iron set screws, heat-treated to a minimum hardness of 370 BHN with twist-off nuts and permanent standard hex head remaining.
    - 5) Provide for the following rated pressure with minimum 2 to 1 safety factor; 3" - 16" 350 psi, 18" - 48" 250 psi.
    - 6) Provide tee-head bolts conforming to ANSI/AWWA C111/A21.11 latest revision.
    - 7) Provide "MEGALUG" series 1100 or series 1200 as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved equal.
  - b. Provide restraint for C900 PVC by mechanical means separate from the mechanical joint gasket sealing gland.
    - 1) Provide wide, supportive contact around full pipe circumference as follows:

<u>Size</u>	<u>Restraint Width</u>
4", 6"	1-1/2"
8", 10", 12"	1-3/4"

- 2) Provide means of restraint by machined serrations on inside surface of restraint device designed to provide circumferential loading over the entire restrainer.
  - a) Design to be such that restraint increases with increased in-line pressure.
  - b) Provide a minimum of 8 serrations per inch of restraint width.

- 3) Restraint device to be pressure rated at 350 psi, or equal to the pipe on which it is used and capable of withstanding test pressures of 2 times pressured rating.
- 4) Fusion applied epoxy coating finish per AWWA C-213.
- 5) Provide series 1600 as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved equal.
- c. Provide restraint for C905 PVC pipe 14" and larger by mechanical means separate from the mechanical joint sealing gland.
  - 1) Restraint device to be a two-piece configuration with plurality of individually actuating gripping services.
  - 2) Restraint device body to be manufactured from ductile iron conforming with ASTM A536.
  - 3) Comply with AWWA C111, ANSI 21.11.
  - 4) Pressure rating to match PVC pipe on which it is used with capability to withstand test pressure of 2 times rated pressure.
  - 5) Fusion applied epoxy coating finish per AWWA C-213.
  - 6) Provide series 2800 as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved equal.
- d. Provide restraint for PVC pipe 3" and smaller by split serrated ring.
  - 1) Restraint device to be a two-piece configuration with plurality of individually actuating gripping services.
  - 2) Restraint device body to be manufactured from ductile iron conforming with ASTM A536.
  - 4) Pressure rating to match PVC pipe on which it is used with capability to withstand test pressure of 2 times rated pressure.
  - 5) Fusion applied epoxy coating finish per AWWA C-213.
  - 6) Provide series 6500 as manufactured by EBAA Iron, Inc. of Eastland, Texas, or approved equal.
- e. Provide restraint between PVC and mechanical joint ductile iron fitting where indicated on the plans.
  - 1) Provide device consisting of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C111/A21.11.
  - 2) The device will have a working pressure rating equal to the pipe on which it is used and include a minimum design pressure safety factor of 2:1.
  - 3) Gland body, wedges and wedge actuating components will be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536.
  - 4) An identification number consisting of year, day, plant and shift will be cast into each gland body.
  - 5) Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
  - 6) Provide series 2000 PV by EBAA Iron, Inc. or equal.

G. Tee head bolts: Provide Cor-Ten steel tee head bolts for use on mechanical joints complying with ASTM A242.

H. Plugs or caps:

1. Provide at all pipe ends and unused branches of fittings.
2. All plugs and caps shall be tapped 2" and provided with 2" plug.

3. Plugs and caps to be restrained joint.

## 2.3 LINE DETECTION TAPE

- A. Provide the following:
  1. Provide 2" wide metallic detection tape on all buried PVC piping.
    - a. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
    - b. Foil to be visible from both sides.
    - c. No inks or printing extended to the edges of the tape.
    - d. Encase printing to avoid ink rub-off.
    - e. Tensile strength - 28 lbs/inch.
    - f. Use heat set mylar inks.
    - g. Locate 12" below ground surface in pipe trench.
    - h. Color to be Safety Precaution Blue.
    - i. Wording on tape to indicate "Potable Water" at no greater than 24" on center.

## 2.4 COPPER TRACER WIRE

- A. Provide a continuous 12 gauge blue insulated copper tracer wire when PVC or polyethylene pipe is used.
- B. Approved for direct burial by the manufacturer.
- C. Locate tracer wire a minimum of 6" above top of water main.
- D. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves and meters.
- E. Place in the trench with all service lines.
- F. Splice at each service lateral and tee connection with an approved copper compression lug.
- G. Test all tracer wire for conductivity in accordance with Part 3.

## 2.5 VALVES

- A. General:
  1. 2" through 12": Use gate valves.
  2. 14" and larger: Use gate valves or butterfly valves.
  3. Open by turning counterclockwise.
  4. End connections as required for the piping in which they are installed.
  6. Two-inch metal operating nut with arrow indicating direction of opening.
  7. Use valves designed for a working pressure of not less than 250 psi.
  8. Provide stem extensions on all valves where the top of the operator nut is located greater than 36" below the top of the valve box.
  9. Fully coat all internal ferrous metal surfaces with two part thermosetting epoxy.



10. Design for external stem failure when excessive closing torque is applied with no failure of the pressure retaining parts.
  11. Provide double disc gate valves with bevel gears, grease case, and other necessary appurtenances for horizontal installation.
  12. Provide valved bypass on valves 14" and larger.
  13. Provide two-part thermosetting epoxy coating on valve exterior.
  14. Provide stainless steel bolting.
  15. Valves to be manufactured in the United States.
  16. Provide all wetted rubber compounds of synthetic rubber.
- B. Gate valves 1-1/2" and smaller:
1. Use all bronze, screw ends, double disc or wedge disc, rising stem, with "T" head or handwheel operator.
- C. Gate valves 2" and larger:
1. Resilient seated wedge valves complying with latest version of ANSI/AWWA C509.
  2. Provide integral bronze stem nut.
  3. Suitable for working pressure of not less than 250 psi.
  4. Design for external stem failure outside of the valve body or bonnet when excessive closing torque is applied with no failure of the pressure retaining parts per AWWA Section 3.2.
    - a. Factory test with no leakage from either side of the disc.
    - b. Test shell to 500 psig.
  5. Provide certified to NSF 61.
  6. Completely encapsulate resilient iron wedge by an elastomer, without thin spots or voids.
  7. Provide polymer wedge guide bearing caps bearing surface between the encapsulated wedge and the interior epoxy coating, lowering operation torque and extending service life of the valve.
  8. The manufacturing plant to have ISO9001 certification.
  9. Valve stuffing box to align parallel to the direction of pipe being laid.
  10. Open by turning counterclockwise.
  11. End connections as required for the piping in which they are installed.
  12. Two-inch metal operating nut with arrow indicating direction of opening.
  13. Use valves designed for a working pressure of not less than 250 psi.
  14. Provide stem extensions on all valves where the top of the operator nut is located greater than 36" below the top of the valve box.
  15. Fully coat all internal ferrous metal surfaces with two part thermosetting epoxy.
  16. Design for external stem failure when excessive closing torque is applied with no failure of the pressure retaining parts.
  17. Provide valves with bevel gears, grease case, and other necessary appurtenances for horizontal installation.
  18. Provide valve bypass on valves 18" and larger.
  19. Provide nominal 10mils epoxy coating on Resilient Wedge valves (interior/exterior).
  20. Provide 304 stainless steel bolting.
  21. Provide all wetted rubber compounds of synthetic rubber.
  22. Valves shall be cast, machined, assembled and tested in the United States.
    - a. Upon request, provide a letter with Manufacturing Professional Engineer stamp to certify origin.

- D. Valve operator:
  - 1. Provide one T-handle operator for each ten buried valves with nut operator.
  - 2. Provide one stainless steel T-handle operator for each four buried valves with "T" head.
- E. Provide valve boxes for all buried service valves and operators.

## 2.6 HYDRANTS

- A. Fire hydrants:
  - 1. Comply with the latest version of ANSI/AWWA C502.
  - 2. The bonnet assembly shall provide an oil reservoir and lubrication system that automatically circulates lubricant to all stem trades and bearing surfaces each time the hydrant is operated.
  - 3. 7" minimum ID upper barrel with a 5-1/4" valve opening.
  - 4. Main valve seat shall be reversible, made of synthetic rubber only, and have a cross section not less than 1" in diameter.
    - a. Plastic (polyurethane) main valves are unacceptable.
  - 5. two 2-1/2" hose connections, one 4-1/2" steamer connection with heavy gauge steel chains on all connections.
    - a. Nozzles to be threaded into the hydrant body for enhanced safety.
    - b. Nozzles shall be Type A in design to ensure maximum flow.
  - 6. Provide National Standard screw threads on outlet nozzles.
  - 7. Open by turning counterclockwise, with arrow cast in top indicating direction of opening.
  - 8. Two-part breakable safety flange shall be an integral part of barrel casting.
  - 9. The lower barrel shall be an integrally cast unit.
    - a. The use of threaded on or mechanically attached flanges is unacceptable.  
T
    - b. Cast the hydrant bury into the hydrant lower barrel.
  - 10. The upper valve plate, seat ring and drain ring must be ASTM B-584 bronze and work in conjunction to form an all bronze drain way. A minimum of two (2) internal and two (2) external drain openings are required.
  - 11. Provide "traffic-model" having upper and lower barrels joined at the ground line by a separate and breakable "swivel" flange providing 360° rotation of upper barrel for proper nozzle facing.
    - a. Flange shall employ not less than eight bolts.
    - b. Join the upper and lower stem by a sleek breakable stainless steel coupling to minimize flow loss.
  - 12. Prime hydrants with Amercoat 370 primer (inside/out) and finish coat with Sherwin Williams Polane, 2 part polyurethane paint color (factory applied) to match Owner's standard.
  - 13. Provide one hydrant wrench for each ten hydrants.
  - 14. Provide Mueller Super Centurion 250 Model A-423 fire hydrant with a pressure rating of 250-psi tested to 500-psi, or approved equal.
- B. Offset fitting:
  - 1. Provide an offset fitting at sloped areas where required for the hydrant connections to be located 1'4" above finished grade.
  - 2. Locate between the shut-off valve and each hydrant with a 12" offset.

3. Provide ductile iron per AWWA C153, compact design, coated per AWWA C104.
4. Provide Grade Lok as manufactured by Assured Flow Sales, Inc., or approved equal.

## 2.7 VALVE BOXES

- A. Provide at each buried valve.
- B. Cast iron extension type, suitable for minimum cover of 3'6" over the pipe.
- C. Minimum inside diameter at the top of 5", minimum riser wall thickness 1/4" and thickness at the top of 1 1/16".
- D. Have the word "WATER"; "SEWER"; "SLUDGE", etc., as applicable, cast into the cover.
- E. Provide Tyler Series 6850.
- F. Where depth requires more than a two piece box use adjustable cast iron extensions.
- G. Coat box and cover with two (2) shop coats of bitumastic paint.

## 2.8 VALVE BOX PROTECTION RING

- A. Provide at each valve box a precast concrete protection ring.
- B. Provide two rings of No. 3 reinforcing steel, one 14" in diameter, and one 23" in diameter.
- C. Inside dimensions to be 9-1/4".
- D. Outside diameter to be 27".
- E. Provide 5" thickness at interior with a continuous slope to 2" thickness at the outside.
- F. Minimum weight of 110 lbs.

## 2.9 SERVICE SADDLE

- A. Provide of the following materials:

Body	Type 304 Stainless Steel
Bales and Strips	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel

- B. Provide plastic lubricating washers
- C. Coat all stainless steel fasteners to prevent galling.

- D. Provide for maximum working pressure of 150 psi. Provide double strap for sizes 5" and larger.
- E. Provide Smith-Blair 313 Double Straps or approved equal.
- F. Connect to pipeline using a 6" stainless steel nipple.
  - 1. Do not use a threaded PVC connection.

#### 2.10 TAPPING SLEEVE AND VALVE

- A. Tapping sleeve:
  - 1. Provide Type 304L stainless steel per ASTM A240.
  - 2. Provide rolled thread stainless steel bolts per ASTM A153, Type 304.
  - 3. Provide Type 304 stainless steel hex head nuts, coated to prevent galling.
  - 4. Virgin SBR gaskets, compounded for water and wastewater service.
  - 5. Provide 3/4" NPT stainless steel test plug.
  - 6. Minimum working pressure of 200 psi.
  - 7. Provide ROMAC Industries Model SST or approved equal.
- B. Tapping valve:
  - 1. Construct of material compatible with tapping sleeve.
  - 2. Valve to conform to Paragraph 2.3 above.
  - 3. Joints - Flange to tapping sleeve, mechanical joint, for pipe end.

#### 2.11 AIR RELEASE VALVES

- A. Provide air release valves where indicated on the drawings.
- B. Provide cast iron body with stainless steel internal trim and float.
- C. Provide stainless steel seat with BUNA-N rubber valve.
- D. Provide 1" NPT inlet with 1" x 3/4" bronze bushing.
- E. Provide Crispin Model PL10 or approved equal.
- F. Provide a heavy-duty cast iron meter box to house valve.
  - 1. USF 7634 heavy duty meter box with FM cover or equal.
  - 2. Coat with two (2) shop coats of bitumastic paint.

#### 2.12 MISCELLANEOUS PARTS AND ACCESSORIES

- A. Use standard commercial grade suitable for the type of installation or system involved and conforming to the applicable standards and specifications of the AWWA.

#### 2.13 REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER

- A. General:

1. 3/4" through 2": Provide Apollo 40-200 Series reduced pressure backflow preventer, or approved equal.
  2. 2-1/2" through 10": Provide Apollo 40-200 Series reduced pressure backflow preventer, or approved equal.
  3. Must be on the approved list published by SCDHEC and tested by a certified tester before placing into service and two (2) copies provided to Owner.
  4. Bypasses not allowed unless equipped with an equal backflow protection.
- B. 3/4" through 2" reduced pressure backflow preventers to consist of the following:
1. Two (2) independently operating, spring-loaded, "Y" pattern check valves and one (1) hydraulically dependent differential relief valve.
  2. Designed to automatically reduce the pressure in the zone between check valves to at least 5 psi lower than inlet pressure.
  3. The differential relief valve will open and maintain proper differential should differential between upstream and the zone drop to 2 psi.
  4. Mainline valve body and caps including relief valve body and cover to be Bronze, ASTM B 584-78.
  5. Center stem guided check valve moving member.
  6. All springs to be stainless steel, 300 series.
  7. Internally locate all hydraulic sensing passages within mainline relief valve bodies and relief valve cover.
  8. Diaphragm to seal area ratio to be 10:1 minimum, nitrile, fabric reinforced.
  9. Removable seat ring on relief valve.
  10. Construct check valve and relief valve components so they may be serviced without removing the valve body from the line.
  11. Reversible, nitrile ASTM D 2000 seats.
  12. Provide full ported ball valves for shut-off valves and test locks complying with this Section.
  13. Rate assembly to 175-psi water working pressure and water temperature range from 32°F to 180°F
  14. Assemblies to meet requirements of ASSE Standard 1013; AWWA Standard Code C511-92, or latest revision; and USC Foundation of Cross Connection Control and Hydraulic Research, latest edition.
- C. 2-1/2" through 10" reduced pressure backflow preventers to consist of the following:
1. Two (2) independent "Y" configured check valves and one (1) differential relief valve.
  2. To automatically reduce pressure in zone between check valves. Should differential between zone and upstream pressure drop to 2 psi, differential relief valve will open, maintaining proper zone differential.
  3. Series 300 stainless steel internal parts containing no dissimilar metals.
  4. Reversible elastomeric seat discs on check valves and relief valves. Seat rings to be B-61 Bronze or Series 300 stainless steel.
  5. Check assembly to be center stem guided at seat ring with replaceable non-corrosive bushings at the cover.
  6. Series 300 stainless steel relief valve spring.
  7. Design ductile iron ASTM A 536, Grade 65-45-12 valve bodies and cover to withstand a 10:1 safety factor over rated cold water working pressure.
  8. Flanged ductile iron bodies, ANSI B16-1, Class 125, epoxy coated internally 10-20 mils.

9. Locate all orifices of the pressure sensing passages out of the normal debris flow path or settling areas.
10. Copper, ASTM B 280 external sensing tubing.
11. Assemblies must be flanged, full port resilient wedge shut-off valves and four vandal resistant ball valve test cocks, integral to assemblies.
12. Factory-assemble and backflow test all assemblies.
13. Construct assemblies so all internal parts, including seat rings, can be serviced from the top or side removed while assemblies are in line.
14. Assemblies to be rated 175 MWWP (32°-140° F).

## 2.14 BACKFLOW PREVENTER, DOUBLE CHECK TYPE

- A. General:
  1. 2-1/2" through 10": Provide Apollo Model 4SG-100 double-check backflow preventer, or approved equal.
  2. 10": Provide Apollo 4S-100 Series double-check backflow preventer, or approved equal.
  3. Must be on the approved list published by SCDHEC and tested by a certified tester before placing into service and two (2) copies provided to Owner.
  4. Bypasses not allowed unless equipped with an equal backflow protection.
- B. 2-1/2" through 10" double-check backflow preventers to consist of the following:
  1. Two independent "Y" configured check valves.
  2. Must be spring-loaded, center stem guided type.
  3. Series 300 stainless steel internal parts.
  4. Elastomeric seat disc must be reversible.
  5. Bronze, ASTM B 61 or series 300 stainless steel seat rings bolted to valve bodies incorporating an O-ring to facilitate field removal and replacement.
  6. Guide double-check assemblies at the seat ring and at the cover by replaceable non-corrosive bushings to assure positive check seating.
  7. Head loss through assemblies not to exceed 5.5 psi at velocities from 0, up to and including 7.5 fps.
  8. Document flow curves by independent laboratory testing.
  9. Design ductile iron ASTM A 536, Grade 65-45-12 valve bodies and cover to withstand 10:1 safety factor over rated cold water working pressure.
  10. Ductile iron bodies flanged, ANSI B16-1, Class 125, epoxy coated internally 10-20 mils. and prime coated externally.
  11. Assemblies to include flanged, full port resilient wedge shut-off valves and four vandal-resistant full port ball valve test cocks, considered integral to assemblies.
  12. Factory-assemble and backflow test all assemblies.
  13. Construct double-check assemblies so all internal parts, including seat rings, can be serviced while in line.
  14. Assemblies to be rated 175 MWWP (32° -140°F).
  15. Assemblies to meet requirements of ASSE Standard 1015; AWWA Standard Code C510-92, or latest revision; and USC Foundation of Cross Connection Control and Hydraulic Research, latest edition.

## 2.15 PIGS

- A. Provide all water piping systems with methods for launching and capturing pigs.
  - 1. Provide wye fitting with removable cap and valve between the cap and the main line.
- B. Design pigs for cleaning of pipe material specified.
- C. Manufacture of open-cell polyurethane foam body, without coating or abrasives, which would scratch or otherwise damage interior pipe wall surface or lining.
- D. Able to pass through reductions of up to 65 percent of nominal cross-sectional area of pipe.
- E. Able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to force main being tested.

## PART 3 - EXECUTION

### 3.1 HANDLING

- A. Handle pipe accessories so as to ensure delivery to the trench in sound, undamaged condition:
  - 1. Carry pipe into position - do not drag.
  - 2. Use pinch bars or tongs for aligning or turning the pipe only on the bare end of the pipe.
  - 3. Use care not to injure pipe linings.
  - 4. Do not damage pipe with chokers or lifting equipment.
- B. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other method approved by the Engineer.
- C. Before installation, inspect each piece of pipe and each fitting for defects.
  - 1. Material found to be defective before or after laying: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.
- D. Gaskets: Store in a cool dark place until just prior to time of installation.

### 3.2 PIPE CUTTING

- A. Cut pipe neatly and without damage to the pipe.
- B. Unless otherwise recommended by the pipe manufacturer, and authorized by the Engineer, cut pipe with mechanical cutter only.
  - 1. Use wheel cutters when practicable.
  - 2. Cut plastic pipe square, remove all burrs, and grind bevel on end.

### 3.3 LOCATING

- A. Water mains shall be laid at least 10' edge-to-edge horizontally distanced from any existing or proposed sewer pipes.
- B. Should a 10' separation not be practical, then the water main may be located closer with South Carolina Department of Health and Environmental Control (SCDHEC) approval provided:
  - 1. It is laid in a separate trench.
  - 2. It is laid in the same trench with the water main located at one side on a bench of undisturbed earth.
  - 3. In either of the above cases, crown elevation of the sewer shall be at least 18" below invert elevation of water line.
- C. Where water lines cross over sewers, maintain 18" vertical separation between the outside of the sewer and the outside of the water line.
- D. Where water lines cross under sewers, each line shall be cast iron or ductile iron.
  - 1. A full length of water line shall be located over an existing sewer so that joints of each line will be as far from each other as possible.
  - 2. Where a new water main crosses a new sewer line, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each line will be as far as possible from the point of crossing and each other.
- E. No water pipe shall pass through or come in contact with any part of a sewer manhole.
- F. Water lines shall not be laid within 25' horizontally from any portion of a wastewater tile or spray field.
- G. Water lines shall be located outside all contaminated areas, unless using pipe materials that will protect the water supply.
- H. No flushing device or drain directly connected to any type of sewer is allowed.
- I. No cross connections between water lines and any pipes, valves, tanks or pumps that are not part of the potable water system are allowed.
- J. Water lines may come in contact with storm sewers or catch basins if there are no other practical alternatives provided that ductile iron is used and no joints of the water line are within the storm sewer or catch basin, and, provided that the joints are located as far as possible from the storm sewer or catch basin.
- K. Structures containing valves, blowoffs, meters, air release valves, etc., shall not be connected directly to any storm drainage or sewer system.

### 3.4 EXCAVATION AND BACKFILLING

- A. Comply with pertinent provisions of Section 31 30 02 of these Specifications.



- B. For P.E. Pipe, comply with manufacturer's recommendations.

### 3.5 ALIGNMENT OF PIPE

- A. Pipe lines intended to be straight shall be so laid.
- B. Where vertical or horizontal alignment requires deflection from straight line or grade, such deflection shall not exceed maximum deflection recommended by the pipe manufacturer.
- C. If alignment requires deflection exceeding recommended limits, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the allowable limits.

### 3.6 PLACING AND LAYING

- A. General:
  - 1. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Engineer.
  - 2. Do not dump or drop any of the materials of this Section into the trench.
  - 3. Except where necessary in making connections to other lines, lay pipe with the bells facing in the direction of laying.
  - 4. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
  - 5. Take up and relay pipe that has the grade or joint disturbed after laying.
  - 6. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
  - 7. Securely close open ends of pipe, fittings, and valves when work is not in progress.
  - 8. Where any part of coating or lining is damaged, repair to the approval of the Engineer and at no additional cost to the Owner.
  - 9. Structures containing valves, blowoffs, meters, air release valves, etc., shall not be connected to any storm drain or sewer system.
- B. Ductile iron pipe:
  - 1. Mechanical, push on and flanged joints, install in accordance with ANSI/AWWA C600.
  - 2. Gaskets: Handle, lubricate where necessary and install in strict accordance with manufacturer's recommendations.
- C. Plastic pipe:
  - 1. Clean gasket, bell or coupling interior, especially groove area.
  - 2. Lubricate and insert gasket as recommended by manufacturer.
  - 3. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.
  - 4. Bell pipe using manufacturer's approved leverage bar.
    - a. Do not use machinery to push pipe "home".
  - 5. Push pipe "home" until reference mark is at proper location and clearly visible.
  - 6. Follow all pipe manufacturers installation instructions.

- D. Flanged joints:
  - 1. Provide true face flanges, field clean and fit with one full face gasket and make bolts up finger tight.
  - 2. Use torque wrench to alternately tighten bolts 180° apart until full gasket flow and seal are secured.
  - 3. Bias cut or unusual refacing of any flange will not be acceptable.
- E. Restrained joints:
  - 1. Install in accordance with manufacturer's instructions.
  - 2. Tighten set screws to the manufacturer's rated torque using a torque wrench. If twist-off nuts are provided, tighten screws until nut breaks loose.

### 3.7 TRACER WIRE TESTING

- A. General:
  - 1. Utilize an approved magnetic locating device, M Scope or Equal.
  - 2. Connect a cable conductively from the transmitter to a metal ground rod and to the tracer wire.
  - 3. Locate the line following the instructions of the magnetic locating device.
  - 4. If interference is encountered from adjacent utilities or if the depth of bury or line length interferes with the signal, install a dummy valve box with access to the tracer wire at no additional cost to the owner.
  - 5. Where there is a break in the tracer wire, repair with 3M DBY or ILSCO #IK-8 repair kit and wrap with poly wrap for cathodic protection.
- B. Creek crossing and wetland areas:
  - 1. Send a prescribed frequency with a shore line base signal ejector between 25 and 1024 HZ down a metal medium and read by a receiver.
  - 2. Select a frequency based on the depth and the amount of linear feet of the line.
  - 3. If the tracer wire has a break, reinstall the cable and repeat the conductivity test at no additional cost to the owner.
- C. Notify in advance and conduct all testing in the presence of the Engineer.

### 3.8 SETTING VALVES AND VALVE BOXES

- A. General:
  - 1. Center valve boxes on the valves, setting plumb.
  - 2. Tamp earth fill around each valve box to a distance of 4' on all sides, or to the undisturbed trench face if less than 4'.
  - 3. Install shaft extensions plumb without any binding.
  - 4. Fully open and close each valve to assure that all parts are in working condition.
  - 5. Place valve box protection ring around top of valve box as indicated on the plans.
    - a. Install ring level with top 1" above finished grade.
    - b. Top of ring to be level with or no more than 1" above the top of the valve box.

### 3.9 INSTALLATION OF HYDRANTS

#### A. General:

1. Inspect carefully, ensuring that all foreign material is removed from the barrel.
2. Set plumb and at such elevation that connecting pipe and distribution main have same depth of cover.
3. Install stone drainage bed and thrust blocking as indicated.
4. No connection or location of hydrant drains within 10' of sewer systems is allowed.
5. Hydrant leads to be a minimum of 6" in diameter and to include an auxiliary gate valve.
6. Fully open and close each hydrant to assure that all parts are in working condition.

### 3.10 INSTALLATION OF REDUCE PRESSURE PRINCIPLE BACKFLOW PREVENTER

#### A. General:

1. Minimum clearance of 12" maximum clearance of 30" between port and floor or grade.
2. Install where no discharge is objectionable and can be positively drained away.
3. Must be easily accessible for testing and maintenance and protected from freezing.
4. Eliminate excessive pressure situations to avoid possible damage to system and assemblies.
5. Provide conduit and grounding wire connection per NEC, IBC, and any local applicable electrical code.
6. Install horizontally unless otherwise shown on the plans or Engineer's approval is obtained.

### 3.11 INSTALLATION OF DOUBLE-CHECK BACKFLOW PREVENTER

- A. Maintain adequate clearance and easy accessibility for testing and maintenance.
- B. Provide conduit and grounding wire connection per NEC, IBC, and any local applicable electrical code.
- C. Install horizontally unless otherwise shown on the plans or Engineer's approval is obtained.

### 3.13 CONNECTIONS TO DEDICATED FIRE LINES

- A. Provide a double-check valve assemblies on dedicated fire lines.

### 3.14 HYDROSTATIC TESTING

#### A. General:

1. Pressure and leakage testing must be conducted in accordance with AWWA Standards C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.
2. Clean and flush line of air, dirt and foreign material.

3. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.
4. Test pump, pipe connection, pressure gauges, measuring devices and all other necessary appurtenances to conduct tests are to be provided by the Contractor.
5. Install brass corporation cocks at all high points that do not have permanent air vents. Corporation cocks are to be left in place and all costs for providing such cocks are to be borne by the Contractor.
6. Conduct tests on each line or valved section of line.
7. Test pressures to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
8. Do not test pipe at pressures exceeding manufacturer's recommendations.
9. The Contractor must provide documentation of the pressure and leakage tests. Documentation must include length of lines, diameter of pipe(s), amount of water required to fill line after test was performed, and amount of allowable leakage.
10. The witness to the hydrostatic testing is to be someone other than the Contractor or the utility installing the lines.

B. Pressure tests:

1. After the pipe is laid, the joints completed, and the trench backfilled, subject the newly laid piping and valved sections of the piping to the test pressure specified in Part A above.
2. Open and close each valve within the section being tested several times during the test period.
3. Conduct the pressure test using a 4" dia. glycerin filled gauge w/ a snuber attached prior to the gauge to remove pulsations.
  - a. Obtain prior approval of the testing gauge approved by the Engineer prior to its use.
  - b. Provide a range of no greater than twice the test pressure and not less than 50% greater than the test pressure.
  - c. Calibrate with cal sticker on gauge face or provide appropriate supporting paper work.
4. Replace or remake joints showing leakage.
  - a. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings and valves. Replace with sound material and repeat the test until results are satisfactory.
  - b. Make repair and replacement without additional cost to the Owner.

C. Leakage test:

1. Conduct leakage test after the pressure test has been completed satisfactorily.
2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to the test pressure specified in Part A above.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
  - a. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula(s):

$$L = S \times D \times \sqrt{P} / 148,000; \text{ where}$$

L = allowable leakage in gallons per hour;

S = length of pipe tested in feet;

D = nominal diameter of pipe in inches; and

P = average test pressure psi gauge.

- b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size will be allowed.
  - 1) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
  - 2) Repair all visible leaks regardless of test results.

### 3.15 PIGGING

- A. After completion of hydrostatic testing and prior to disinfection, clean water mains by pigging.
- B. Test Execution:
  - 1. Conduct pigging test in presence of Engineer.
  - 2. Provide at least 48-hours notice of scheduled pigging.

### 3.16 STERILIZATION

- A. Sterilize in accordance with Section 33 05 01 – Disinfection of Potable Water Lines.

### 3.17 DECHLORINATION OF CHLORINATED STERILIZATION WATER

- A. Dechlorinate in accordance with Section 33 05 01 – Disinfection of Potable Water Lines.

### 3.18 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all cost for same shall be included in the lump sum price bid for the project.

## END OF SECTION

**SECTION 33 05 02**  
**WATER SERVICE CONNECTIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide water service connections, including meters, meter boxes, and other appurtenances as shown on the drawings, specified herein, and needed for a complete and proper installation.
  - 1. Service connections include connection to the distribution main, service line between main and the meter, meter with box and service stops.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Section 31 30 02 - Trenching, Backfilling for Utilities.
  - 3. Section 33 05 03 – Disinfection of Potable Water Lines

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be 100% manufactured in the United States.

**1.3 SUBMITTALS**

- A. Comply with pertinent provisions of Section 01 33 01.
- B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

**1.4 PRODUCT HANDLING**

- A. Comply with pertinent provisions of Section 01 60 01.
- B. Shipment of pipe:
  - 1. Protect pipe with tarp or other means during shipment to prevent truck exhaust from damaging pipe.

- C. Storage of PVC pipe:
  - 1. Store in unit packages as received from manufacturer until just prior to use.
  - 2. Stack units in such manner as to prevent deformation to pipe barrel and bells.
  - 3. Protect from direct sunlight by covering with opaque material if storage period will exceed six weeks.
- D. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

## PART 2 - PRODUCTS

### 2.1 SERVICE PIPE

- A. Use materials for the various sizes of services as follows:
- B. Services 1" in diameter and smaller:
  - 1. Provide Type K, soft copper complying with ASTM B88, Table 4; or
  - 2. High molecular weight polyethylene pipe complying with ASTM D1248, Type III, and AWWA C-901 for flexible pipe with SDR 7, CTS.
    - a. Pipe shall be stamped with National Sanitation Foundation approval for use with potable water at 18" intervals.
    - b. When polyethylene pipe is used, provide a continuous #12 gauge blue insulated copper tracer wire, approved by the manufacturer for direct burial, in the trench and tape to the top of the pipe using 2" duct tape. Terminate the tracer wire in the meter box and arrange to allow for the connection of equipment for tracking pipe, yet not interfere with the operation of the curb stop, meter, etc. Use underground water proof connections on all splices and thoroughly wrap all connections in electrical tape.
      - 1) Test all tracer wire for conductivity in accordance with Part 3.
- C. Services 1-1/2" in diameter and larger:
  - 1. Provide PVC pipe complying with ASTM D2241 for PVC 1120, SDR 26, with NSF approval marked at 18" intervals.
    - a. Use integral bell or coupling type joints with elastomeric gaskets.
      - 1) Integral bells to comply with ASTM D2672.
      - 2) Couplings to comply with ANSI/AWWA C900.
      - 3) Gaskets to comply with ASTM F477.
      - 4) Lubricants shall be compatible with pipe and gasket materials, shall not support bacteria growth and shall not adversely affect potable quality of line contents.
    - b. Use PVC fittings, 160 psi at 73° pressure rating, joint design to conform to pipe joints.
  - 2. Provide pipe complying with ASTM D1785 for PVC 1120. Schedule 80, dark gray color NSF approved solvent weld coupling joints, unless otherwise indicated.
  - 3. Provide standard weight, hot-dip galvanized steel pipe complying with ASTM A53, ends threaded and coupling on one end.

## 2.2 SERVICE SADDLE

A. Provide of the following materials:

Body	Type 304 Stainless Steel
Sales and Strips	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel

B. Provide double-strap for sizes 5" and larger.

C. Provide Romac 304 and 305 or approved equal.

D. Connect to pipeline using a 6" stainless steel nipple.

1. Do not use a threaded PVC connection.

## 2.3 BRASS MATERIALS

A. Provide materials complying with AWWA Standard C800, unless otherwise indicated or specified.

B. Corporation stops: Furnish with AWWA Standard Corp. Stop Thread on inlet side, with outlet connection suitable for use with the type service pipe being installed.

C. Service stops: Provide water works ground key type, oval flow way, tee handle, without drain.

1. Quarter turn between "open-close" positions, controlled by integral check lugs.

2. Inlet connection to match service pipe, outlet end to match meter spud.

D. Goosenecks: Form from Type K copper tubing complying with ASTM B88, to a minimum length of 18".

## 2.4 METER BOXES

A. General:

1. Provide cast iron boxes in traffic areas.

2. Provide pre-cast concrete boxes where indicated on the plans and only in non-traffic areas.

3. Minimum dimensions: 19-1/2" long by 10" wide by 13" deep.

B. Cast iron boxes:

1. Provide MS-19 Rome meter box and cover by Opelika Foundry/Bingham and Taylor or equal.

2. Coat with two (2) shop coats of water based bitumastic paint.



C. Concrete boxes:

1. Furnish with minimum wall thickness of 1-1/2".
2. Provide small opening in top lid for reading meter, closed with hinged, cast iron flap.

2.5 METERS

A. Provide sizes as listed in the Bid Form.

B. Provide meters of standard design, complying with AWWA C700, and the following:

1. Furnish meters with nutating discs.
2. Utilize split case design.
3. Furnish coupling nuts and tail pieces for each meter.

C. Nutating disc shall rotate a permanent magnet within a completely sealed chamber; an opposing magnet shall actuate the gear train and register.

2.6 OTHER MATERIALS

A. Provide other materials related to water service installation as shown on the plans.

B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. Install service lines from the distribution main to the property lines at each lot, or at each location indicated or directed by the Engineer.

B. Depth of the service connection shall be no less than the top of main connected to, and shall be at least 12" deep at the meter box.

C. Install insulating couplings between ferrous and non-ferrous pipe, fittings, etc. of such shape to effectively prevent metal-to-metal contact between the dissimilar metals.

3.2 EXCAVATION AND BACKFILLING

A. Comply with pertinent provisions of Section 31 30 02, except as otherwise specified herein.

B. Under paved areas install service lines by jetting, unless otherwise directed by the Engineer.

3.3 INSTALLATION - SERVICE LINES

- A. Install flexible service lines in one continuous piece from main to service stop.
- B. Connections to mains, 3" and smaller:
  - 1. Provide tees or tapped couplings in new mains.
  - 2. Use approved service saddle on existing mains.
  - 3. Provide corporation stop on mains.
- C. Connections to cast iron or ductile iron mains:
  - 1. Drill and tap pipe barrel and install corporation stop therein.
- D. Connections to PVC mains, 4" and larger:
  - 1. Provide factory tapped coupling sleeves in new mains, located within 3-1/2' of designated service location.
  - 2. Use approved service saddle on existing mains.
  - 3. Provide corporation stop at all connections.
- E. Terminate each service line with service stop and/or meter, as indicated.
- F. Install service lines and casings under payment by coring method in accordance with the SCDOT Policy for Accommodating Utilities on Highway Rights-of-Way.

### 3.4 INSTALLATION - METER BOXES AND METERS

- A. Install boxes level in both directions and with top flush with finished grades.
- B. Do not let weight of box rest on the service line.
- C. Make installation in such manner that meter may be removed at any time without disturbing box setting.

### 3.5 TRACER WIRE TESTING

- A. General:
  - 1. Utilize an approved magnetic locating device, M Scope or Equal.
  - 2. Connect a cable conductively from the transmitter to a metal ground rod and to the tracer wire.
  - 3. Locate the line following the instructions of the magnetic locating device.
  - 4. If interference is encountered from adjacent utilities or if the depth of bury or line length interferes with the signal, install a dummy valve box with access to the tracer wire at no additional cost to the owner.
  - 5. Where there is a break in the tracer wire, repair with 3M DBY or ILSCO #IK-8 repair kit and wrap with poly wrap for cathodic protection.
- B. Creek crossing and wetland areas:
  - 1. Send a prescribed frequency with a shore line base signal ejector between 25 and 1024 HZ down a metal medium and read by a receiver.

2. Select a frequency based on the depth and the amount of linear feet of the line.
  3. If the tracer wire has a break, reinstall the cable and repeat the conductivity test at no additional cost to the owner.
- C. Notify in advance and conduct all testing in the presence of the Engineer.

### 3.6 FLUSHING

- A. Flush each service line thoroughly after installation to clear of sand, dirt, or other construction debris.
- B. When meters are to be installed, accomplish flushing prior to meter installation.

### 3.7 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all cost for same shall be included in the lump sum price bid for the project.

**END OF SECTION**

**SECTION 33 05 03**  
**DISINFECTION OF POTABLE WATER LINES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide disinfection of potable water lines as specified herein, and as needed for a complete and proper installation.
- B. Related work: Documents affecting work of this Section include, but are not necessarily limited to the Special Provisions, General Specifications, and Sections in Division 1 of these specifications.

**1.2 REFERENCES**

- A. American Water Works Association (AWWA):
  - 1. C-651: Disinfecting Water Mains.
  - 2. B-300: Standard for Hypochlorites.

**1.3 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All work shall comply with South Carolina Department of Environmental Services (SCDES) State Primary Drinking Water Regulations.
- C. All work shall conform to provisions of AWWA C-651 for water line distribution.
  - 1. Do not use Tablet Method or Slug Method therein.

**1.4 SUBMITTALS**

- A. Not Used.
- B. Submit chlorination and dechlorination plan to Engineer thirty (30) days before chlorination and dechlorination.
- C. Submit flushing plan to Engineer.

**PART 2 - PRODUCTS**

**2.1 DISINFECTANT**

- A. Sodium Hypochlorite complying with AWWA B-300.
- B. Calcium Hypochlorite granules and tablets complying with AWWA B-300. Calcium hypochlorite intended for use in swimming pools is not permitted.

- C. Disinfection with pure chlorine gas is not permitted.

## 2.2 DECHLORINATION (NEUTRALIZING) AGENTS

- A. Liquid sulfur dioxide or sulfite solution
- B. Sulfur dioxide gas is not permitted.

## 2.3 TEST KITS

- A. High Range Test Kit for Chlorine Residual (0 - 200 mg/l): Provide Hach Chemical Company Model CN-21P.
- B. DPD Chlorine Residual Test Kit (0 – 3.5 mg/l): Provide Hach Chemical Company Model CN-66.

## 2.4 MISCELLANEOUS PARTS AND ACCESSORIES

- A. Use standard commercial grade suitable for the type of installation or system involved, and conforming to the applicable standards and specifications of the AWWA and approved by the Engineer.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Upon completion of testing, disinfect all water lines to meet requirements of AWWA C-651 and the SCDHEC.
  - 1. Utilize the Continuous Feed Method.
- B. Newly laid valves or other appurtenances shall be operated several times while line is filled with chlorinating agent.
- C. Should initial treatment fail to meet results specified, repeat procedures until satisfactory results are obtained, at no additional cost to the Owner.
- D. All pipe taps, feeders, chemicals, etc. for sterilization shall be provided by the Contractor.
- E. Perform hydrostatic testing of water main prior to disinfection.

## 3.2 DISCHARGE REQUIREMENTS

- A. Discharges to the environment:
  - 1. Discharges shall not cause or have the reasonable potential to cause or contribute to a violation of a SCDES water quality standard.
  - 2. Utilize Best Management Practices (BMPs) to prevent erosion from discharge of water during any construction activities including flushing and disinfection.

- B. Notify the Engineer immediately in the event of any accidental discharge.

### 3.3 PRELIMINARY FLUSHING

- A. Prior to chlorination, fill water main with clear water to eliminate air pockets and flush to remove foreign materials that might have entered the main during installation or repair.
- B. Provide flushing of sufficient magnitude and duration to flush all foreign material out of the lines, valves, and hydrants.
- C. Provide a minimum flushing velocity of 2.5 feet per second (FPS). Required flow and openings required to produce proper flushing velocity of forty (40) PSI are:

Pipe Size (Inches)	Flow (GPM) at 2.5 FPS	Hydrant Openings
4	100	1 - 2-1/2"
6	200	1 - 2-1/2"
8	400	1 - 2-1/2"
10	600	1 - 2-1/2"
12	900	1 - 2-1/2"
16	1600	2 - 2-1/2"
24	3530	1 - 4-1/2" 1 - 2-1/2"
48	14100	6 - 4-1/2"

- D. All valves and hydrants to be fully opened and closed under water pressure to ensure proper operations during flushing and to dislodge foreign material.
- E. All valves or connections to existing distribution system to be closed and backflow preventer or other approved equipment installed at the source during flushing operations to prevent contamination of existing distribution system.
- F. Provide protection of existing site improvements during flushing operation.
- G. For water mains twenty-four (24) inches and larger, an acceptable alternative to flushing is to broom-sweep the main.
1. Remove sweepings prior to chlorinating the main.

### 3.4 DISINFECTION OF WATER MAINS

- A. Provide water supplied from a temporary, backflow-protected connection to the existing distribution system at a constant measured rate into the new water main.
1. In absence of a meter, determine the flow rate either by placing a pilot gauge at discharge or by measuring the time to fill a container of known volume.
- B. Inject water entering the new main with a chlorine solution fed at a constant rate. Chlorine solution feed rate to provide and maintain a free chlorine concentration of no less than fifty (50) milligrams per liter (mg/L) during the filling of the water main.

1. Injection point to be no more than ten (10) feet downstream from the beginning of the new water main.
2. Measure chlorine concentration at regular intervals utilizing high-range chlorine test kits to ensure the minimum chlorine concentration is provided.
3. Chlorine solutions may be prepared with sodium hypochlorite or calcium hypochlorite. The amount of chlorine required for each one hundred (100) feet of pipe to produce a fifty (50) mg/L concentration is:

Pipe Size (Inches)	100% Chlorine (LB)	1% Chlorine Solution (gal)
4	0.013	0.16
6	0.030	0.37
8	0.054	0.65
10	0.085	1.02
12	0.122	1.47
16	0.218	2.61
24	0.490	5.87
48	1.960	23.50

4. Feed chlorine solution until the entire main is filled with chlorinated water with a minimum concentration of fifty (50) mg/L.
  5. Provide a gasoline or electrically powered chemical-feed pump designed for feed chlorine solutions to feed hypochlorite solutions.
    - a. Provide feed lines made of material capable of withstanding the corrosion caused by concentrated chlorine solutions and the maximum pressures that may be caused by the feed pumps.
    - b. Check all connections for tightness before the chlorine solution is applied to the main.
- C. Retain the chlorinated water in the water main for a minimum of twenty-four (24) hours.
1. Operate valves and hydrants in the treated section of the water main during the twenty-four (24) hours period to ensure disinfection of appurtenances.
- D. At end of the twenty-four (24) hour retention period, all sample locations shall have a residual of not less than ten (10) mg/L of free chlorine.
- E. Final flushing: After the retention period, flush the chlorinated water from the water main, valves, and branches until the chlorine residual is less than 0.5 mg/L.
1. Provide dechlorination of the chlorinated water in the main by applying a dechlorination agent.

### 3.5 SAMPLING PROGRAM AND ACCEPTANCE

- A. After final flushing, provide two separate samples for each sample location, taken at twenty-four (24) hour intervals, free of coliform bacteria.
  1. Contractor to take 1st and 2nd samples, deliver to SCDES approved laboratory for testing.
  2. The 1st and 2nd sample results shall include the free chlorine residual at the time the samples were collected.
  3. Notify SCDES to take a 3rd sample.

- B. At a minimum, sample locations shall be as required by SCDES and the following:
  - 1. The tie-in location of new and existing water lines.
  - 2. The end of all dead end lines.
  - 3. At intervals of no more than 1,200' for all new lines longer than 1,200' in length.
- C. All sample locations are to be given an identifying label and a corresponding identification label is to be included on the record drawings indicating each sample location.
- D. Provide all results to the Engineer.
- E. Resampling: If the initial disinfection fails to produce satisfactory bacteriological results or if other water quality is affected, reflush the water main and resample.
- F. Redisinfection: If the check samples fail to produce acceptable results, repeat disinfection procedures until satisfactory results are obtained.

### 3.6 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all costs for same shall be included in the price bid for the project.

### **END OF SECTION**



**SECTION 33 10 02**  
**SANITARY SEWER - PRESSURE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide sanitary sewer pressure (force) mains as shown on the drawings, specified herein, and needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  - 2. Section 31 30 02 - Trenching, Backfilling for Utilities.
  - 3. Section 33 10 01 – Sanitary Sewer - Gravity.
  - 4. Section 32 92 02 – Grassing for Stabilization.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be 100 % manufactured in the United States.

**1.3 SUBMITTALS**

- A. Not Used.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

**1.4 PRODUCT HANDLING**

- A. Not Used.
- B. Storage of pipe:
  - 1. Store in unit packages as received from manufacturer until just prior to use.
  - 2. Stack units in such manner as to prevent deformation to pipe barrel and bells.
  - 3. Protect from direct sunlight by covering with opaque material if storage period will exceed six weeks.
  - 4. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Use any pipe material and associated fittings as specified herein, except where use of a particular material is indicated on the plans, or specified herein.

### 2.2 PIPE AND FITTINGS

- A. Pipe:
  - 1. Ductile iron pipe (DIP):
    - a. Comply with AWWA C151/A21.51, latest revision.
    - b. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.
    - c. Wall thickness in accordance with Table 51.1 of ANSI/AWWA C151/A21.51 with working pressure of 150 psi, depth of cover indicated and Type 3 bedding conditions, minimum Class 52.
  - 2. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
  - 3. Use rubber gaskets and lubricant complying with ANSI/AWWA C111/A21.11.
  - 4. Use lining complying with one of the following:
    - a. Amine cured Novalac Epoxy polymeric lining, 40-60 mils nominal thickness. The standards of quality are based on Protecto 401 by Vulcan Painters, Birmingham, Alabama or Corrosion-Clad Polymer Lining No. 210 by Sauereisen Cements, Pittsburgh, Pennsylvania.
  - 5. Ductile iron pipe must be installed in accordance with AWWA C-600, latest revision.
  - 6. Restrained joint pipe and fittings:
    - a. Provide restrained joint pipe and fittings where indicated on the plans.
    - b. Provide one of the following:
      - 1) Snap-Lok by Griffin Pipe.
      - 2) American Cast Iron Pipe Company.
        - a) Flex-Ring (4" - 48")
        - b) Lok-Ring (54" - 64").
      - 3) U. S. Pipe.
        - a) TR-Flex (4" - 36")
        - b) HP-LOK (42" - 64")
      - 4) Super-Lock by Clow (4" - 30").
- B. Ductile iron fittings:
  - 1. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
  - 2. Fittings for use with push-on joint pipe, comply with ANSI/AWWA C111/A21.11.
  - 3. Use lining complying with Part 2.2.A.4 above.
  - 4. The maximum phosphorous level in the casting will be 0.08%.

5. The fitting surface finish will conform to MSS SP-112 Quality Standard for Evaluation of Cast Surface Finishes.
6. The manufacturer shall be ISO 9000 certified.
7. Markings:
  - \* Each fitting shall have the following markings cast integrally to the fitting:
  - a. Manufacturer's Name or Logo.
  - b. "MJ".
  - c. Country of Origin.
  - d. Manufacturer's Foundry Mark.
  - e. AWWA C-153 or C-110.
  - f. Pressure Rating.
  - g. Nominal Diameter (each leg).
  - h. "DI" or "Ductile".
  - i. No. of degrees (bends).

C. Polyvinyl chloride pipe and fittings (PVC):

1. 4" - 12": Comply with ANSI/AWWA C900, Table 2, Pressure Class 150 (DR 18).
2. 14" and above: Comply with ANSI/AWWA C905, Table 2, Pressure Class 165 (DR 25).
3. 3" and below: Comply with ASTM D2201 for PVC 1120, SDR 21, pressure rating 160 psi at 73°F.
4. Color of pipe to be green and reuse pipe to be purple.
5. Use integral bell or coupling type with elastomeric gaskets.
5. Gaskets are to be factory-installed and integral with the pipe.
6. Use ductile iron fittings with lining complying with Part 2.2.B above.
7. Provide adaptor glands, gaskets, etc. as required to accommodate any differences in pipe and fitting dimensions.
8. Restrained joint pipe and fittings:
  - a. Provide restraint for C-900 PVC by mechanical means separate from the mechanical joint gasket sealing gland.
    - 1) Provide wide, supportive contact around full pipe circumference as follows:

<u>Size</u>	<u>Restraint Width</u>
4", 6"	1-1/2"
8", 10", 12"	1-3/4"

- 2) Provide means of restraint by machined serrations on inside surface of restraint device designed to provide circumferential loading over the entire restrainer.
  - a) Design to be such that restraint increases with increased in-line pressure.
  - b) Provide a minimum of 8 serrations per inch of restraint width.
- 3) Restraint device to be pressure rated at 350 psi, or equal to the pipe on which it is used and capable of withstanding test pressures of 2 times pressured rating.
- 4) Provide "MEGALUG" as manufactured by EBAA Iron, Inc. of Eastland, Texas or approved equal.

- b. Provide restraint for C-905 PVC pipe 14" and larger by mechanical means separate from the mechanical joint sealing gland.
  - 1) Restraint device to be a two-piece configuration with a serrated inside surface to provide contact around full pipe circumference.
  - 2) Restraint device body to be manufactured from steel (ASTM A285 Grade C) with fusion epoxy coated surfaces except the serrations.
  - 3) Provide restraint width as follows:

<u>Size</u>	<u>Restraint Width</u>
14", 16", 18"	5"
20", 24"	7"
30"	10"

- 4) Provide 6 serrations per inch of restraint width.
  - 5) Comply with AWWA C111, ANSI 21.11.
  - 6) Pressure rating to match PVC pipe on which it is used with capability to withstand test pressure of 2 times rated pressure.
  - 7) Finish fusion applied epoxy coating per AWWA C-213.
  - 8) Provide "MEGALUG" as manufactured by EBAA Iron, Inc. of Eastland, Texas or approved equal.
- c. Restraint system coating:
  - 1) Process all wedge and wedge assemblies through an iron phosphate spray, rinse and dry prior to coating with two coats of liquid Xylan, with heat curing following each coat.
  - 2) Surface pre-treat castings (rings) with an iron phosphate spray, rinse and apply sealer before drying, followed by an electrostatically applied and heat cured polyester based powder to provide corrosion, UV and impact resistance.
  - 3) Provide Mega-Bond coating by EBAA Iron, Inc. or approved equal.

D. Polyethylene (PE) pipe:

1. Comply with AWWA C-906, DR 11\_ and working pressure of 160 psi.
2. The pipe supplied under this Specification shall be SDR high performance, high molecular weight, high density polyethylene pipe, and shall conform to ASTM D 1248 (Type III C, Category 5, P34). Minimum cell classifications values shall be 345434C as referenced in ASTM D 3350 - latest edition. All pipe resin shall be manufactured by the same company that manufactures the pipe itself, in accordance with these specifications, to ensure complete resin compatibility and total product accountability. The fittings supplied in this specification shall be molded or manufactured from a polyethylene compound having a cell classification equal to or exceeding the compound used in the pipe. To ensure compatibility of polyethylene resins, all fittings supplied under this specification shall be of the same manufacture as the pipe being supplied.
3. Physical properties:
  - a) The pipe shall conform to the physical properties as described herein.
  - b) Typical pipe physical properties:

<u>Property</u>	<u>Test Method</u>	<u>Unit</u>	<u>Value</u>
Density	ASTM Method	gms/cc	0.955
Melt Index	ASTM D-1238 (190/2.16)	gms/10 min	

#### **Environmental Stress Cracking Resistance:**

Condition A, B, & C, F-0	ASTM D 1693	hrs	>5000**
Compressed Ring, F-60	ASTM F 1248	hrs	>1500
Tensile Strength, Yield	ASTM D 638	psi	3200
Type IV Specimen	(2"/min)		
Elongation at Break	ASTM D 638	%	>750
Type IV Specimen	(2"/min)		
Vicat Softening Temp	ASTM D 1525	°F	257
Brittleness Temp	ASTM D 746	°F	<-180
Flexural Modulus	ASTM D 790	psi	135,000
Modulus of Elasticity	ASTM D 638	psi	130,000
Hardness	ASTM D 2240	Shore D	65
Linear Thermal Expansion Coef.	ASTM D 696	in./in./°F	1.2x10- 4
Thermal Conductivity	Dynatech-Colora BTU, In./Thermoconductor ft./2hrs/°F		2.7

#### **Long Term Strength:**

73° F	ASTM D 2837	psi	1600
UV Stabilizer	ASTM D 1603	%C	2.5
Material Cell Classification	ASTM D 1248		345434C
Material Description	PPI Recommendation		PE 3408

#### **4. Quality control:**

- a) The resin used for manufacture of the pipe shall be manufactured by the pipe manufacturer, thus maintaining complete control of the pipe quality. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, or other deleterious defects and shall be identical in color, density, melt index, and other physical properties. The polyethylene resin used shall have all ingredients pre-compound prior to extrusion of pipe, in plant blending is not acceptable. Owner may request, as part of the quality control records submittal, certification that the pipe produced is represented by the quality assurance testing.

Additionally, test results from manufacturer's testing or random sampling by the Engineer that do not meet appropriate ASTM standards or manufacturer's representation, may be cause for rejection of pipe represented by the testing. These tests may include density and flow rate measurements from samples taken at selected locations within the pipe wall and thermal stability determinations according to ASTM D 3350, 10.1.9. Certified lab data may be requested to verify the physical properties of the materials supplied under this specification or may take random samples and have them tested by an independent laboratory.

5. Rejection: The Owner reserves the right to reject any polyethylene pipe and fittings failing to meet any of the requirements of this specification.
6. Pipe dimensions: Pipe supplied under this specification shall have a nominal DIP (ductile iron pipe) size O.D. unless otherwise specified. The DR (Dimension Ratio) of the pipe supplied shall be as specified.
7. Polyethylene pipe joining:
  - a) Sections of polyethylene pipe should be joined into continuous lengths on the job site above ground. The joining method shall be the butt fusion method and shall be performed by the manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures. Prior approval of equipment and personnel shall be obtained before fusion begins. The completed pipe joints shall be guaranteed for five years in writing to the Owner and its Contractor.
  - b) End connections: Special restrained joint mechanical joint adapters may be required for each end of the P.E. pipeline. The price quoted shall include any special end configuration and polyethylene ring to hold a standard mechanical joint.

E. Couplings:

1. Provide couplings where needed to make piping connections and where located on the plans.
2. Provide mechanical joint ductile iron sleeve, full length, minimum 12".
3. Provide cutting-in sleeve where installing fittings in an existing line.
  - a. Provide ductile iron with mechanical joint.
4. Provide restrained joint couplings where restrained joints are specified herein.

- F. Tee head bolts: Provide Cor-Ten steel tee head bolts for use on mechanical joints complying with ASTM A242.

## 2.3 AIR RELEASE AND VACUUM VALVES

A. Provide single body universal type with compound lever system.

1. Design valve to automatically exhaust large amounts of air and gases while the pipeline or system is being filled.
2. Design valve to release accumulated pockets of air while the pipeline is in operation.

3. Design valve to re-open to admit air during draining or when a negative pressure exists in the system.
- B. Provide an interchangeable drop-in head assembly for easy cleaning. Valves requiring on-site backwashing are not acceptable.
- C. Provide the valve body and interchangeable drop-in head assembly of cast or fabricated 316 stainless steel.
1. Incorporate a “sanitary clamp” to attach the head assembly to the body at the outlet.
  2. Valves that use bolting to attach the cover flange to the body are not acceptable.
  3. Locate the flange clamp at the outlet of the body for ease of cleaning and maintenance.
    1. Other clamping locations are not acceptable.
- D. All non-sealing internal metal components shall be 316 stainless steel. Plastic, nylon, or fiberglass components will not be acceptable.

Component	Material	Specification
Body & Cover Flange	316 stainless steel	ASTM A240
Float	316 stainless steel	ASTM A240
Internal Trim	316 stainless steel	ASTM A240
Seat	Rubber	Buna-N
Bolting-Sanitary Clamp	316 stainless steel	ASTM A240

- E. Provide valve with minimum 2” inlet, or larger, if shown on the drawings.
- F. Provide air and vacuum valves of the size listed in the schedule or shown on the plans with threaded inlet and outlet to 3” size and ANSI B16.1 Class 125 flanged inlet and threaded outlet in larger sizes.
- G. Incorporate an air release orifice of 3/16” for use at 200 psi.
1. No deviation from this orifice size will be allowed.
  2. Locate in the outlet of the valve and drill in a 3/16” stainless steel orifice plate that seals against a Buna-N rubber seat.
  3. Valves with seals that flex or roll will not be acceptable.
- H. Provide protective cover to prevent debris from falling into release orifice.
- I. Provide inlet Type 316 stainless steel ball valve with T-handle operator and three piece body.
- J. All piping, nipples, etc., to be Schedule 40, Type 316L stainless steel.
- K. Valves to be a maximum 14 inches in overall height and maximum weight of 25 lbs.
- L. Provide one spare drop-in head assembly for every five (5) valves.
- M. Provide Crispin “X” Series, Model UX20.

- N. Air release and vacuum valve manhole:
1. Provide reinforced precast concrete ring and flat top slab section complying with ASTM C-478 and the following.
  2. Use portland cement complying with ASTM C-150, Type II.
  3. Cast base slab monolithically with walls.
  4. Design flat slab top sections for HS-20 traffic loadings.
  5. Provide tongue and groove with vulcanized butyl rubber sealant or "O" ring rubber gasketed joints.
  6. Cast or factory cut pipe opening in manholes:
    - a. Provide flexible pipe boot conforming to ASTM C-923M.
    - b. Attach boot to piping with dual stainless steel straps.
    - c. All other hardware to be stainless steel.
    - d. Provide Kor-N-Seal or equal.
  7. Size lift holes and inserts for a precision fit with the lift devices.
    - a. Holes shall not penetrate through the manhole wall.
    - b. Comply with OSHA Standard 1926.704.
  8. Provide flat slab tops.
  9. Manhole liners:
    - a. Provide epoxy coating on manhole interior.
  10. Steps:
    - a. Provide polypropylene plastic steps reinforced with 3/8" diameter steel rod, M.S.A. Industries, Inc. Model PS-K, or equal.
    - b. Provide steps having non-skid top surfaces, safety slope at each end, minimum width of 10" and not less than 5" projection from wall.
    - c. Embed a minimum of 3".
    - d. Maximum spacing - 16".
  11. Frames and covers:
    - a. Provide gray iron castings, complying with ASTM A 48, Class 35B iron and AASHTO M-306.
    - b. Provide a minimum recycled material content of 75 consisting of post-consumer material.
    - c. Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage, cracks and other surface defects ground smooth and clean by shot blasting.
    - d. Cast or machine bearing surfaces between rings and covers with such precision to prevent rocking.
    - e. Casting dimensional tolerances shall be +/- 1/16" per foot.
    - f. Conduct a first article proof load test and make the results of that proof load available upon request.
      - i. Conduct in accordance with the method and procedure outlined in AASHTO M-306.
      - ii. Test casting on a suitable and calibrated load testing machine. Casting shall hold a 40,000 pound proof load for one minute without experiencing any cracks or detrimental permanent deformation.
      - iii. Maintain test results for each lot of castings by the foundry for a minimum of seven years. Make available upon request.
    - g. Provide inspections in accordance with AASHTO M-306 and furnish results of these tests upon request.
    - h. Furnish a foundry certification stating that samples representing each lot have been tested, inspected, and are in accordance with this specification.



- i. Each casting shall be identifiable and show, at a minimum, the following: name of the producing foundry, country of manufacturer, ASTM material designation, recycle symbol, individual part number, cast or heat date.
- j. Provide frame weighing not less than 200 lbs. with inside opening between 21.8" and 24".
- k. Provide circular cover with two "pick" holes, two 1" diameter vent hole, and weighing not less than 130 lbs.
- l. Covers to have the words "SANITARY SEWER" cast in the metal.
- m. Coat frames and covers with two (2) shop coats of water based bitumastic paint, MC4 MPFC by Molecular Coating Specialist of Cedar Hill, Texas or approved equal.
- n. Provide watertight covers, where indicated, conforming to above requirements.
  - i. Tap for four bolts, countersunk in cover.
  - ii. Provide rubber gasket between frame and cover.
  - iii. Provide stainless steel bolts.
- o. Provide USF Model 678-KM.

## 2.4 SERVICE SADDLE

- A. Provide of the following materials:

Body	Type 304 Stainless Steel
Bales and Strips	Type 304 Stainless Steel
Studs	Type 304 Stainless Steel
Hardware	Type 304 Stainless Steel

- B. Provide plastic lubricating washers
- C. Coat all stainless steel fasteners to prevent galling.
- D. Provide for maximum working pressure of 150 psi. Provide double strap for sizes 5" and larger.
- E. Provide Smith-Blair 313 Double Straps or approved equal.
- F. Connect to pipeline using a 6" stainless steel nipple.
  - 1. Do not use a threaded PVC connection.

## 2.5 VALVE BOXES

- A. Provide at each buried valve.
- B. Cast iron extension type, suitable for minimum cover of 3'6" over the pipe.
- C. Minimum inside diameter at the top of 5", minimum wall thickness 3/16" and thickness at the top of 11/16".

- D. Have the word "WATER"; "SEWER"; "SLUDGE", etc., as applicable, cast into the cover.
- E. Provide Tyler Series 6850.
- F. Where depth requires more than a two piece box use adjustable cast iron extensions.
- G. Coat box and cover with two (2) shop coats of bitumastic paint.

## 2.6 METALLIC DETECTION TAPE

- A. Provide 2" wide metallic detection tape on all buried PVC piping.
  - 1. Provide 5.0 mil overall thickness with no less than a 50 gauge solid aluminum foil core.
  - 2. Foil to be visible from both sides.
  - 3. No inks or printing extended to the edges of the tape.
  - 4. Encase printing to avoid ink rub-off.
  - 5. Tensile strength - 28 lbs/inch.
  - 6. Use heat set mylar inks.
- B. Locate 12" below ground surface in pipe trench.
- C. Color to be safety brown.
- D. Wording on tape to indicate pipe contents and repeated a minimum of every 24".

## 2.7 COPPER TRACER WIRE

- A. Provide a continuous 12 gauge insulated copper tracer wire when PVC or polyethylene pipe is used.
- B. Approved for direct burial by the manufacturer.
- C. Terminate tracer wire at each valve and air release valve and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves.
- D. Connect to the line with duct tape at every bell connection or every 20' to ensure that the wire is directly over the top of the pipe.
- E. Splice wire at each tee connection with an approved copper compression lug.
- F. Test all tracer wire for conductivity in accordance with Section 3.

## 2.8 CONCRETE

- A. Use 3000 psi complying with Section 03 30 00.

## 2.9 PIGS

- A. Provide all piping systems with methods for launching and capturing pigs.
  - 1. Provide wye fitting with removable cap and valve between the cap and the main line.
- B. Design pigs for cleaning of pipe material specified.
- C. Manufacture of open-cell polyurethane foam body, without coating or abrasives, which would scratch or otherwise damage interior pipe wall surface or lining.
- D. Able to pass through reductions of up to 65 percent of nominal cross-sectional area of pipe.
- E. Able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to force main being tested.

## PART 3 - EXECUTION

### 3.1 LAYING OUT WORK

- A. Provide all materials, labor, instruments, etc. required to lay out Work.
- B. Prepare "cut sheets" under direct supervision of the Engineer.
- C. Exercise proper precaution to verify figures on the drawings prior to layout Work. Contractor will be held responsible for any errors therein that otherwise might have been avoided.
- D. Promptly inform Engineer of errors or discrepancies found, in order that proper corrections may be made.

### 3.2 HANDLING

- A. Handle pipe accessories so as to ensure delivery to the trench in sound, undamaged condition:
  - 1. Carry pipe into position - do not drag.
  - 2. Use pinch bars or tongs for aligning or turning ductile iron pipe only on the bare end of the pipe.
  - 3. Use care not to injure pipe linings.
- B. Thoroughly clean interior of pipe and accessories before lowering pipe into trench. Keep clean during laying operations by plugging or other method approved by the Engineer.
- C. Before installation, inspect each piece of pipe and each fitting for defects.
  - 1. Material found to be defective before or after laying: Replace with sound material meeting the specified requirements, and without additional cost to the Owner.

- D. Rubber gaskets: Store in a cool dark place until just prior to time of installation.

### 3.3 PIPE CUTTING

- A. Cut pipe neatly and without damage to the pipe.
- B. Unless otherwise recommended by the pipe manufacturer and authorized by the Engineer, cut pipe with mechanical cutter only.
  - 1. Use wheel cutters when practicable.
  - 2. Cut plastic pipe square, and remove all burrs.

### 3.4 LOCATING

- A. Where possible, locate pressure sewer at least 10' away, horizontally, from water mains.
- B. Where pressure sewers cross over or under water lines, maintain minimum 18" separation between outside edges of the two pipes.
  - 1. A full length of the pressure sewer pipe shall be located so that the joints will be equal distance from the water main.

### 3.5 EXCAVATION AND BACKFILLING

- A. Comply with pertinent provisions of Section 31 30 02 and of these Specifications.

### 3.6 ALIGNMENT OF PIPE

- A. Pipe lines intended to be straight shall be so laid.
- B. Where vertical or horizontal alignment requires deflection from straight line or grade, such deflection shall not exceed maximum deflection recommended by the pipe manufacturer.
- C. If alignment requires deflection exceeding recommended limits, furnish special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the allowable limits.

### 3.7 PLACING AND LAYING

- A. General:
  - 1. Lower pipe and accessories into trench by means of derrick, ropes, belt slings, or other equipment approved by the Engineer.
  - 2. Do not dump or drop any of the materials of this Section into the trench.
  - 3. Rest the full length of each section of pipe solidly on the pipe bed, with recesses excavated to accommodate bells, couplings, and joints.
  - 4. Take up and relay pipe that has the grade or joint disturbed after laying.
  - 5. Do not lay pipe in water, or when trench conditions are unsuitable for the work; keep water out of the trench until jointing is completed.
  - 6. Securely close open ends of pipe when work is not in progress.
  - 7. Where any part of coating or lining is damaged, repair to the approval of the Engineer and at no additional cost to the Owner.
  - 8. Lay each pipe accurately to the indicated line and grade maintaining a positive slope toward the air release valve locations as shown on the drawings.

9. Record pipe elevation every 100' and submit elevations to Engineer weekly.
- B. Ductile iron pipe:
  1. Mechanical and push-on joints: Install in accordance with ANSI/AWWA C600.
  2. Gaskets: Handle, lubricate where necessary, and install in strict accordance with manufacturer's recommendations.
- C. Plastic pipe:
  1. Clean gasket, bell or coupling interior, especially groove area.
  2. Lubricate and invert gasket as recommended by manufacturer.
  3. Align spigot to bell, insert spigot into bell until it contacts gasket uniformly.
  4. Push pipe "home" until reference mark is at proper location.
  5. PVC force main must be installed in accordance with ASTM D-2321, latest revision.
- D. Restrained joints:
  1. Install in accordance with manufacturer's instructions.
  2. Tighten set screws to the manufacturer's rated torque using a torque wrench. If twist-off nuts are provided, tighten screws until nut breaks loose.

### 3.8 TRACER WIRE TESTING

- A. General:
  1. Utilize an approved magnetic locating device, M Scope or Equal.
  2. Connect a cable conductively from the transmitter to a metal ground rod and to the tracer wire.
  3. Locate the line following the instructions of the magnetic locating device.
  4. If interference is encountered from adjacent utilities or if the depth of bury or line length interferes with the signal, install a dummy valve box with access to the tracer wire at no additional cost to the owner.
  5. Where there is a break in the tracer wire, repair with 3M DBY or ILSCO #IK-8 repair kit and wrap with poly wrap for cathodic protection.
- B. Creek crossing and wetland areas:
  1. Send a prescribed frequency with a shore line base signal ejector between 25 and 1024 HZ down a metal medium and read by a receiver.
  2. Select a frequency based on the depth and the amount of linear feet of the line.
  3. If the tracer wire has a break, reinstall the cable and repeat the conductivity test at no additional cost to the owner.
- C. Notify in advance and conduct all testing in the presence of the Engineer.

### 3.9 INSTALLATION OF MANHOLES

- A. Set bases level so that walls will be plumb.
- B. Clean bells and spigots.
- C. Apply joint sealer, or ring gasket to wall section(s), set firmly in place to assure watertight joints.

- D. Set risers and cones so steps align.
- E. Tightly connect pipe boot to piping with dual stainless steel straps.
- F. Grout lift holes from the outside using non-shrink grout.
- G. Install manhole to grade utilizing precast grade rings.

### 3.10 INSTALLATION OF AIR RELEASE VALVES

- A. Compact backfill thoroughly over pressure sewer.
- B. Install gravel drainage bed as shown on plans.
- C. Set valve plumb, using a bronze nipple between pressure sewer and valve.
- D. Install manhole wall sections plumb and level.
- E. Install concrete valve marker at right-of-way.

### 3.11 THRUST BLOCKS

- A. General:
  - 1. Provide thrust blocks on plugs, caps, tees and bends deflecting 11-1/4° or more either vertically or horizontally.
  - 2. Size of blocking will be determined by the Engineer, based on soil bearing capacity.
- B. Installation:
  - 1. Locate thrust blocking between solid ground and the fitting to be anchored.
  - 2. Unless otherwise shown or directed by the Engineer, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
  - 3. Sides of thrust blocking not subject to thrust may be placed against forms.
  - 4. Place thrust blocking so the fitting joints will be accessible for repair.

### 3.12 HYDROSTATIC TESTING

- A. General:
  - 1. Pressure and leakage testing must be conducted in accordance with AWWA Standards C600.
  - 2. Clean and flush line of air, dirt and foreign material.
  - 3. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.
  - 4. Test pump, pipe connection, pressure gauges, measuring devices and all other necessary appurtenances to conduct tests are to be provided by the Contractor.
  - 5. Install brass corporation cocks at all high points that do not have permanent air vents. Corporation cocks are to be left in place and all costs for providing such cocks are to be borne by the Contractor.
  - 6. Conduct tests on each line or valved section of line.

7. Test pressures to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.
8. Do not test pipe at pressures exceeding manufacturer's recommendations.
9. The Contractor must provide documentation of the pressure and leakage tests. Documentation must include length of lines, diameter of pipe(s), amount of water required to fill line after test was performed, and amount of allowable leakage.
10. The witness to the hydrostatic testing is to be someone other than the Contractor or the utility installing the lines.

B. Pressure tests:

1. After the pipe is laid, the joints completed, and the trench backfilled, subject the newly laid piping and valved sections of the piping to the test pressure specified in Part A above.
2. Open and close each valve within the section being tested several times during the test period.
3. Replace or remake joints showing leakage.
  - a. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings and valves. Replace with sound material and repeat the test until results are satisfactory.
  - b. Make repair and replacement without additional cost to the Owner.

C. Leakage test:

1. Conduct leakage test after the pressure test has been completed satisfactorily.
2. Duration of each leakage test: At least two hours.
3. During the test, subject water lines to the test pressure specified in Part A above.
4. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
  - a. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula(s):
    - 1) Ductile iron piping:

$$L = S \times D \times \sqrt{P} / 133,200; \text{ where}$$

L = allowable leakage in gallons per hour;  
 S = length of pipe tested in feet;  
 D = nominal diameter of pipe in inches; and  
 P = average test pressure psi gauge.

- 2) PVC piping:

$$L = N \times D \times \sqrt{P} / 7400; \text{ where}$$

L = allowable leakage in gallons per hour;  
 N = number of joints in pipeline being tested;  
 D = nominal diameter of pipe in inches; and  
 P = average test pressure psi gauge.

- b. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size will be allowed.
  - 1) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.
  - 2) Repair all visible leaks regardless of test results.

### 3.13 PIGGING

- A. After completion of hydrostatic testing and prior to disinfection, clean water mains by pigging.
- B. Test Execution:
  - 1. Conduct pigging test in presence of Engineer.
  - 2. Provide at least 48-hours notice of scheduled pigging.

### 3.14 MEASUREMENT AND PAYMENT

- A. All work under this Section will be measured and paid for as follows.
- B. Pipe installed before final project acceptance will be paid for at the unit price per linear foot as stated in the Proposal, and shall include cost of excavation, backfilling, detection tape, tracer wire, installation records, etc. Upon approved completion of cleanup, testing and successful pumping systems operation, the remaining payment will be made. Measurement will be from center to center of fittings; no deduction will be made for the space occupied by valves and fittings.
- C. Restrained joint pipe will be paid for at the unit price per linear foot as stated in the Bid Form and include all items described in "B" above and the cost of all restrained joint accessories.
- D. Pipe installed cannot be included in quantities for payment until weekly installation elevation reports are submitted and approved by the Engineer.
- E. Ductile iron fittings including couplings will be paid for at the unit price per pound stated in the Bid Form, with weight of fittings being based upon the published weight of the fitting body. When mechanical and restrain joint fittings are used, no payment will be made for the weight of joint accessories. The weight of compact fittings will be calculated based on the weight of standard fittings of the same size and type.
- F. Fittings other than ductile iron: No measurement will be made and cost for these fittings shall be included in the price bid per linear foot of the pipe with which they are used. No extra payment will be made for these fittings.
- G. Air release valve will be paid for at the unit price, each, stated in the Proposal and shall include cost of valve, pipe, manhole, etc.
- H. Thrust blocks: No measurement or direct payment will be made and cost for same shall be included in the price bid for the pipe with which they are used.



- I. Connection to Existing System: Payment will be made at the unit price as stated for each in the Bid Form. Payment shall include cost of materials, excavation, core in existing manhole, grout around new sewer, modification of invert, backfill, and flow control.
- J. Pigging of the water lines shall be paid for on a linear foot basis and shall include the cost of the pigs, the labor and materials needed to insert and retrieve the pigs and other costs associated with the pigging operation. No additional payment shall be made for any tracking equipment deemed necessary by the Contractor.

**END OF SECTION**

**SECTION 33 10 01**  
**SANITARY SEWER - GRAVITY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work included: Provide gravity sanitary sewer as shown on the drawings, specified herein, and needed for a complete and proper installation.
- B. Related work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.
  - 2. Section 31 30 02 - Trenching, Backfilling for Utilities.

**1.2 QUALITY ASSURANCE**

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All materials in this Section are to be manufactured in the United States.

**1.3 SUBMITTALS**

- A. Not Used.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

**1.4 PRODUCT HANDLING**

- A. Storage of PVC pipe:
  - 1. Store in unit packages as received from manufacturer until just prior to use.
  - 2. Stack units in such a manner as to prevent deformation to pipe barrel and bells.
  - 3. Protect from direct sunlight by covering with opaque material if storage period will exceed six weeks.
- B. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

**1.5 ORDER AND ACCEPTANCE OF WORK**

- A. Engineer shall direct on what line or street the Contractor shall work and the order thereof.
  - 1. Generally, Work shall commence with outfalls, to mains, thence to laterals.

- B. Owner reserves right to accept and use any portion of Work whenever it is considered to be in the public interests to do so.

#### 1.6 PROTECTION OF OTHER UTILITIES

- A. Location:
  - 1. Approximate location of certain known underground lines is shown.
  - 2. Existing small lines not shown.
  - 3. Locate small and other possible utility lines using electronic pipe finder, or other approved method.
  - 4. Excavate and expose existing underground utilities ahead of trenching operations.
- B. Repair or replace any damaged utility line or structure at no additional cost to Owner.

#### 1.7 CONFLICTING UTILITIES

- A. Remove and/or relay conflicting utilities, when so directed by the Engineer, at the expense of the Owner.
- B. Where alterations to existing utilities are shown to avoid conflicts, make alterations at no cost to Owner.

#### 1.8 JOB CONDITIONS

- A. Work under this Section may require construction or work in a confined space, defined as any space having one or more of the following characteristics:
  - 1. Limited openings for entry and exit.
  - 2. Unfavorable natural ventilation.
  - 3. Not designed for continuous worker occupancy.
- B. The Contractor shall have on the job site at all times the following minimum safety equipment:
  - 1. Gas monitor capable of testing and detecting for combustible gas, oxygen deficiency and hydrogen sulfide.
  - 2. Confined space access and retrieval winch system.
  - 3. Ventilating fan with large diameter ventilating hose.
  - 4. Supplied air respirator, MISHA/NIOSH approved type.
  - 5. Safety harness and lifelines.

This equipment to be available for use by the Contractor, Engineer and Owner for the duration of the project.

- C. All entries into or work within confined spaces to be conducted in accordance with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health [DHHS (NIOSH)] Publication No. 87-113, A Guide to Safety in Confined Spaces.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Pipe shall be subject to Engineer's observation, at plant, trench or other point of delivery, for culling and rejecting pipe, independent of laboratory tests, not conforming to specifications.
- B. Rejected pipe will be marked by the Engineer and Contractor shall remove it from project site.

### 2.2 PIPE AND FITTINGS

- A. Use any pipe material specified herein, except where use of a particular pipe material is indicated on the Contract Drawings.
- B. Ductile-iron pipe and fittings (DIP):
  - 1. Comply with ANSI/AWWA C151/21.51, latest revision.
  - 2. Wall thickness in accordance with Table 51.1 of ANSI/AWWA C151/A21.51 with working pressure of 150 psi, depth of cover indicated and Type 3 bedding conditions, minimum Class 52.
  - 3. Use mechanical or push-on joints complying with ANSI/AWWA C111/A21.11 as modified by ANSI/AWWA C151/A21.51.
  - 4. Use rubber gaskets and lubricant complying with ANSI/AWWA C111/A21.10.
  - 5. Use wall thickness in accordance with table included herein for depth and bedding conditions.
  - 6. Provide 250 psi rated ductile iron fittings or specials unless otherwise indicated, complying with ANSI/AWWA C110/A21.10 and in accordance with ANSI/AWWA C111/A21.11.
  - 7. Clearly cast the manufacturer's mark, country where cast, year in which the fitting was produced, and the letters "DI" or "Ductile" on the fitting."
  - 8. Use lining complying with the following:
    - a. Amine cured Novalac Epoxy polymeric lining, 40 mils nominal thickness. The standards of quality are based on Protecto 401 by Vulcan Painters, Birmingham, Alabama or Corrosion-Clad Polymer Lining No. 210 by Seauereisen Cements, Pittsburgh, Pennsylvania.
  - 9. Polyethylene encasement:
    - a. Provide polyethylene encasement of pipe where indicated on the plans and where controlled density fill is utilized.
    - b. Minimum nominal thickness of 8 mils.±10%.
- C. Polyvinyl chloride pipe and fittings (PVC):
  - 1. Use integral wall bell and spigot, minimum of SDR26, complying with ASTM 3034.
  - 2. Use elastomeric gasket joints, providing watertight seal.
  - 3. Furnish pipe in 12.5 or 20-foot lengths.
  - 4. Transition Adapter PVC to DIP:

- a. For transition between ductile iron pipe and PVC pipe use ductile iron adapter with Protecto 401 lining by Romac Industries, Inc. Model 501 Transition Coupling or approved equal.
- b. Fasteners to be Type 316 stainless steel.

## 2.3 MANHOLES

- A. Use precast manholes:
  - 1. Provide reinforced precast concrete ring and eccentric cone sections complying with ASTM C 478 and the following.
  - 2. Use portland cement complying with ASTM C 150, Type II.
  - 3. Cast base slab monolithically with walls.
  - 4. Design flat slab top sections for HS-20 traffic loadings.
  - 5. Cast ladder rungs into the units.
    - a. Embed a minimum of 3".
    - b. Maximum spacing - 16".
  - 6. Provide tongue and groove with vulcanized butyl rubber sealant or O-ring rubber gasketed joints.
  - 7. Cast or factory cut pipe opening in manholes:
    - a. Provide flexible pipe boot conforming to ASTM C923M.
    - b. Attach boot to piping with dual stainless steel straps.
    - c. All other hardware to be stainless steel.
    - d. Provide Kor-N-Seal or equal.
  - 8. Size lift holes and inserts for a precision fit with the lift devices.
    - a. Holes shall not penetrate through the manhole wall.
    - b. Comply with OSHA Standard 1926.704.
  - 9. Provide flat slab tops where manhole depth is less than 4'0".
- B. Steps:
  - 1. Provide polypropylene plastic steps reinforced with 3/8" diameter steel rod, M.S.A. Industries, Inc. Model PS-K, or equal.
  - 2. Provide steps having non-skid top surfaces, safety slope at each end, minimum width of 10" and not less than 5" projection from wall.
- D. Frames and covers:
  - 1. Provide gray iron castings, complying with ASTM A 48, Class 35B iron and AASHTO M-306.
  - 2. Provide a minimum recycled material content of 75 consisting of post-consumer material.
  - 3. Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage, cracks and other surface defects ground smooth and clean by shot blasting.
  - 4. Cast or machine bearing surfaces between rings and covers with such precision to prevent rocking.
  - 5. Casting dimensional tolerances shall be +/- 1/16" per foot.
  - 6. Conduct a first article proof load test and make the results of that proof load available upon request.
    - a. Conduct in accordance with the method and procedure outlined in AASHTO M-306.

- b. Test casting on a suitable and calibrated load testing machine. Casting shall hold a 40,000 pound proof load for one minute without experiencing any cracks or detrimental permanent deformation.
    - c. Maintain test results for each lot of castings by the foundry for a minimum of seven years. Make available upon request.
  - 7. Provide inspections in accordance with AASHTO M-306 and furnish results of these tests upon request.
  - 8. Furnish a foundry certification stating that samples representing each lot have been tested, inspected, and are in accordance with this specification.
  - 9. Each casting shall be identifiable and show, at a minimum, the following: name of the producing foundry, country of manufacturer, ASTM material designation, recycle symbol, individual part number, cast or heat date.
  - 10. Provide frame weighing not less than 155 lbs. with inside opening between 21.8" and 24".
  - 11. Provide circular cover with two "pick" holes, one 1" diameter vent hole, and weighing not less than 130 lbs.
  - 12. Covers to have the words "SANITARY SEWER" cast in the metal.
  - 13. Coat frames and covers with two (2) shop coats of water based bitumastic paint, MC4 MPFC by Molecular Coating Specialist of Cedar Hill, Texas or approved equal.
  - 14. Provide watertight covers, where indicated, conforming to above requirements.
    - a. Tap for four bolts, countersunk in cover.
    - b. Provide rubber gasket between frame and cover.
    - c. Provide stainless steel bolts.
  - 15. Provide East Jordan Iron Works, Inc. Model V-1384 or approved equal.
- E. Precast grade rings:
  - 1. Use Precast Grade Rings to adjust ring and covers to finished grade.
  - 2. No more than 8 vertical inches of grade rings will be allowed per manhole.
  - 3. Conform to ASTM C 478
  - 4. Provide no less than 4" in height.
  - 5. Use cement brick for adjustments less than 4".
- F. Precast inverts:
  - 1. Provide precast inverts.
    - a. Pipe openings shall provide clearance for pipe projecting a minimum of 2" inside the manhole.
    - b. The height of the transition from the pipe opening to the invert trough shall be equal to one-half of the Opening ID minus Pipe ID,  $\pm 1/4"$ .
  - 2. The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe.
    - a. When the fall between the inlet and the outlet holes is greater than 4", the inlet end of the trough shall be below the inlet pipe invert and aligned horizontally within 1".
    - b. Form and finish troughs to provide a consistent slope from the pipe outlet to the inlets up to 4" fall.
      - 1) Minimum fall-1".
      - 2) Minimum bending radius of the trough centerline-1.5 times the pipe I.D.
      - 3) Provide a 1/2" radius at the intersection of 2 or more channels.
      - 4) The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be 7".

- c. Float finish benches to provide a uniform 2-1/2" slope,  $\pm 1"$ , from the high point at the manhole wall to the low point at invert trough.
  - 1) Provide a 1/4" radius at the edge of the bench and trough.
- d. Fill, depressions, high spots, voids, chips, or fractures over 1/4" in diameter or depth with a sand cement paste and finish to a texture reasonably consistent with the formed surface.

## 2.4 CLEANOUTS

- A. Provide cleanouts on each separate service line.
  - 1. Locate within the Owner's right-of-way.
  - 2. Provide J. R. Smith, Josam or equal.
  - 3. Provide Smith #4253S-G (taper thread - bronze plug, cast iron top) or Josam #58860-22-5.
  - 4. Coat with 2 shop coats of bitumastic paint.
  - 5. Provide cleanouts of the same diameter as lines in which they are installed up to 4", and not less than 4" for larger pipe diameters.
  - 6. Comply with the latest adopted version of the International Plumbing Code or local codes where applicable.
  - 7. Provide concrete protection pad set at grade.

## 2.5 SERVICE PIPE FITTINGS

- A. Provide PVC fittings in conformance with the requirements of ASTM D-3034 with minimum wall thickness of SDR35.
- B. Provide PVC material with cell classification of 12454-B or C as defined in ASTM D-1784.
- C. Gaskets will have a minimum cross-sectional area of 0.20 square inches and conform to ASTM F-477.
- D. Provide fittings with socket depths not less than the minimum depths shown in Table 2 of ASTM D-3034 latest revision.

## 2.6 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

# PART 3 - EXECUTION

## 3.1 LAYING OUT WORK

- A. Provide all materials, labor, instruments, etc. required to lay out Work.
- B. Prepare "cut sheets" under direct supervision of the Engineer.

- C. Exercise proper precaution to verify figures on the drawings prior to laying out Work. Contractor will be held responsible for any errors therein that otherwise might have been avoided.
- D. Promptly inform Engineer of errors or discrepancies found, in order that proper corrections may be made.

### 3.2 LOCATION

- A. Sewer lines in relation to water lines must conform to South Carolina Standards for Wastewater Facility Construction R.61-67 section 67-300 paragraph A.14.
- B. Where the sewer location is not located clearly by dimensions on the drawings, locate the sewer:
  - 1. Not closer than 10' horizontally from a water supply main or service line. The distance shall be measured edge to edge.
  - 2. Where it is not practical to maintain a 10' horizontal separation, the sewer pipe may be installed closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the water main is at least 18" above the top of the sewer.
  - 3. Where sewers are crossing a water main, either above or below, provide a minimum vertical distance of 18" between the outside of the water main and the outside of the sewer.
  - 4. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.
  - 5. Where a water main crosses under a sewer, fully encase the sewer pipe for a distance of 10' on each side of the crossing; or
  - 6. Use acceptable pressure pipe with no joint closer horizontally than 3' feet from the crossing. This pipe will be pressure tested to assure watertightness prior to backfilling.
  - 7. Where concrete encasement is used, provide not less than 4" thickness including that on pipe joints.

### 3.3 INSTALLATION

- A. Trench, backfill and compact for the work of this Section in strict accordance with pertinent provisions of Section 31 30 02 of these specifications, and the following requirements:
  - 1. Maximum trench widths, depths and bedding methods.
    - a. Install all sewers complying with tables for depths of cut and class of bedding included hereinafter.
    - b. Where trenches are excavated beyond specified widths, or trench walls collapse, lay sewer complying with requirements of the next better class of bedding at no additional cost to the Owner.
    - c. Include cost of special bedding and tamping in unit prices bid for sewer.
  - 2. Ductile-iron pipe:



MAXIMUM DEPTHS IN FEET						
Pipe Size	Max. Trench Width	Pipe Class	Class of Bedding			
			D	C	B	A
			Flat Bottom Trench	Type 1 or Type 2	Type 1 or Type 2	Special Concrete Bedding
8"	2'2"	50	24	28	32	35
10"	2'4"	50	15	24	32	35
10"	2'4"	51	24	32	35	35
12"	2'6"	50	16	20	32	35
12"	2'6"	51	20	24	35	35
12"	2'6"	52	28	32	35	35
14"	2'9"	50	14	16	32	35
14"	2'9"	51	16	20	35	35
14"	2'9"	52	24	28	35	35
16"	3'0"	50	13	17	32	35
16"	3'0"	51	17	21	35	35
16"	3'0"	52	21	25	35	35
18"	3'2"	50	11	15	32	35
18"	3'2"	51	15	17	35	35
18"	3'2"	52	17	21	35	35
20"	3'6"	50	11	15	32	35
20"	3'6"	51	13	17	35	35
20"	3'6"	52	17	21	35	35
24"	3'10"	50	10	14	30	35
24"	3'10"	51	12	16	34	35
24"	3'10"	52	14	18	35	35
30"	4'7"	50	0	12	26	35
30"	4'7"	51	0	14	30	35
30"	4'7"	52	0	16	34	35
36"	5'5"	50	0	13	27	35
36"	5'5"	51	0	19	31	35
36"	5'5"	52	0	19	35	35
36"	5'5"	53	0	23	35	35
42"	6'1"	50	0	15.5	27.5	35
42"	6'1"	51	0	17.5	27.5	35
42"	6'1"	52	0	19.5	31.5	35

3. Polyvinyl chloride pipe (SDR35):

MAXIMUM DEPTHS IN FEET					
Pipe Size	Max. Trench Width	Class of Bedding			
		D	C	B	A
		Flat Bottom Trench	Type 1 or Type 2	Type 2* Only	Special Concrete Bedding
4"	2'0"	**	**	30	30
8"	2'2"	**	**	30	30
10"	2'4"	**	**	30	30
12"	2'6"	**	**	30	30
15"	2'10"	**	**	30	30
18"	3'2"	**	**	30	30
21"	3'6"	**	**	30	30
*Class B Bedding (Type 2) shall extend to the top of the pipe.					
**Do not use this Class of bedding for this pipe size and trench width.					

4. Bedding and tamping requirements for the various classes of bedding shall comply with the following specifications:
  - a. Class A Bedding - Excavate trench to one-fourth of nominal pipe diameter below pipe grade; lay pipe to grade on concrete blocking; place 2500 psi concrete around pipe for full width of trench up to one-fourth nominal pipe diameter above the invert.
  - b. Class B (Type 1) Bedding - Shape bottom of trench to a level 2" below bottom of pipe; bring bed to proper level by spreading and thoroughly tamping fine granulated moist earth and sand to conform accurately to one-fourth circumference of pipe barrel; provide suitable material if not available from trench excavation; lay pipe, backfill and hand tamp in thin layers to height three-fourths of pipe diameter, using material same as bedding material; complete trench backfill complying with Section 02221.
    - 1) Trenches excavated to excess depths shall be brought to grade with stone or gravel bedding at the Contractor's expense.
    - 2) Exercise care to avoid disturbing pipe grade, alignment or joints at all times.
    - 3) In lieu of this class bedding, Contractor may elect to use Class B (Type 2) bedding.
  - c. Class B (Type 2) Bedding - Undercut 4" below pipe barrel, full width of trench; bring to grade with approved backfill and compacted crushed stone complying with SCDOT Aggregate No. 5; except for PVC sewers, use SCDOT Aggregate No. 57, then:
    - 1) For pipe other than PVC, place stone in six-inch layers to mid-point of pipe, compacting by slicing with shovel.
    - 2) For PVC pipe, place stone (Aggregate No. 57) in six-inch layers to the top of the pipe, compacting by slicing with shovel.
    - 3) Complete trench backfill complying with Section 02221.
  - d. Class C (Type 1) bedding - Shape trench bottom by hand to conform accurately to bottom one-quarter of pipe barrel circumference.
    - 1) Use Class C (Type 2) bedding if unable to properly shape trench bottom.

- 2) If shaping is not performed accurately, the Contractor will be required to use Class C (Type 2) bedding.
  - e. Class C (Type 2) Bedding - Undercut 4" below bottom of pipe barrel; full width of trench; bring to grade with approved backfill and compacted crushed stone complying with SCDOT Aggregate No. 5; lay pipe; place stone in 6" layers to quarter-point of pipe, compacting by slicing with shovel; complete backfill complying with Section 31 30 02.
  - f. Class D Bedding - Excavate bell holes in flat-bottomed trench; lay pipe; backfill complying with Section 31 30 02.
- B. Drain stop:
1. Provide a drain stop at 100' intervals where pipe length is 1000' or less and 1000' intervals where length is greater than 1000' for Class B (Type 2) and Class C (Types 1 and 2) bedding.
  2. Drain stop to consist of compacted cohesive clay 2'-0" minimum length at top of bedding material with side slopes no greater than 1:1 to trench bottom.
  3. Remove water from excavation prior to placing drain stop.
- C. Pipe laying:
1. General:
    - a. Protect pipe during handling against shocks and free fall. Remove extraneous material from the pipe interior.
    - b. Lay pipe by proceeding upgrade with the spigot ends of bell-and-spigot pipe pointing in direction of flow.
    - c. Lay each pipe accurately to the indicated line and grade, aligning so the sewer has a uniform invert.
    - d. Continually clear interior of the pipe free from foreign material.
    - e. Before making pipe joints, clean and dry all surfaces of the pipe to be joined.
    - f. Use gasket lubricants as recommended by the pipe manufacturer.
    - g. Place, fit, join and adjust the joints to obtain the degree of water tightness required.
  2. Polyvinyl chloride pipe and CCFRPM pipe:
    - a. Select proper bedding class from preceding table as determined by pipe size and depth of cut.
      - 1) Class B (Type 2) or better bedding shall be used for all PVC and CCFRPM sewers.
    - b. Comply with ASTM D2321, except as otherwise specified herein.
  3. Ductile-iron pipe:
    - a. Select proper bedding class from preceding table as determined by pipe size and depth of cut.
      - 1) Class D bedding limited to maximum pipe size of 24", Class 52 at 14' foot depth.
    - b. Comply with ANSI/AWWA C600, except as otherwise specified herein.
  4. Remove defective pipe and replace with sound pipe, at no cost to the Owner.

### 3.4 INSTALLATION OF MANHOLES

- A. Set bases level so that walls will be plumb.
- B. Clean bells and spigots.

- C. Apply joint sealer, or ring gasket to wall section(s), set firmly in place to assure watertight joints.
- D. Set risers and cones so steps align.
- E. Tightly connect pipe boot to piping with dual stainless steel straps.
- F. Grout lift holes from the outside using non-shrink grout.
- G. Install manhole to grade utilizing precast grade rings.

### 3.5 DROP MANHOLES

- A. Where indicated, or as directed by the Engineer, construct drop manhole connections, complying with plan details.

### 3.6 CONNECTIONS TO EXISTING SYSTEM

- A. Construct new manhole as specified, breaking upper half of existing pipe after base of manhole is completed so as not to obstruct flow of the existing pipe.
- B. At existing manhole tie-ins, temporarily block and/or divert sewage flows, perform other miscellaneous work.
  - 1. Use high-early strength cement for mortar, forming proper channels with minimum interruption to service of the existing sewer.

### 3.7 INSTALLATION IN CASING PIPES

- A. Install sewer where indicated within a casing pipe complying with Section 33 60 10 of these specifications.

### 3.8 SERVICE LINES

- A. Connect to street sewers using wye branches and ells as indicated on the plans.
- B. Do not stack service lines vertically over the sewer main.
- C. Provide sufficient fittings to route piping without bending the pipe sections.
- D. The Contractor is responsible for coordinating with the property owner and the utility owner's representative to determine the depth and location of both the sewer line connection and clean out to best provide a sewer service connection point for the property being served.
- E. The Contractor is responsible for locating service lines to avoid conflicts with existing utilities and exposure of line in ditches.

### 3.9 CLEANOUTS

- A. Secure the Engineer's approval of locations for cleanouts in finished areas prior to installation.
- B. Pour 4" concrete protection pad around cleanout.

### 3.10 INSPECTIONS AND TESTING

- A. General:
  - 1. All sewers will be visually inspected, tested and gauged for infiltration and/or exfiltration.
  - 2. All visible leaks shall be repaired even if infiltration is within allowable limits.
  - 3. Broken or cracked pipe, mislaid pipe and other defects shall be corrected.
  - 4. All repairs, relaying of sewers, etc., required to bring the sewers to specified status shall be made at no additional cost to the Owner.
  - 5. Expense of all testing will be borne by the Contractor.
- B. Construction observation:
  - 1. Clean and prepare for observation each block or section of sewer upon completion, or at such other time as the Engineer may direct.
  - 2. Each section between manholes shall show a full circle of light when viewed from either end.
- C. Deflection tests:
  - 1. Perform deflection tests on all PVC pipe in the presence of the Engineer.
  - 2. No pipe to exceed a deflection of 5%.
  - 3. Conduct deflection testing after the final backfill, and compaction thereof, has been in place at least thirty (30) days and prior to placing the sewer lines into operation.
  - 4. Conduct the deflection tests using a rigid ball or mandrel having a diameter equal to 95% of the inside diameter of the pipe.
  - 5. Do not use mechanical pulling devices for the deflection tests.
- D. Infiltration tests:
  - 1. Conduct tests using V-notch weir, or by direct measurement prior to allowing sewage flows in the line.
  - 2. Close the end of the sewer at upstream structure sufficiently to prevent the entrance of water.
  - 3. Discontinue use of well points or other groundwater pumping operations at least three days prior to testing.
  - 4. Infiltration into the entire system of new sewers or any one trunk, interceptor or outfall sewer, including connecting laterals, or any stretch of sewer shall not exceed 200 gallons per inch of diameter per mile per day.
  - 5. Make tests in presence of the Engineer, giving the Engineer at least three days advance notice.
- E. Air testing: Where sewers are installed above the groundwater table, conduct air tests complying with ASTM C 828 for ductile iron and concrete pipe and ASTM F 1417 for PVC pipe.

- F. Vacuum Test of Manholes:
1. Vacuum test manholes in accordance with ASTM C-1244.
  2. Typical Field Test Procedure.
    - a. The test head gauge shall be placed at the top of the manhole or in accordance with the manufacturer's recommendations.
    - b. A vacuum of 10 in. of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. of mercury.
    - c. The manhole shall pass if the time for the vacuum reading to drop from 10 in. of mercury to 9 in. of mercury meets or exceeds the values indicated in the Table 1 below.
    - d. If the manhole fails the initial test, necessary repairs shall be made. The manhole shall then be retested until a satisfactory test is obtained.
  3. Minimum test times for various diameter manholes.

**TABLE 1**

<b><u>Depth of Manhole (feet)</u></b>	<b><u>Diameter of manhole (feet)</u></b>			<b><u>Time (Sec.)</u></b>
	4'	5'	6'	
To – 8		20	26	33
8 - 10		25	33	41
10 – 12		30	39	49
12 – 14		35	46	57
14 – 16		40	52	67
16 – 18		45	59	73
18 – 20		50	65	81
20 – 22		55	72	89
22 – 24		59	78	97
24 – 26		64	85	105
26 – 28		69	91	113
28 – 30		74	98	121

### 3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the items under this Section and all cost for same shall be included in the lump sum price bid for the project.

**END OF SECTION**



**Date: May 30, 2025**

FRM Lighting and Controls  
75 Beattie Place, Suite 805  
Greenville SC 29601  
Phone: (864) 920-7710  
Fax:

Job Name  
**HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK IMPROVEMENTS**  
FRM-GREENVILLE25-161113  
NEWBERRY SC

Bid Date  
Jun 11, 2025

Submittal Date  
May 30, 2025

*Engineer:*  
DEVITA & ASSOCIATES, INC.  
1150 E WASHINGTON STREET  
GREENVILLE SC 29601



# Transmittal

FRM Lighting and Controls  
 75 Beattie Place, Suite 805  
 Greenville SC 29601  
 Phone: (864) 920-7710  
**From: KIRK WILLIAMS-GR**

**Project** HISTORIC LITTLE MOUNTAIN NEWBERRY  
 COUNTY REUNION PARK  
 IMPROVEMENTS

**Quote#** FRM-GREENVILLE25-161113

**Location** NEWBERRY SC

**To** DP3 ARCHITECTS-GREENVILLE  
 15 S. MAIN ST SUITE 400  
 GREENVILLE SC 29601  
 Contact:

ATTACHED WE ARE SENDING YOU 1 COPY OF THE FOLLOWING ITEM:

- |                                   |  |        |
|-----------------------------------|--|--------|
| <input type="checkbox"/> Drawings | <input checked="" type="checkbox"/> Specifications | Other: |
| <input type="checkbox"/> Prints   | <input type="checkbox"/> Information               |        |
| <input type="checkbox"/> Plans    | <input checked="" type="checkbox"/> Submittals     |        |

THESE ARE TRANSMITTED FOR:

- |  |   |                                 |
|--|---|---------------------------------|
| <input checked="" type="checkbox"/> Prior Approval | <input type="checkbox"/> Resubmittal for Approval | <input type="checkbox"/> Record |
| <input type="checkbox"/> Approval                  | <input type="checkbox"/> Corrections              | Bids due on:                    |
| <input type="checkbox"/> Approval as Submitted     | <input type="checkbox"/> Your Use                 | Other:                          |
| <input type="checkbox"/> Approval as Noted         | <input type="checkbox"/> Review and Comment       |                                 |

Type	MFG	Part
EM	ISOLITE	BUG-3W-WH-MB-SD
	BUG High Performance LED Emergency Light	
FP	YYZ LIGHTING	EFE-22W-CT40 - AC -36- 68 - SS -RB
FS	KIM LIGHTING	KFL1/8L-20/4K8/M/UNV/K/BLT/SF/HS
PS	HEVI LITE INC	AA L40 40 FL UNV SMED-L40
SP	COLUMBIA LIGHTING	LXEM4-40LW-RP-EDU-TP
SPE	COLUMBIA LIGHTING	LXEM4-40LW-RP-EDU-ELL14-TP
ST4	COLUMBIA LIGHTING	MPS4-40HL-CW-EDU
WPE	BEACON LIGHTING	TRP1-24L-25-4K7-4W-120-DBT-PCU-E
XC	DUAL-LITE	EVCURWD4I
XR	DUAL-LITE	EVODB





May 30, 2025

DP3 ARCHITECTS-GREENVILLE  
15 S. MAIN ST SUITE 400  
GREENVILLE SC 29601

**RE:** HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS  
NEWBERRY SC

Type	MFG	Part
EM	ISOLITE BUG High Performance LED Emergency Light	BUG-3W-WH-MB-SD
FP	YYZ LIGHTING	EFE-22W-CT40 - AC -36- 68 - SS -RB
FS	KIM LIGHTING	KFL1/8L-20/4K8/M/UNV/K/BLT/SF/HS
PS	HEVI LITE INC	AA L40 40 FL UNV SMED-L40
SP	COLUMBIA LIGHTING	LXEM4-40LW-RP-EDU-TP
SPE	COLUMBIA LIGHTING	LXEM4-40LW-RP-EDU-ELL14-TP
ST4	COLUMBIA LIGHTING	MPS4-40HL-CW-EDU
WPE	BEACON LIGHTING	TRP1-24L-25-4K7-4W-120-DBT-PCU-E
XC	DUAL-LITE	EVCURWD4I
XR	DUAL-LITE	EVODB



**Date: May 30, 2025**


Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS


**BUG-3W-WH-MB-SD**

**TYPE: EM**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

Submitted by FRM Lighting and Controls		Catalog Number: BUG-3W-WH-MB-SD	Type:  EM
	Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK IMPROVEMENTS Engineer: DEVITA & ASSOCIATES, INC. (GREENVILLE)	Notes:	




### BUG



High Performance LED Emergency Light

DATE:

PROJECT:

COMMENTS:





#### FEATURES

- CEC Title 20 Compliant.
- BUG3: 2 adjustable lamp heads with (3) 1 Watt LEDs producing 300 lumens/head (600 lumens total).
- BUG6: 2 adjustable lamp heads with (3) 2 Watt LEDs producing 650 lumens/head (1300 lumens total).
- Brownout detection ensures emergency operation during periods of low line voltage.
- Simple, snap-fit assembly and canopy with knockout mounting pattern on back plate and top conduit entry for easy installation.
- Optional full Self Diagnostics available - performs monthly test and continuously monitors unit status.
- Push-to-test switch and LED AC status indicator are used for manual testing.
- 120/277 VAC with field selectable inputs.
- Line latch prevents unnecessary discharge of battery during installation. Loads will not illuminate until after application of utility power.
- Low voltage disconnect prevents battery damage and ensures positive charge after extended discharge.
- Listed for indoor damp locations.
- Eco-friendly, long life, high performance lithium iron phosphate battery allows for 90 minutes of emergency run-time.

#### NOTES

- SD only available with WH Housing.
- EB cannot be specified with SD option.
- If using the remote capacity option (EB) without any remote lamp heads attached, the base unit run time is extended to greater than 2 hours.
- VRWP is designed for use in NEMA 4X or wet locations, IP65 rated.

#### ORDERING INFORMATION

BUG-3W-WH-MB      BUG High Performance LED Emergency Light, 3W, White, Back Mount

BUG-3W-WH-MB-EB      BUG High Performance LED Emergency Light, 3W, White, Back Mount - 5.4W Remote Capacity<sup>1</sup>

BUG-3W-WH-MB-SD      BUG High Performance LED Emergency Light, 3W, White, Back Mount - Self Diagnostic<sup>2</sup>

BUG-6W-WH-MB      BUG High Performance LED Emergency Light, 6W, White, Back Mount

BUG-6W-WH-MB-SD      BUG High Performance LED Emergency Light, 6W, White, Back Mount - Self Diagnostic<sup>2</sup>

BUG-6W-BK-MB      BUG High Performance LED Emergency Light, 6W, Black<sup>3</sup>, Back Mount

#### ORDERING NOTES

- Compatible with MVH remote heads
- Self-diagnostics (SD) not available with remote capacity (EB)
- Self-diagnostics (SD) and remote capacity (EB) not available with Black Finish

#### ACCESSORIES; ORDER SEPARATELY

- BUG-ACCY-VRS = Vandal Shield
- BUG-ACCY-CANOPY = Top Mount Canopy
- Remote Heads = See MVH
- WG-16.5LX14.0WX6.0D = Wireguard, Length: 16.5", Width: 14", Depth: 6"
- WG-20.0LX19.0WX9.0D = Wireguard, Length: 20", Width: 19", Depth: 9"
- WG-26.0LX19.0WX9.0D = Wireguard, Length: 26", Width: 19", Depth: 9"
- VRWP = Wet Location Vandal Resistant Shield

ISOLITE • WWW.ISOLITE.COM

ISOLITE HEADQUARTERS • 800.888.5483 • 31 WATERLOO AVENUE, BERWYN, PA 19312

ISOLITE WEST • 800.799.5343 • 3563 SUELDO SUITE M, SAN LUIS OBISPO, CA 93401

D-7.2.3.0-212 • REV-15 • 20250425

SPECIFICATIONS AND DETAILS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION.

CONTACT ISOLITE FOR UP TO DATE DETAILS.

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**  
BUG-3W-WH-MB-SD

Notes:

**Type:****EM**

FRM-GREENVILLE25-161113

**BUG**

High Performance LED Emergency Light

**SPECIFICATIONS****CONSTRUCTION**

- 5VA flame rated, injection molded ABS thermoplastic housing.
- Extruded aluminum LED heat sinks for optimal LED operation and long life.

**TEMPERATURE RATING**

- From 50°F to 104°F (10°C to 40°C)

**WEIGHT**

- 4 lbs. (options depending)

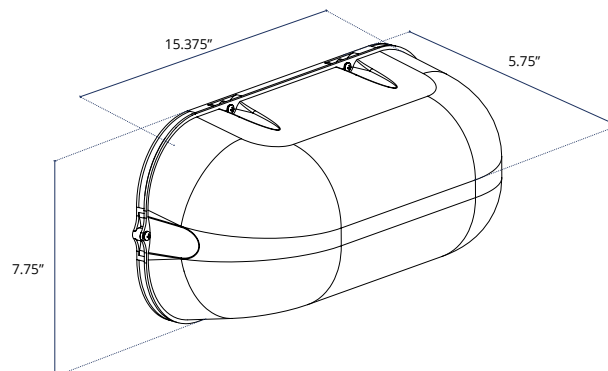
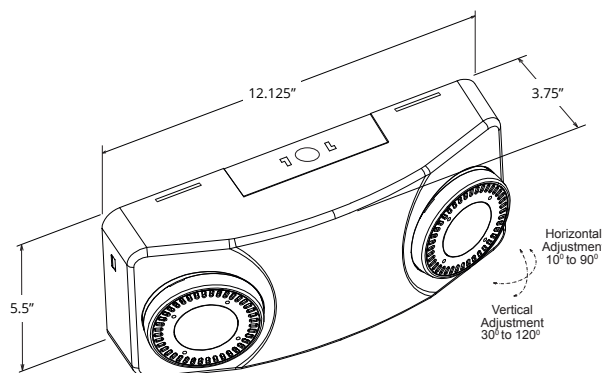
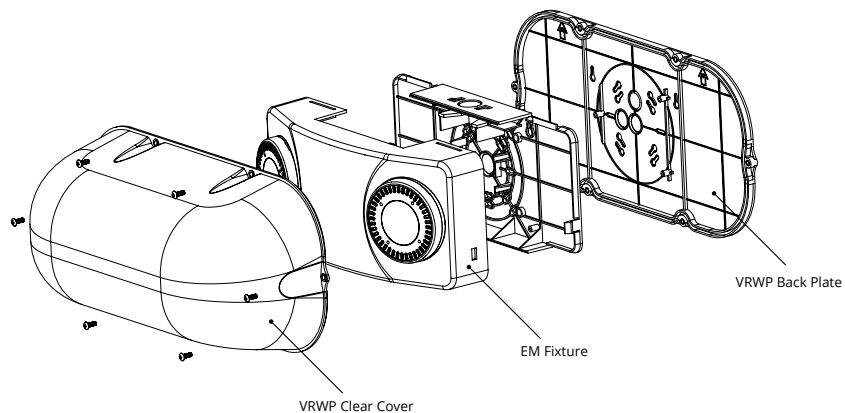
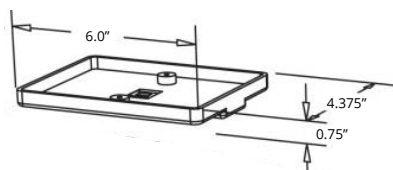
**APPROVALS**

- UL924
- UL Listed for Damp Location
- CEC Title 20 Compliant
- NFPA 101 Life Safety Code

- NFPA 70-NEC
- OSHA

**WARRANTY**

- Isolite offers a 5-year limited warranty. For further details, refer to General Warranty and Obligations in the Isolite manual or on our website. Lamps not warranted.

**DIMENSIONS****BUG****VRWP: WET LOCATION RESISTANT VANDAL SHIELD****BUG-ACCY-CANOPY DIMENSIONS****DRAWING**

ISOLITE • WWW.ISOLITE.COM

ISOLITE HEADQUARTERS • 800.888.5483 • 31 WATERLOO AVENUE, BERWYN, PA 19312  
ISOLITE WEST • 800.799.5343 • 3563 SUELDO SUITE M, SAN LUIS OBISPO, CA 93401

D-7.2.3.0-212 • REV-15 • 20250425

SPECIFICATIONS AND DETAILS ARE SUBJECT TO CHANGE WITHOUT NOTIFICATION.  
CONTACT ISOLITE FOR UP TO DATE DETAILS.



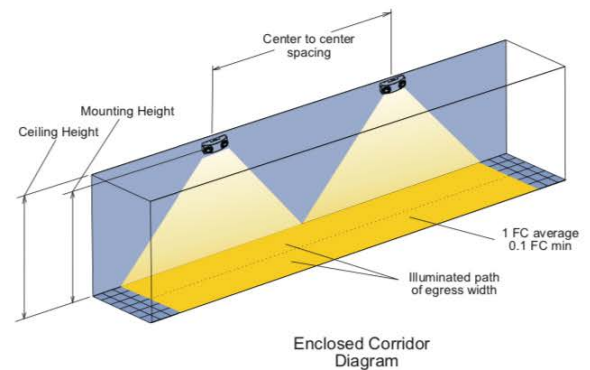
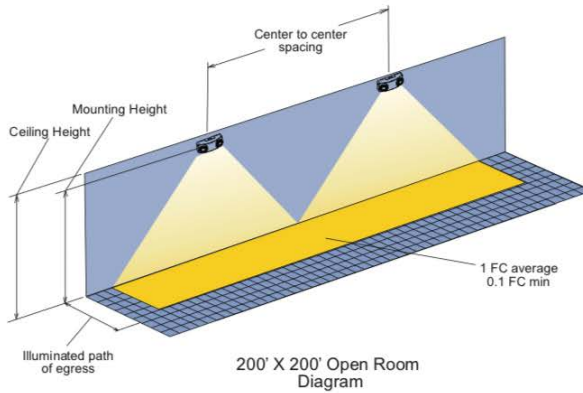
## BUG

High Performance LED Emergency Light

CFC Title 20



### BUG HIGH PERFORMANCE LED EMERGENCY LIGHT



### MULTIPLE UNIT MAXIMUM SPACING GUIDELINES (IN FT)

200 X 200' OPEN ROOM									
BUG3 - 600 LUMENS					BUG6 - 1300 LUMENS				
MOUNTING HEIGHT	CEILING HEIGHT	SPACING (CENTER TO CENTER)	AVERAGE (≥ 1.0FC)	UNIFORMITY RATIO MAX / MIN (≤ 40:1)	MOUNTING HEIGHT	CEILING HEIGHT	SPACING (CENTER TO CENTER)	AVERAGE (≥ 1.0FC)	UNIFORMITY RATIO MAX / MIN (≤ 40:1)
7.5	9	70	1.00	37.77	7.5	9	100	1.07	38.80
9	11	61	1.02	38.70	9	11	98	1.07	39.00
10	12	60	1.01	39.50	10	12	96	1.01	33.24
12	14	45	1.06	38.67	12	14	84	1.00	39.31
14	16	44	1.01	34.91	14	16	58	1.05	34.25
16	18	42	1.03	32.18	16	18	58	1.02	38.36

6' WIDE ENCLOSED CORRIDOR W/ 6' PATH OF EGRESS									
BUG3 - 600 LUMENS					BUG6 - 1300 LUMENS				
MOUNTING HEIGHT	CEILING HEIGHT	SPACING (CENTER TO CENTER)	AVERAGE (≥ 1.0FC)	UNIFORMITY RATIO MAX / MIN (≤ 40:1)	MOUNTING HEIGHT	CEILING HEIGHT	SPACING (CENTER TO CENTER)	AVERAGE (≥ 1.0FC)	UNIFORMITY RATIO MAX / MIN (≤ 40:1)
7.5	9	75	1.02	38.85	7.5	9	114	1.01	37.31
9	11	73	1.03	39.50	9	11	112	1.00	38.79
10	12	71	1.04	33.31	10	12	109	1.02	38.60
12	14	68	1.01	34.93	12	14	105	1.05	39.81
14	16	63	1.01	36.76	14	16	105	1.00	37.59
16	18	57	1.00	37.55	16	18	101	1.01	38.78

6' WIDE ENCLOSED CORRIDOR W/ 3' PATH OF EGRESS									
BUG3 - 600 LUMENS					BUG6 - 1300 LUMENS				
MOUNTING HEIGHT	CEILING HEIGHT	SPACING (CENTER TO CENTER)	AVERAGE (≥ 1.0FC)	UNIFORMITY RATIO MAX / MIN (≤ 40:1)	MOUNTING HEIGHT	CEILING HEIGHT	SPACING (CENTER TO CENTER)	AVERAGE (≥ 1.0FC)	UNIFORMITY RATIO MAX / MIN (≤ 40:1)
7.5	9	83	1.02	38.08	7.5	9	117	1.06	38.92
9	11	81	1.03	34.23	9	11	113	1.05	38.50
10	12	79	1.01	32.21	10	12	111	1.05	39.86
12	14	77	1.01	32.53	12	14	108	1.04	39.73
14	16	71	1.01	37.15	14	16	104	1.05	39.63
16	18	63	1.00	38.91	16	18	101	1.04	39.00



**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**EFE-22W-CT40 - AC -36- 68 - SS -RB**

**TYPE: FP**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

## EDIFICE INGROUND LIGHT

EFE



YYZ Edifice inground lights feature robust construction with body in heavy duty die-cast aluminium and 304/316 marine grade stainless steel. High performance adjustable optics render precise beam of light suited for wide range of facade and landscape applications.



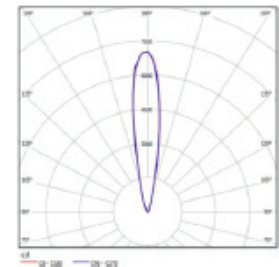
### FEATURES

MATERIAL	Die cast aluminum body with stainless steel frame
RATED POWER	18W, 22W
WORKING VOLTAGE	100-277V AC
BEAM ANGLE	9°/18°/36°/58°
MOUNTING	Floor recessed
LAMP LIFE	L90, B10, 65, 000hrs
DIMENSIONS	Ø200x150mm
OPERATION TEMP	-20° C - +50° C
CONTROL	Dali, On-Off, 1-10V
SDCM	SDCM3, SDCM2 (On request)
DRIVER OVER	4000kg@20km/hr

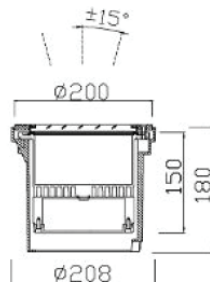


### ELECTRICAL DATA

POWER CONSUMPTION	18W, 22W
SUPPLY VOLTAGE	100-277V AC
COLORS	2700K, 3000K, 4000K, 5000K
CRI	80+
LUMEN	90-95lm/W



### DIMENSION



#### ACCESSORIES



Recessed Box



IP 68 Connector



Square cover

### ORDERING LOGIC

PRODUCT	WATTAGE	COLOR TEMPERATURE	VOLTAGE	BEAM ANGLE	IP RATE	FINISH	ACCESSORIES	CUSTOM
EFE	18 - 18W	(CT27) 2700K	AC - 100-277V AC	9 - 9°	68 - IP68	SS - Stainless Steel	RB - Recessed Box	XX - XX
	22 - 22W	(CT30) 3000K		18 - 18°		BK - Black	CN - IP 68 Connector	
		(CT40) 4000K		36 - 36°			SC - Square cover	
		(CT50) 5000K		58 - 58°				

Sample: EFE - 18 - CT27 - AC - 9 - 68 - SS - RB - XX



**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**KFL1/8L-20/4K8/M/UNV/K/BLT/SF/HS**

**TYPE: FS**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025



**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

Notes:

**Type:****FS**

FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

**FEATURES**

- Lumen range from 2,000 to 4,000 lm
- Color Temperature 3000K, 4000K, 5,000K at 70 and 80 CRI
- Yoke and Threaded Knuckle mounting options
- 6 beam distributions and beam angles including: Narrow 17°x17°, Medium 28°x27°, Medium Flood 62°x61°, Wide 79°x64°, Horizontal 54°x22°, and Vertical 22°x54°



DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
CATALOG #: \_\_\_\_\_

## Architectural

FLOODLIGHT COLLECTION



KFL1 White

**RELATED PRODUCTS**

Ouro

Pavilion

Intent

**SPECIFICATIONS****CONSTRUCTION**

- One piece die-cast, low copper (<0.6% Cu) Aluminum Alloy 360 with vents and .100" minimum wall thickness
- Finish: fade and abrasion resistant, electrostatically applied, thermally cured, triglycidal isocyanurate (TGIC) polyester powdercoat
- Lens is impact resistant 1/8" tempered glass with anti-reflective coating
- Lens has a one-piece extruded vulcanized silicone gasket
- Lens frame one piece die-cast, low copper (<0.6% Cu) Aluminum Alloy 360 and .100" minimum wall thickness
- Lens frame has a one-piece O-ring extruded vulcanized silicone gasket
- Mid-frame one piece die-cast, low copper (<0.6% Cu) Aluminum Alloy 360 and .100" minimum wall thickness
- Mid-frame secures to Lens Frame and housing by stainless steel recessed Allen-head screws
- Silicone gaskets throughout
- All external fasteners are stainless steel

**OPTICS**

- LEDs mount to a metal printed circuit board assembly (MCPCB)
- Optical lenses are clear injection molded PMMA acrylic

**INSTALLATION**

- Fixtures must be grounded in accordance with national, state and/or local electrical codes. Failure to do so may result in serious personal injury

**ELECTRICAL**

- Universal voltage, 120 through 277V with a ±10% tolerance. Driver is Underwriters Laboratories recognized
- High voltage configurations, 347/480. Driver has a 0-10V dimming interface for multi-level illumination options. Driver is Underwriters Laboratories recognized
- "Thermal Shield", secondary side, thermistor provides protection for the sustainable life of LED module and electronic components
- Drivers shall have greater than a 0.9 power factor, less than 20% harmonic distortion, and be suitable for operation in -40°C to 40°C ambient environments
- Luminaire shall be capable of operating at 100% brightness in a 40°C environment. Both driver and optical array have integral thermal protection that will dim the luminaire upon detection of temperatures in excess of 85°C
- Dimming range from 10% to 100% through the use of standard 0-10V interface on the programmable driver
- Modular wiring harness in the service area provides user access to the dimming circuitry

**ELECTRICAL (CONTINUED)**

- Optional factory programmed dimming profile
- Surge protection: 10,000k in parallel, 20,000k in series
- SF for 120, 277, 347 Line volts  
DF for 208, 240, 480 Line volts
- Wiring: No. 18AWM rated 105°C, wet rating.

**CERTIFICATIONS AND LISTINGS**

- UL 1598 Standard for Luminaires
- IP66 certified
- 3G rated for ANSI C136.31 high vibration applications
- RoHS compliant
- IEC 66262 Mechanical Impact Code IK08

**WARRANTY**

- 5 year warranty

KEY DATA	
<b>Lumen Range</b>	1,839–4,105
<b>Wattage Range</b>	20–40
<b>Efficacy Range (LPW)</b>	93.3–117.5
<b>Reported Life (Hours)</b>	L70/60,000
<b>Weight</b>	9 lbs 4.08 kg
<b>EPA Front View / Side View</b>	.53 / .25

**Current®**

currentlighting.com/kimlighting

© 2022 HJ Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Page 1 of 9

Rev 07/18/22

kl\_kfl1\_spec\_R01

**KIMLIGHTING®**

**KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

**ORDERING GUIDE**

Example: KFL1-16L-40-3K7-WF-UNV-K-GTT-BD

CATALOG #

**HOUSING**

KFL1						
Housing	LED Engine	CCT/CRI		Beam Spread		Color
KFL1 Architectural Floodlight	8L-20 20W, 2,000 lm	3K7	3000K, 70 CRI	N	Narrow	BLS Black Gloss Smooth
	16L-40 40W, 4,000 lm	3K8	3000K, 80 CRI	M	Medium	BLT Black Matte Textured
		4K7	4000K, 70 CRI	MF	Medium Flood	DBS Dark Bronze Gloss Smooth
		4K8	4000K, 80 CRI	WF	Wide Flood	DBT Dark Bronze Matte Textured
		5K7	5000K, 70 CRI	HF	Horizontal Flood	GTT Graphite Matte Textured
		5K8	5000K, 80 CRI	VF	Vertical Flood	LGS Light Grey Gloss Smooth
						LGT Light Grey Matte Textured
						PSS Platinum Silver Gloss Smooth
						VGT Verde Green Matte Textured
						WHS White Gloss Smooth
						WHT White Matte Textured
						Color Option
						CC <sup>1</sup> Custom Color

Options	Optical Options
SF Single Fuse 120, 277, 347 Line Volts	BD Barn Doors
DF Double Fuse 208, 240, 480 Line Volts	HS Half Glare Shield

**Mounting Accessories**

Mounting Accessories	Accessories Color
JBR 2/3/21/24 <sup>2</sup> Brass In-Grade Architectural Junction Box	BLS Black Gloss Smooth
JBR 4/5 <sup>2</sup> Composite In-Grade Architectural Junction Box	BLT Black Matte Textured
JBR30 <sup>2</sup> (2) ½" NPT in bottom, (2) 19" long stakes Brass In-Grade Staked Junction Box	DBS Dark Bronze Gloss Smooth
JBR32 <sup>2</sup> (2) ½" NPT in bottom, (2) 19" long stakes with 9' cord Brass In-Grade Staked Junction Box	DBT Dark Bronze Matte Textured
J-27N Surface Mount	GTT Graphite Matte Textured
SM18 Stanchion Mount	LGS Light Grey Gloss Smooth
SPM Side Pole Mount	LGT Light Grey Matte Textured
JB1 Architectural Junction Box	PSS Platinum Silver Gloss Smooth
WM Wall or Ceiling Mount	VGT Verde Green Matte Textured
WM1 Wall Mount	WHS White Gloss Smooth
TM2 Twin Mount	WHT White Matte Textured
PT Post Top Mount	Color Option
PT2 Twin Post Top Mount	CC <sup>1</sup> Custom Color

Notes:

- 1 Consult factory for custom color, marine and corrosive finish options
- 2 See pages 8 for all JBR options and ordering logic

**Current®**

currentlighting.com/kimlighting

© 2022 HJ Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Page 2 of 9

Rev 07/18/22

kl\_kfl1\_spec\_R01



## KFL1

STATIC WHITE ARCHITECTURAL FLOOD

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
CATALOG #: \_\_\_\_\_

### DELIVERED LUMENS

LEDs #	Nominal Watts	Nominal Lumens	Distribution	Beam Angles	3000K 70CRI			4000K 70CRI			5000K 70CRI		
					Lumen	Center Beam Candlepower	lm/w	Lumen	Center Beam Candlepower	lm/w	Lumen	Center Beam Candlepower	lm/w
8L	20	2000	N	17° x 17°	1895	15710	98.5	1948	16150	101.2	2022	16763	104.9
			M	28° x 28°	2003	6789	104.1	2059	6979	107.0	2137	7243	111.0
			MF	61° x 63°	1968	2139	102.3	2023	2199	105.1	2100	2283	109.1
			WF	79° x 83°	2118	1585	109.2	2177	1606	113.1	2260	1670	117.5
			HF	54° x 22°	1841	3276	95.7	1892	3367	98.3	1964	3495	102.0
			VF	22° x 54°	1839	3198	95.6	1890	3287	98.2	1962	3412	102.0
16L	40	4000	N	17° x 17°	3810	32563	104.7	3916	33469	107.7	4065	34742	111.4
			M	28° x 28°	3847	13558	105.8	3954	13935	108.7	4105	14467	112.8
			MF	61° x 63°	3755	4033	103.3	3860	4146	106.1	4007	4304	110.1
			WF	79° x 83°	3817	3075	105.0	3923	3160	107.9	4073	3281	112.0
			HF	54° x 22°	3443	6472	94.7	3539	6652	97.3	3674	6906	101.1
			VF	22° x 54°	3394	6441	93.3	3489	6622	95.9	3622	6874	99.6

CRI Lumen Multiplier	
CCT	80 CRI
3000K	0.9408
4000K	0.9067

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

Notes:

**Type:****FS**

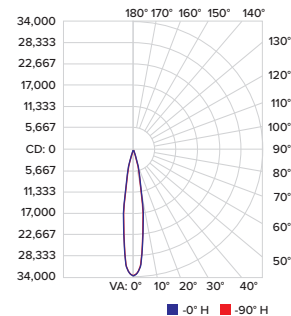
FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

**PHOTOMETRY****KFL1-16L-40-4K7-N****LUMINAIRE DATA**

Description	4000K, 70CRI
Delivered Lumens	3916
Watts	36.37
Efficacy	107.7
Beam Angles (H x V)	17° x 17°
Center Beam Candlepower	33469

**POLAR CANDELA DISTRIBUTION****ILLUMINANCE AT A DISTANCE**

	Center Beam fc	Beam Width
30.5 ft	36.00 fc	8.9 ft 8.9 ft
61.0 ft	8.99 fc	17.7 ft 17.9 ft
91.5 ft	4.00 fc	26.6 ft 26.8 ft
122.0 ft	2.25 fc	35.5 ft 35.8 ft
152.5 ft	1.44 fc	44.4 ft 44.7 ft
182.9 ft	1.00 fc	53.2 ft 53.6 ft

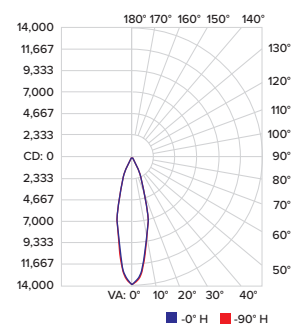
Vertical Spread: 16.5° Horizontal Spread: 16.7°

**LUMENS PER ZONE**

Zone	Lumens	% Total
0-10	2,033.40	51.60%
10-20	1,324.20	33.60%
20-30	282.7	7.20%
30-40	115.5	2.90%
40-50	74.1	1.90%
50-60	55	1.40%
60-70	35.9	0.90%
70-80	15.7	0.40%
80-90	2.8	0.10%

**KFL1-16L-40-4K7-M****LUMINAIRE DATA**

Description	4000K, 70CRI
Delivered Lumens	3954
Watts	36.37
Efficacy	108.7
Beam Angles (H x V)	27.8° x 26.8°
Center Beam Candlepower	13935

**POLAR CANDELA DISTRIBUTION****ILLUMINANCE AT A DISTANCE**

	Center Beam fc	Beam Width
19.7 ft	35.90 fc	9.4 ft 9.8 ft
39.3 ft	9.02 fc	18.7 ft 19.5 ft
59.0 ft	4.00 fc	28.1 ft 29.3 ft
78.7 ft	2.25 fc	37.5 ft 39.0 ft
98.3 ft	1.44 fc	46.8 ft 48.7 ft
118.0 ft	1.00 fc	56.2 ft 58.5 ft

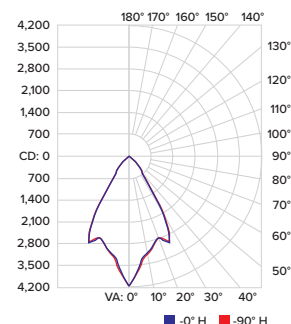
Vertical Spread: 26.8° Horizontal Spread: 27.8°

**LUMENS PER ZONE**

Zone	Lumens	% Total
0-10	1,050.30	26.50%
10-20	1,732.80	43.70%
20-30	841.6	21.20%
30-40	193.1	4.90%
40-50	66.1	1.70%
50-60	40.1	1.00%
60-70	25.3	0.60%
70-80	11.9	0.30%
80-90	2.7	0.10%

**KFL1-16L-40-4K7-MF****LUMINAIRE DATA**

Description	4000K, 70CRI
Delivered Lumens	3860
Watts	36.37
Efficacy	106.1
Beam Angles (H x V)	62.4° x 61.2°
Center Beam Candlepower	4146

**POLAR CANDELA DISTRIBUTION****ILLUMINANCE AT A DISTANCE**

	Center Beam fc	Beam Width
10.7 ft	36.20 fc	12.7 ft 13.0 ft
21.3 ft	9.14 fc	25.2 ft 25.8 ft
32.0 ft	4.05 fc	37.9 ft 38.8 ft
42.7 ft	2.27 fc	50.5 ft 51.7 ft
53.3 ft	1.46 fc	63.1 ft 64.6 ft
64.0 ft	1.01 fc	75.7 ft 77.5 ft

Vertical Spread: 61.2° Horizontal Spread: 62.4°

**LUMENS PER ZONE**

Zone	Lumens	% Total
0-10	333	8.60%
10-20	838.6	21.70%
20-30	1,335.00	34.60%
30-40	815.1	21.10%
40-50	296.9	7.70%
50-60	130.3	3.40%
60-70	76	2.00%
70-80	31.2	0.80%
80-90	7.2	0.20%

**Current®**

currentlighting.com/kimlighting

© 2022 HJI Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Page 4 of 9

Rev 07/18/22

kl\_kfl1\_spec\_R01

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

Notes:

**Type:****FS**

FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

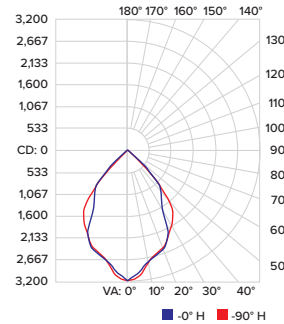
DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

**PHOTOMETRY CONTINUED****KFL1-16L-40-4K7-WF****LUMINAIRE DATA**

Description	4000K, 70CRI
Delivered Lumens	3923
Watts	36.37
Efficacy	107.9
Beam Angles (H x V)	78.7° x 63.7°
Center Beam Candlepower	3160

**POLAR CANDELA DISTRIBUTION****ILLUMINANCE AT A DISTANCE**

Center Beam fc	Beam Width
9.3 ft	36.50 fc
18.7 ft	9.04 fc
28.0 ft	4.03 fc
37.3 ft	2.27 fc
46.7 ft	1.45 fc
56.0 ft	1.01 fc
	11.6 ft
	23.2 ft
	34.8 ft
	46.4 ft
	58.1 ft
	69.6 ft
	81.2 ft
	91.8 ft

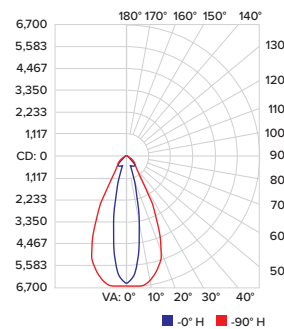
■ Vertical Spread: 63.7° ■ Horizspread: 78.7°

**LUMENS PER ZONE**

Zone	Lumens	% Total
0-10	283.2	7.20%
10-20	734.5	18.70%
20-30	1,032.60	26.30%
30-40	1,057.70	26.90%
40-50	653	16.60%
50-60	116.5	3.00%
60-70	28.7	0.70%
70-80	14.6	0.40%
80-90	5.7	0.10%

**KFL1-16L-40-4K7-HF****LUMINAIRE DATA**

Description	4000K, 70CRI
Delivered Lumens	3539
Watts	36.37
Efficacy	97.3
Beam Angles (H x V)	54° x 22°
Center Beam Candlepower	6652

**POLAR CANDELA DISTRIBUTION****ILLUMINANCE AT A DISTANCE**

Center Beam fc	Beam Width
13.7 ft	35.30 fc
27.3 ft	8.89 fc
41.0 ft	3.94 fc
54.7 ft	2.21 fc
68.3 ft	1.42 fc
82.0 ft	0.99 fc
	5.4 ft
	10.8 ft
	16.2 ft
	21.7 ft
	27.0 ft
	32.5 ft
	38.4 ft

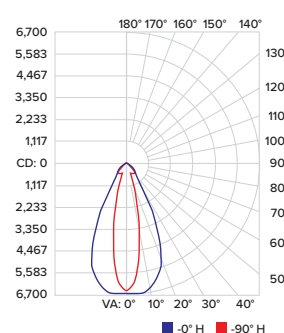
■ Vertical Spread: 22.4° ■ Horizspread: 54.5°

**LUMENS PER ZONE**

Zone	Lumens	% Total
0-10	556.2	15.70%
10-20	973.1	27.40%
20-30	632.5	17.80%
30-40	484.2	13.70%
40-50	450.5	12.70%
50-60	272.9	7.70%
60-70	124.3	3.50%
70-80	44.7	1.30%
80-90	8.4	0.20%

**KFL1-16L-40-4K7-VF****LUMINAIRE DATA**

Description	4000K, 70CRI
Delivered Lumens	3489
Watts	36.37
Efficacy	95.9
Beam Angles (H x V)	22° x 54°
Center Beam Candlepower	6622

**POLAR CANDELA DISTRIBUTION****ILLUMINANCE AT A DISTANCE**

Center Beam fc	Beam Width
13.3 ft	3710 fc
26.7 ft	9.22 fc
40.0 ft	4.11 fc
53.3 ft	2.31 fc
66.7 ft	1.48 fc
80.0 ft	1.03 fc
	13.8 ft
	27.6 ft
	41.4 ft
	55.2 ft
	69.1 ft
	82.8 ft
	96.6 ft

■ Vertical Spread: 54.7° ■ Horizspread: 22.4°

**LUMENS PER ZONE**

Zone	Lumens	% Total
0-10	549.7	15.70%
10-20	968.2	27.70%
20-30	633.7	18.10%
30-40	492	14.10%
40-50	436.8	12.50%
50-60	242.2	6.90%
60-70	119.6	3.40%
70-80	44.5	1.30%
80-90	8.7	0.20%

**Current®**

currentlighting.com/kimlighting

© 2022 HLI Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Page 5 of 9

Rev 07/18/22

kl\_kfl1\_spec\_R01

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

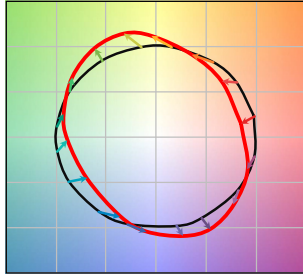
Notes:

**Type:****FS**

FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

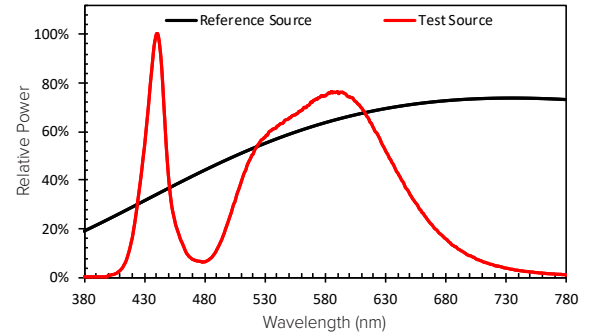
STATIC WHITE ARCHITECTURAL FLOOD

**TM-30 DATA****COLOR VECTOR GRAPHIC**

— Reference Illuminant — Test Source

**TEST SOURCE**

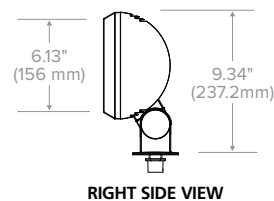
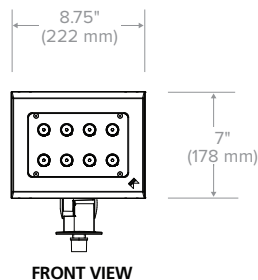
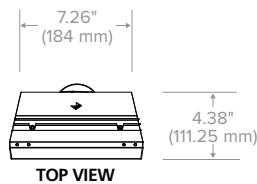
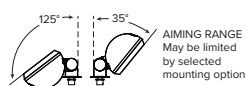
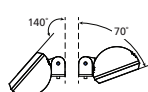
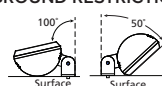
R <sub>t</sub>	68
R <sub>a</sub>	99
CCT(K)	3947
D <sub>uv</sub>	0.0004
x	0.3831
y	0.3793
CIE R <sub>a</sub>	72

**SPECTRAL POWER DISTRIBUTION COMPARISON****ELECTRICAL DATA**

Electrical												Dimming					
Light Engine	System Watts	Drive Current	Line Voltage		Amps AC						Min. Power Factor	Max THD (%)	Dimming Range	Source current out of 0-10V		Absolute voltage range on 0-10V (+)	
			VAC	Hz	120	208	240	277	347	480				Min	Max	Min	Max
8L	20	700 mA	120-480	50/60	017	010	008	007	006	004	>0.9	20	10% to 100%	0mA	1mA	0V	10V
16L	40	700 mA			033	019	017	014	012	008							

TM-21 Lifetime Calculation - Projected Lumen Maintenance (25°C / 77°C)						
Hours	0	25,000	36,000	50,000	100,000	Reported L70
Projected Lumen Maintenance	100%	97.94%	96.78%	95.33%	90.33%	> 60,000

CRI Multiplier	
CCT	Multiplier
3000K	0.9119
4000K	0.8941
5000K	0.8625

**DIMENSIONS****AIMING INFORMATION****THREADED KNUCKLE****YOKE AIMING RANGE****YOKE AIMING RANGE WITH GROUND RESTRICTIONS****Current**

currentlighting.com/kimlighting

© 2022 HLI Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Page 6 of 9

Rev 07/18/22

kl\_kf1\_spec\_R01

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

Notes:

**Type:****FS**

FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

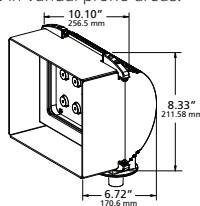
CATALOG #: \_\_\_\_\_

**PRODUCT EXCEPTIONS & DETAILS****OPTICAL OPTIONS****BARN DOORS (BD)**

- Formed 3/32" thick aluminum. Each door is hinged to a cast, low copper (<0.6% Cu) aluminum frame, and locks by set screws. Doors are individually removable. Barn Door assembly mounts to predrilled door frame holes. Assembly will be painted to match fixture housing.

**CAUTION:**

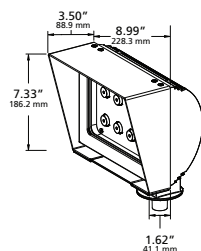
- Not recommended for ground mounted fixtures in vandal prone areas.

**HALF GLARE SHIELD (HS)**

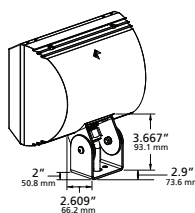
- Formed 3/32" thick aluminum. Mounts to predrilled door frame holes. Can be mounted along the top or bottom of the fixture to shield the lamp and lens from view. Assembly will be painted to match fixture housing.

**CAUTION:**

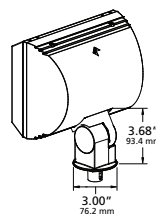
- Not recommended for ground mounted fixtures in vandal prone areas.

**MOUNTING OPTIONS****ARCHITECTURAL YOKE (Y)**

- Architectural Yoke Mount used for surface mounting applications. Secured to surface using two 1/4" bolts.
- Yoke is stainless steel material with powder coating finish.

**THREADED KNUCKLE (K)**

- Threaded Knuckle is die-cast aluminum with integral locking teeth providing 5° adjustment intervals. Stainless steel allen-head screw with spring locking washer and 1/2" NPSM. Clear anodized prior to chromate conversion coating for added corrosion resistance.
- Threaded Knuckle mounting used in conjunction with mounting accessories listed on page 1.



**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

Notes:

**Type:****FS**

FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

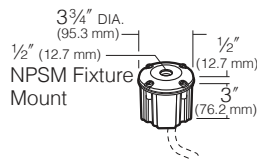
DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

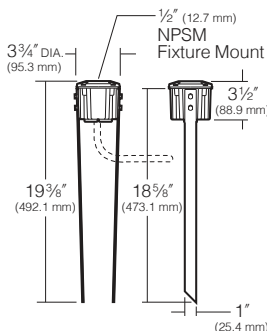
CATALOG #: \_\_\_\_\_

**PRODUCT EXCEPTIONS & DETAILS CONTINUED****MOUNTING ACCESSORIES****BRASS IN-GRADE ARCHITECTURAL JUNCTION BOX (THREADED KNUCKLE MOUNT ONLY)**

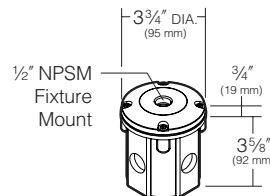
- **JBR-2** (2) 1/2" NPT in bottom
- **JBR-3**. (2) 3/4" NPT in bottom
- **JBR21** (2) 1/2" NPT in sides (2) 1/2" NPT in bottom
- **JBR24** (4) 1/2" NPT in sides (2) 1/2" NPT in bottom
- Die-cast brass with 1/2" NPSM fixture mount and die-cast cover. Internal set screw provided for locking position. 21 cu in. internal volume. NOTE: All side taps provided with plugs. Creates a flush-mounted appearance. May be cast in concrete for increased stability. **CAUTION:** Fixture stem and swivel must not contact soil or standing water. Provide drainage away from junction box.

**BRASS IN-GRADE STAKED JUNCTION BOX (THREADED KNUCKLE MOUNT ONLY)**

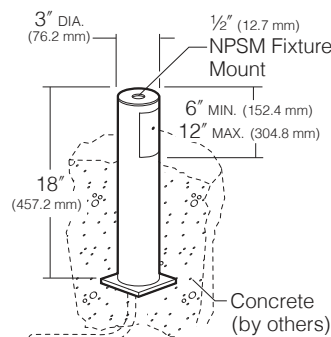
- **JBR-30** (2) 1/2" NPT in bottom, (2) 19" long stakes Brass In-Grade Staked Junction Box
- **JBR-32**. (2) 19" long stakes
- Die-cast brass with 1/2" NPSM fixture mount and die-cast cover. Internal set screw provided for locking position. 21 cu in. internal volume. Creates a flush-mounted appearance. May be cast in concrete for increased stability. **CAUTION:** To assure a rigid installation, Staked Junction Box must be set in concrete (by others). Fixture stem and swivel must not contact soil or standing water. Provide drainage away from junction box.

**COMPOSITE IN-GRADE ARCHITECTURAL JUNCTION BOX**

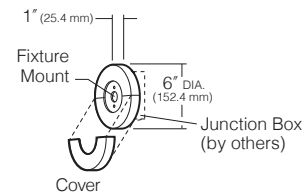
- **JBR-4** (2) 1/2" NPT knock-outs in bottom (4) 1/2" NPT knock-outs on sides at 90°
- **JBR-5** Same as above but with brass cover
- Composite box with 1/2" NPSM fixture mount and composite cover. Internal set screw provided for locking position. 19 cu in. internal volume.

**NOTE:** May also be used to hard mount low voltage fixtures.**CAUTION:** Fixture stem and swivel must not contact soil or standing water. Provide drainage away from junction box.**STANCHION MOUNT (SM18) (THREADED KNUCKLE MOUNT ONLY)**

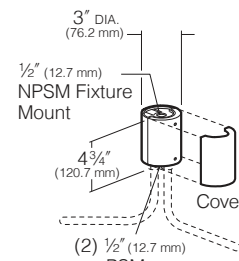
- 3" O.D. by .188" wall cast low copper (<0.6% Cu) aluminum with 1/2" NPSM fixture mount and hand hole with flush cover. Internal set screw fixture lock accessible through hand hole. Internal ground lug supplied with installed lead. **CAUTION:** To assure a rigid installation, stanchion must be set in concrete (by others).

**WALL OR CEILING MOUNT (WM) (THREADED KNUCKLE MOUNT ONLY)**

- Electro zinc steel mounting plate adapts to standard 4" square or octagonal Junction Boxes. Fixture mounts to cast low copper (<0.6% Cu) aluminum upper cover which attaches to mounting plate. Lower cover half provides splice access. Dielectric sealing compound provided for wall interface.

**ARCHITECTURAL JUNCTION BOX (JB1) (THREADED KNUCKLE MOUNT ONLY)**

- Die-cast, low copper (<0.6% Cu) anodized aluminum with 1/2" NPSM fixture mount. Internal set screw provided for locking position. Two 1/2" NPSM in bottom, 17 cu in. internal volume. **CAUTION:** Junction Box must be installed high enough to avoid contact with soil or standing water.





**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

KFL1/8L-20/4K8/M/UNV/K/BLT/SF/  
HS

Notes:

**Type:****FS**

FRM-GREENVILLE25-161113

**KIMLIGHTING®****KFL1**

STATIC WHITE ARCHITECTURAL FLOOD

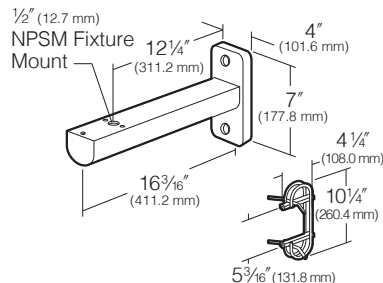
DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

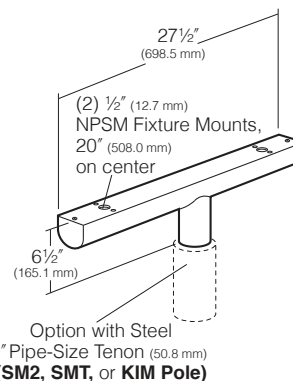
CATALOG #: \_\_\_\_\_

**PRODUCT EXCEPTIONS & DETAILS (CONTINUED)****MOUNTING ACCESSORIES****WALL MOUNT (WM1)  
(THREADED KNUCKLE MOUNT ONLY)**

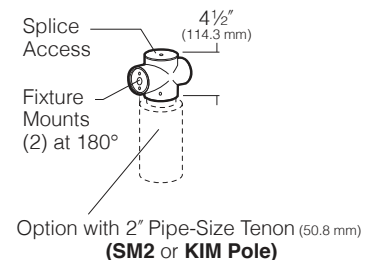
- Extruded aluminum arm with a removable end cap for wiring access. Arm is welded to a cast aluminum plate with two 1/2" dia. mounting holes. Optional Wall Embedment Bracket (WEB) provides 3/8-16 bolt receptacles welded in a galvanized re-bar cage for casting into poured-in-place concrete walls. Bolt receptacles receive fixture attachment bolts. Component EPA: 0.3.

**TWIN MOUNT (TM2)  
(THREADED KNUCKLE MOUNT ONLY)**

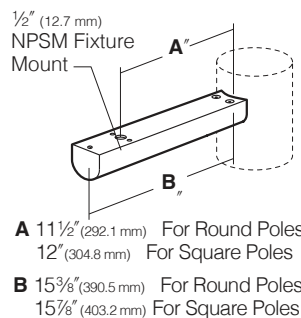
- Extruded aluminum arm. Internal set screw fixture locks. Can be mounted on a SM2, SMT, or Steel Kim Pole with steel 2" pipe-size tenon (2-3/8" O.D. x 3-1/2" min. length). Removable end caps for wiring access. CAUTION: Approved for mounting to poles with steel tenons only. Component EPA: 0.6.

**TWIN POST TOP MOUNT (PT2)  
(YOKE MOUNT ONLY)**

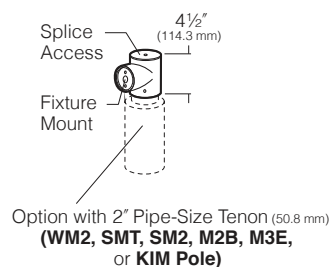
- Cast aluminum mount for pole or other mounting option with 2" pipe-size tenon (2-3/8" O.D. x 3-1/2" minimum length). Fixture attaches with concealed internal studs, mounting is with 1/4-20 allen set screws. Top cap provides splice access. NOTE: Not for use with SMT, WM2, M2B, or M3E options. Component EPA: 0.1.

**SIDE POLE MOUNT (SPM-X)  
(THREADED KNUCKLE MOUNT ONLY)**

- Available for Round and Square Poles. Extruded aluminum arm. Internal set screw fixture lock. Removable end cap for wiring access. For use with other Kim Site/Roadway Luminaires as an additional mid-pole floodlight. X in Side Pole Mount Cat. No. indicates 3", 3-1/2", 4", 5" or 6" pole dia. Example: SPM-4/BL is for 4" round pole with Black finish. For square poles, omit -X. NOTE: Field drilling of Poles is required. Component EPA: 0.3.

**POST TOP MOUNT (PT)  
(YOKE MOUNT ONLY)**

- Cast aluminum mount for pole or other mounting option with 2" pipe-size tenon (2-3/8" O.D. x 3-1/2" minimum length). Fixture attaches with concealed internal studs, mounting is with 1/4-20 allen set screws. Top cap provides splice access. Component EPA: 0.7.





**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**AA L40 40 FL UNV SMED-L40**

**TYPE: PS**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

AA L40 40 FL UNV SMED-L40

**Notes:****Type:****PS**

FRM-GREENVILLE25-161113

**SPECIFICATIONS****DESCRIPTION:**

High output adjustable LED accent fixture. Suitable for wet/damp/dry location installations.

**MATERIAL:**

Standard overall material is 6061 aluminum.

**FINISH:**

**AA - Anodized Satin Aluminum**

AP - Powder Coat Aluminum

BK - Powder Coat Black

BZ - Powder Coat Bronze

WT - Powder Coat White

**LED OPTIONS:**

Integral high output Xicato LED module.

**LED Output**

**L40 - 16.5W, 700mA, 1700 Lumens**

L50 - 26W, 1050mA, 2400 Lumen

Color Temperature CCT

27 - 2700K CCT

30 - 3000K CCT

35 - 3500K CCT

**40 - 4000K CCT**

Reflector, Field Replaceable

NSP - Narrow Spot, 10°

NF - Narrow Flood, 20°

**FL - Flood, 40°**

WFL - Wide Flood, 60°

**VOLTAGE:**

Requires LED driver, leading edge/trailing edge dimmable (120V only) constant current remote LED Driver included. Dimmable for 120V only. See driver options.

**120-277 - 120-277V LED driver**

**DRIVER OPTIONS:**

Fixture includes HL-RD remote LED driver enclosure (3R rated stainless steel enclosure) standard. Driver options available in place of HL-RD for direct burial, surface and wall mounting available.

H-POD-LED-L40 - Remote direct burial driver.

H-POD-LED-L50 - Remote direct burial driver.

HLD-CBB-L40 - Composite burial box for driver w/fixture mount.

HLD-CBB-L50 - Composite burial box for driver w/fixture mount.

**SMED-L40 - Surface mount driver canopy.**

SMED-L50 - Surface mount driver canopy.

WMED-L40 - Wall mount driver canopy.

WMED-L50 - Wall mount driver canopy.

**MOUNTING:**

Fixture is designed with a 1/2-NPS adjustable mounting stem.

**OPTIONS:**

Glare shield

GL-30 - Angled, aluminum

GL-31 - Straight, aluminum

Lenses/Louvers/Color Filters

LA-1-30 - Hexcell Louver (Black)

LA-2-30 - Prismatic lens

LA-3-30 - Linear spread lens

LA-4-30 - Soft focus lens (diffused)

LA-5-30 - Moonlight lens

LA-6-30 - Blue lens

See fixture accessories for more information.

**SAMPLE ORDER SPECIFICATION:**

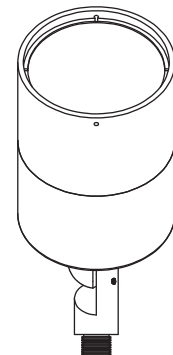
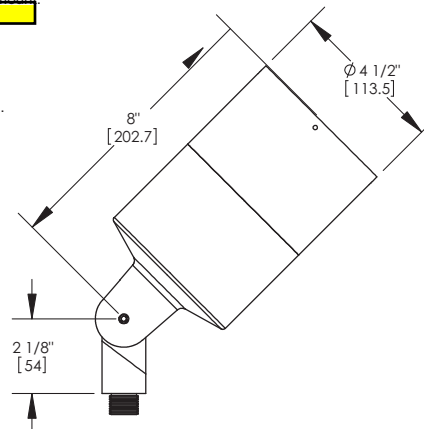
HL-925-BZ-L50-30-FL-120-277-SMED-L50

**RATING:**

Wet/damp/dry location.



MADE IN THE USA

**ORDER SPECIFICATION:**

Fixture - Finish - Lamping - Voltage - Options/Access.

PROJECT:

APPROVED:

NOTE:

TYPE:



**HEVI LITE, INC.**

9714 Variel Ave, Chatsworth, CA 91311  
Tel., (818) 341-8091 - Fax (818) 998-1986  
Web Site <http://www.hevilite.com>

CATALOG NUMBER:

**HL-925**

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF HEVI LITE, INC. ANY REPRODUCTION IN PART OR WHOLE WITHOUT THE WRITTEN PERMISSION OF HEVI LITE, INC. IS PROHIBITED.

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

AA L40 40 FL UNV SMED-L40

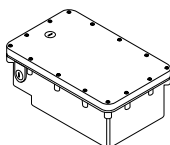
Notes:

**Type:****PS**

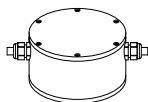
FRM-GREENVILLE25-161113



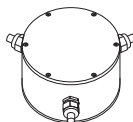
## L30, L40, & L50 Driver Options

**HLD-CBB-L\*\***

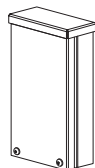
Direct burial composite enclosure with (1)LED driver and (1)fixture mount location.  
Enclosure comes standard with junction compartment and anti-siphon chamber ensures no water can enter the main housing.

**H-POD-L\*\***

Direct burial LED Driver pod with (1) driver. Pod is equipped with moisture-lock cords to prevent water wicking.  
Suitable for wet/damp/dry location installation.

**H-POD-L\*\*-2X**

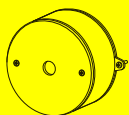
Direct burial LED Driver pod with (2) LED drivers. Pod is equipped with moisture-lock cords to prevent water wicking.  
Suitable for wet/damp/dry location installation.

**HL-RD-L\*\***

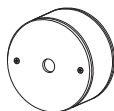
3R rated rain tight stainless steel enclosure with (1) LED driver. Suitable for wet/damp/dry location installations.

**HL-RD-2X-L\*\***

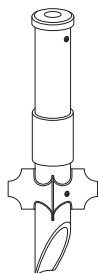
3R rated rain tight stainless steel enclosure with (2) LED drivers. Suitable for wet/damp/dry location installations.

**SMED-L\*\***

Surface mount canopy with (1) LED driver, for (1) fixture. Suitable for wet/damp/dry location installations.

**WMED-L\*\***

Wall mount canopy with (1) LED driver, for (1) fixture. Suitable for wet/damp/dry location installations.

**GM-9-L\*\***

LED driver in PVC landscape post/mounting spike for ground mounting applications.  
Suitable for wet/damp/dry location installations.

**HEVI LITE, INC. • 9714 Variel Ave, Chatsworth, CA 91311**  
**(818) 341-8091 • Fax (818) 998-1986 • www.hevilite.com**



**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**LXEM4-40LW-RP-EDU-TP**

**TYPE: SP**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

**Columbia**  
LIGHTING

**LXEM**

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
CATALOG #: \_\_\_\_\_

## FEATURES

- Available in 2', 4', or 8' lengths
- IP65, IP67 and IP66 all models with standard polyacetal (POM) latches
- NEMA 4X housing
- Fiberglass housing with F1 weatherability rating, standard
- IK10 rated when ordered with polycarbonate lens
- Impact modified acrylic lens equivalent to 100% DR
- UL Sanitation Certified per NSF Standards
- Includes stainless steel surface mounting brackets
- -20°C up to +50°C ambient operation; see table provided for details



See Certification Specifications

## SPECIFICATIONS

### CONSTRUCTION

- Housing is formed from UL 5VA fiberglass
- F1 weatherability rating, suitable for indoor or outdoor use with respect to exposure to UV light
- Pour-in-place non-porous gasketing assures seal
- LED affixed to removable heat sinked gear tray
- 14 Latches per 8'; 8 per 4'; 6 per 2'
- Latches are provided tamper resistance ready, tamper resistant screws by others
- Latches are standard polyacetal (POM), optional in stainless steel
- Access openings are provided for electrical connection
- White painted parts are treated with a five-stage phosphate bonding process and finished with high reflectance baked enamel

### OPTICS

- Lineal ribbed frosted acrylic lens impact modified equivalent to 100% DR; modification adds flexibility to reduce impact breakage compared to standard acrylic formulations
- Optional ribbed polycarbonate lens or deep acrylic
- All lenses available in clear or frost

### ELECTRICAL

- Long life 60,000 hour LEDs at L80 for reduced maintenance
- Extra High Lumen packages (XL) rated L70 at 60,000 hours
- 80 CRI
- Driver options include fixed output for on/off function, step dimming (high/low/off) or continuous 0-10V dimming
- QR code label affixed to housing for easy traceability

### CERTIFICATIONS

- All luminaires are built to UL 1598 and 2108 standards, and bear appropriate cCSAus labels
- CSA certified to UL 924 standards with battery pack or DTS (Dimming Bypass Module) options
- Wet Location label standard
- UL Sanitation certified to NSF standards
- Ingress protection IP65 and IP67 standard; IP66 on certain models

### CERTIFICATIONS (CONTINUED)

- DLC® (DesignLights Consortium) Qualified. Please refer to the DLC website for specific product qualifications at [www.designlights.org](http://www.designlights.org)
- The DTS, Dimming Bypass Module, is for emergency circuit control loads including sensors and wireless systems CSA certified to UL 924. See page 10 for wiring diagram.
- This product qualifies as a "designated country construction material" per FAR 52.225-11 Buy American-Construction Materials under Trade Agreements effective 06/01/2020.

### WARRANTY

- 5 year warranty

KEY DATA	
Lumen Range	2145–22,473
Wattage Range	20-183
Efficacy Range (LPW)	99-147
Reported Life (Hours)	L80/60,000

Columbia  
LIGHTING

LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

ORDERING GUIDE

Example: LXEM4-35HL-RFA-EDU

CATALOG #

LXEM							
Model	Size	Color Temp	Nominal Lumens		Shielding	Driver	Voltage
LXEM	2 2' 1,2,3,4	30 3000K	VW 2' (2,145-2,708)	HL 2' (4,254-5,416)	RFA Ribbed Frosted Acrylic	E Fixed Output	U 120-277V
LED Enclosed and Gasketed	4 4'	35 3500K	4' (2,802-3,433)	4' (5,449-6,763)	RA Ribbed Clear Acrylic <sup>5</sup>	ED 0-10V Dimming	347 347V
	8 8'	40 4000K	8' (6,078-6,866)	8' (11,851-13,525)	DFA Deep Frosted Acrylic	ED1 0-10V 1% Dimming <sup>7</sup>	
		50 5000K	LW 2' (2,738-3,529)	VL 4' (7,086-8,415)	DCA Deep Clear Acrylic <sup>5</sup>	ESD Step Dimming <sup>7</sup>	
			4' (3,726-4,922)	8' (14,747-16,830)	RFP Ribbed Frosted Polycarbonate <sup>6</sup>		
			8' (8,095-9,276)		RP Ribbed Clear Polycarbonate <sup>5,6</sup>		
			ML 2' (3,862-4,921)	XL 4' (9,059-11,237)			
			4' (4,533-5,646)	8' (19,558-22,473)			
			8' (9,844-11,293)				

Options	
ELL14	Emergency Battery Pack Installed, 1400 Lumens <sup>3,7,8</sup>
GLR	Fast Blow Fuse
DTS	Dimming Bypass Module <sup>3,8,9</sup>
OCM	Microwave Occupancy Sensor <sup>8,13</sup>
SSL	Stainless Steel Tamper Resistance Ready Latches
TP	Tamper Proof Latches
F3C8W	3-Wire 8' Wet Cord
F3C15W	3-Wire 15' Wet Cord
F4C8W	4-Wire 8' Wet Cord
F4C15W	4-Wire 15' Wet Cord
F5C8W	5-Wire 8' Wet Cord
F5C15W	5-Wire 15' Wet Cord
F6C6W	6-Wire 6' Wet Cord
SWH	Single Wet Hub ½" NPT Hub
DWH	Dual Wet Hub ½" NPT Hub
ZRE	ControlScope® compatible <sup>8,10</sup>

Accessories	
<input type="checkbox"/> XEDPM	Dual Pendant Brackets (pendant by others) <sup>11</sup>
<input type="checkbox"/> XEHC	Chain Hanger Kit (Includes 14" Chain)
<input type="checkbox"/> XE45MB	45° Mounting Bracket <sup>12</sup>
<input type="checkbox"/> XE45MBSS	45° Stainless Steel Mounting Bracket <sup>12</sup>

Sensor kits (Order Separately)					
All sensor kits include On/Off Occupancy & Daylight.					
Daylight activation requires setting of dip-switches on site.					
120V/277V	Catalog #	# Relays	Lens Type	Voltage	Wet Label
	<input type="checkbox"/> OS1360WLK	1	360°	120/277	Yes
	<input type="checkbox"/> OS2360WLK	2	360°	120/277	Yes
	<input type="checkbox"/> OS1AWLK	1	Aisle	120/277	Yes
	<input type="checkbox"/> OS2AWLK	2	Aisle	120/277	Yes

Notes:

- |   |   |
|---|---|
| 1 VL and XL not available in 2' size  | 8 Not available in 347V   |
| 2 Not available with battery pack or DTS  | 9 For emergency circuit control loads including sensors and wireless systems listed to UL924. Only available with 0-10V drivers. See page 10 for wiring diagram |
| 3 Not available with XL lumen package   | 10 Registered trademark of Daintree Networks, used by permission  |
| 4 Not available with VL lumen package   | 11 Requires ⅜" OD threaded rod by others  |
| 5 Clear lenses (RA, DCA and RP) may cause noticeable light patterns on lit surfaces. See ies files for exact distribution | 12 2 required for 8' fixture  |
| 6 2' and 4' only. 8' not available  | 13 OCM option uses Wattstopper FM-105   |
| 7 See table for availability  |   |

**Columbia**  
LIGHTING

**LXEM**

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
 TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
 CATALOG #: \_\_\_\_\_

**PRODUCT EXCEPTIONS & DETAILS**

Options listed below are available for the outputs as shown.

DRIVER AVAILABILITY TABLE							
Length	Output	Nominal Lumen Range	ESD Available	ED1 Available	347V Available	347V with ESD Available	347V with ED1 Available
2'	VW	2,145–2,708	Y	Y	Y	N/A	Y
	LW	2,738–3,529	Y	Y	Y	N/A	Y
	ML	3,862–4,921	Y	Y	Y	N/A	Y
	HL	4,254–5,416	Y	Y	Y	N/A	Y
4'	VW	2,802–3,433	Y	Y	Y	N/A	Y
	LW	3,726–4,922	Y	Y	Y	N/A	Y
	ML	4,533–5,646	Y	Y	Y	N/A	Y
	HL	5,449–6,763	Y	Y	Y	N/A	Y
	VL	7,086–8,415	Y	Y	Y	N/A	N/A
	XL	9,059–11,237	N/A	Y	Y	N/A	N/A
8'	VW	6,078–6,866	Y	Y	Y	N/A	Y
	LW	8,095–9,276	Y	Y	Y	N/A	Y
	ML	9,844–11,293	Y	Y	Y	N/A	Y
	HL	11,851–13,525	Y	Y	Y	N/A	Y
	VL	14,747–16,830	Y	Y	Y	N/A	N/A
	XL	19,558–22,473	N/A	Y	Y	N/A	N/A

MAX. AMBIENT OPERATING TEMP.							
Length	Output	Nominal Lumen Range	Watts	LPW	Max Ambient Operating Temperature (C°) (Universal Voltage)	ELL14 (with Universal Voltage)	347V
2'	VW	2,145–2,708	21	102–130	40	NA	35
	LW	2,738–3,529	26	105–135	40	NA	35
	ML	3,862–4,921	39	100–128	40	NA	35
	HL	4,254–5,416	44	97–123	35	NA	30
4'	VW	2,802–3,433	25	114–141	50	45	45
	LW	3,726–4,922	33	112–139	50	45	45
	ML	4,533–5,646	42	108–134	50	45	45
	HL	5,449–6,763	47	115–143	45	45	35
	VL	7,086–8,415	62	115–136	40	40	35
	XL	9,059–11,237	92	99–123	30	NA	25
8'	VW	6,078–6,866	49	124–141	50	45	45
	LW	8,095–9,276	67	122–139	50	45	45
	ML	9,844–11,293	84	117–134	50	45	45
	HL	11,851–13,525	95	125–143	45	45	35
	VL	14,747–16,830	123	120–136	40	40	35
	XL	19,558–22,473	183	107–123	30	NA	25





LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM2-30VW-RFP-EDU	Very Low Watt	30K	RFP	2,145	21.1	101.6	40°C
LXEM2-30VW-RA-EDU			RA	2,365	20.8	113.7	40°C
LXEM2-30VW-RP-EDU			RP	2,373	20.8	114.1	40°C
LXEM2-30VW-RFA-EDU			RFA	2,448	20.8	117.7	40°C
LXEM2-30VW-DFA-EDU			DFA	2,467	20.8	118.6	40°C
LXEM2-30VW-DCA-EDU			DCA	2,512	20.8	120.8	40°C
LXEM2-35VW-RFP-EDU		35K	RFP	2,217	21.1	105.1	40°C
LXEM2-35VW-RA-EDU			RA	2,446	20.8	117.6	40°C
LXEM2-35VW-RP-EDU			RP	2,454	20.8	118	40°C
LXEM2-35VW-RFA-EDU			RFA	2,531	20.8	121.7	40°C
LXEM2-35VW-DFA-EDU			DFA	2,551	20.8	122.6	40°C
LXEM2-35VW-DCA-EDU			DCA	2,598	20.8	124.9	40°C
LXEM2-40VW-RFP-EDU		40K	RFP	2,252	21.1	106.7	40°C
LXEM2-40VW-RA-EDU			RA	2,484	20.8	119.4	40°C
LXEM2-40VW-RP-EDU			RP	2,492	20.8	119.8	40°C
LXEM2-40VW-RFA-EDU			RFA	2,571	20.8	123.6	40°C
LXEM2-40VW-DFA-EDU			DFA	2,590	20.8	124.5	40°C
LXEM2-40VW-DCA-EDU			DCA	2,638	20.8	126.8	40°C
LXEM2-50VW-RFP-EDU		50K	RFP	2,312	21.1	109.6	40°C
LXEM2-50VW-RA-EDU			RA	2,550	20.8	122.6	40°C
LXEM2-50VW-RP-EDU			RP	2,558	20.8	123	40°C
LXEM2-50VW-RFA-EDU			RFA	2,639	20.8	126.9	40°C
LXEM2-50VW-DFA-EDU			DFA	2,659	20.8	127.8	40°C
LXEM2-50VW-DCA-EDU			DCA	2,708	20.8	130.2	40°C
LXEM2-30LW-RFP-EDU	Low Watt	30K	RFP	2,738	26	105.3	40°C
LXEM2-30LW-RP-EDU			RP	3,049	26.1	116.8	40°C
LXEM2-30LW-RA-EDU			RA	3,144	26	120.9	40°C
LXEM2-30LW-RFA-EDU			RFA	3,180	26.2	121.4	40°C
LXEM2-30LW-DFA-EDU			DFA	3,239	26.1	124.1	40°C
LXEM2-30LW-DCA-EDU			DCA	3,273	26.1	125.4	40°C
LXEM2-35LW-RFP-EDU		35K	RFP	2,831	26	108.9	40°C
LXEM2-35LW-RP-EDU			RP	3,153	26.1	120.8	40°C
LXEM2-35LW-RA-EDU			RA	3,251	26	125	40°C
LXEM2-35LW-RFA-EDU			RFA	3,289	26.2	125.5	40°C
LXEM2-35LW-DFA-EDU			DFA	3,349	26.1	128.3	40°C
LXEM2-35LW-DCA-EDU			DCA	3,385	26.1	129.7	40°C
LXEM2-40LW-RFP-EDU		40K	RFP	2,875	26	110.6	40°C
LXEM2-40LW-RP-EDU			RP	3,202	26.1	122.7	40°C
LXEM2-40LW-RA-EDU			RA	3,302	26	127	40°C
LXEM2-40LW-RFA-EDU			RFA	3,339	26.2	127.5	40°C
LXEM2-40LW-DFA-EDU			DFA	3,401	26.1	130.3	40°C
LXEM2-40LW-DCA-EDU			DCA	3,437	26.1	131.7	40°C
LXEM2-50LW-RFP-EDU		50K	RFP	2,951	26	113.5	40°C
LXEM2-50LW-RP-EDU			RP	3,287	26.1	125.9	40°C
LXEM2-50LW-RA-EDU			RA	3,390	26	130.4	40°C
LXEM2-50LW-RFA-EDU			RFA	3,428	26.2	130.9	40°C
LXEM2-50LW-DFA-EDU			DFA	3,492	26.1	133.8	40°C
LXEM2-50LW-DCA-EDU			DCA	3,529	26.1	135.2	40°C
LXEM2-30ML-RFP-EDU	Medium Lumen	30K	RFP	3,862	38.5	100.3	40°C
LXEM2-30ML-RP-EDU			RP	4,228	38.5	109.8	40°C
LXEM2-30ML-RFA-EDU			RFA	4,343	38.5	112.8	40°C
LXEM2-30ML-RA-EDU			RA	4,446	38.5	115.5	40°C
LXEM2-30ML-DFA-EDU			DFA	4,526	38.5	117.5	40°C
LXEM2-30ML-DCA-EDU			DCA	4,565	38.5	118.6	40°C
LXEM2-35ML-RFP-EDU		35K	RFP	3,993	38.5	103.7	40°C
LXEM2-35ML-RP-EDU			RP	4,371	38.5	113.5	40°C
LXEM2-35ML-RFA-EDU			RFA	4,490	38.5	116.6	40°C
LXEM2-35ML-RA-EDU			RA	4,597	38.5	119.4	40°C
LXEM2-35ML-DFA-EDU			DFA	4,680	38.5	121.5	40°C
LXEM2-35ML-DCA-EDU			DCA	4,720	38.5	122.6	40°C
LXEM2-40ML-RFP-EDU		40K	RFP	4,055	38.5	105.3	40°C
LXEM2-40ML-RP-EDU			RP	4,439	38.5	115.3	40°C
LXEM2-40ML-RFA-EDU			RFA	4,560	38.5	118.4	40°C
LXEM2-40ML-RA-EDU			RA	4,668	38.5	121.3	40°C
LXEM2-40ML-DFA-EDU			DFA	4,752	38.5	123.4	40°C
LXEM2-40ML-DCA-EDU			DCA	4,793	38.5	124.5	40°C
LXEM2-50ML-RFP-EDU		50K	RFP	4,163	38.5	108.1	40°C
LXEM2-50ML-RP-EDU			RP	4,558	38.5	118.4	40°C
LXEM2-50ML-RFA-EDU			RFA	4,682	38.5	121.6	40°C
LXEM2-50ML-RA-EDU			RA	4,793	38.5	124.5	40°C
LXEM2-50ML-DFA-EDU			DFA	4,879	38.5	126.7	40°C
LXEM2-50ML-DCA-EDU			DCA	4,921	38.5	127.8	40°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM2-30HL-RFP-EDU	High Lumen	30K	RFP	4,254	44.1	96.5	35°C
LXEM2-30HL-RP-EDU			RP	4,700	44.1	106.6	35°C
LXEM2-30HL-RA-EDU			RA	4,868	44.1	110.4	35°C
LXEM2-30HL-RFA-EDU			RFA	4,874	44.1	110.5	35°C
LXEM2-30HL-DFA-EDU			DFA	5,008	44.1	113.6	35°C
LXEM2-30HL-DCA-EDU			DCA	5,024	44.1	113.9	35°C
LXEM2-35HL-RFP-EDU		35K	RFP	4,399	44.1	99.7	35°C
LXEM2-35HL-RP-EDU			RP	4,860	44.1	110.2	35°C
LXEM2-35HL-RA-EDU			RA	5,033	44.1	114.1	35°C
LXEM2-35HL-RFA-EDU			RFA	5,040	44.1	114.3	35°C
LXEM2-35HL-DFA-EDU			DFA	5,179	44.1	117.4	35°C
LXEM2-35HL-DCA-EDU			DCA	5,195	44.1	117.8	35°C
LXEM2-40HL-RFP-EDU		40K	RFP	4,467	44.1	101.3	35°C
LXEM2-40HL-RP-EDU			RP	4,935	44.1	111.9	35°C
LXEM2-40HL-RA-EDU			RA	5,111	44.1	115.9	35°C
LXEM2-40HL-RFA-EDU			RFA	5,117	44.1	116	35°C
LXEM2-40HL-DFA-EDU			DFA	5,259	44.1	119.2	35°C
LXEM2-40HL-DCA-EDU			DCA	5,275	44.1	119.6	35°C
LXEM2-50HL-RFP-EDU		50K	RFP	4,586	44.1	104	35°C
LXEM2-50HL-RP-EDU			RP	5,066	44.1	114.9	35°C
LXEM2-50HL-RA-EDU			RA	5,248	44.1	119	35°C
LXEM2-50HL-RFA-EDU			RFA	5,254	44.1	119.1	35°C
LXEM2-50HL-DFA-EDU			DFA	5,399	44.1	122.4	35°C
LXEM2-50HL-DCA-EDU			DCA	5,416	44.1	122.8	35°C
LXEM4-30VW-RFP-EDU	Very Low Watt	30K	RFP	2,802	24.5	114.4	50°C
LXEM4-30VW-RP-EDU			RP	2,938	24.4	120.4	50°C
LXEM4-30VW-RA-EDU			RA	3,039	24.4	124.6	50°C
LXEM4-30VW-RFA-EDU			RFA	3,048	24.5	124.4	50°C
LXEM4-30VW-DCA-EDU			DCA	3,180	24.4	130.3	50°C
LXEM4-30VW-DFA-EDU			DFA	3,184	24.4	130.5	50°C
LXEM4-35VW-RFP-EDU		35K	RFP	2,897	24.5	118.2	50°C
LXEM4-35VW-RP-EDU			RP	3,038	24.4	124.5	50°C
LXEM4-35VW-RA-EDU			RA	3,143	24.4	128.8	50°C
LXEM4-35VW-RFA-EDU			RFA	3,151	24.5	128.6	50°C
LXEM4-35VW-DCA-EDU			DCA	3,288	24.4	134.8	50°C
LXEM4-35VW-DFA-EDU			DFA	3,293	24.4	134.9	50°C
LXEM4-40VW-RFP-EDU		40K	RFP	2,942	24.5	120.1	50°C
LXEM4-40VW-RP-EDU			RP	3,085	24.4	126.4	50°C
LXEM4-40VW-RA-EDU			RA	3,191	24.4	130.8	50°C
LXEM4-40VW-RFA-EDU			RFA	3,200	24.5	130.6	50°C
LXEM4-40VW-DCA-EDU			DCA	3,339	24.4	136.8	50°C
LXEM4-40VW-DFA-EDU			DFA	3,344	24.4	137	50°C
LXEM4-50VW-RFP-EDU		50K	RFP	3,020	24.5	123.3	50°C
LXEM4-50VW-RP-EDU			RP	3,168	24.4	129.8	50°C
LXEM4-50VW-RA-EDU			RA	3,276	24.4	134.3	50°C
LXEM4-50VW-RFA-EDU			RFA	3,285	24.5	134.1	50°C
LXEM4-50VW-DCA-EDU			DCA	3,428	24.4	140.5	50°C
LXEM4-50VW-DFA-EDU			DFA	3,433	24.4	140.7	50°C
LXEM4-30LW-RFP-EDU	Low Watt	30K	RFP	3,726	33.3	111.9	50°C
LXEM4-30LW-RP-EDU			RP	3,872	33.3	116.3	50°C
LXEM4-30LW-RFA-EDU			RFA	4,048	33.3	121.5	50°C
LXEM4-30LW-RA-EDU			RA	4,054	33.3	121.8	50°C
LXEM4-30LW-DFA-EDU			DFA	4,241	33.3	127.4	50°C
LXEM4-30LW-DCA-EDU			DCA	4,303	33.3	129.2	50°C
LXEM4-35LW-RFP-EDU		35K	RFP	3,853	33.3	115.7	50°C
LXEM4-35LW-RP-EDU			RP	4,004	33.3	120.2	50°C
LXEM4-35LW-RFA-EDU			RFA	4,185	33.3	125.7	50°C
LXEM4-35LW-RA-EDU			RA	4,192	33.3	125.9	50°C
LXEM4-35LW-DFA-EDU			DFA	4,385	33.3	131.7	50°C
LXEM4-35LW-DCA-EDU			DCA	4,449	33.3	133.6	50°C
LXEM4-40LW-RFP-EDU		40K	RFP	3,912	33.3	117.5	50°C
LXEM4-40LW-RP-EDU			RP	4,066	33.3	122.1	50°C
LXEM4-40LW-RFA-EDU			RFA	4,250	33.3	127.6	50°C
LXEM4-40LW-RA-EDU			RA	4,257	33.3	127.8	50°C
LXEM4-40LW-DFA-EDU			DFA	4,453	33.3	133.7	50°C
LXEM4-40LW-DCA-EDU			DCA	4,518	33.3	135.7	50°C
LXEM4-50LW-RFP-EDU		50K	RFP	4,017	33.3	120.6	50°C
LXEM4-50LW-RP-EDU			RP	4,174	33.3	125.3	50°C
LXEM4-50LW-RFA-EDU			RFA	4,363	33.3	131	50°C
LXEM4-50LW-RA-EDU			RA	4,371	33.3	131.3	50°C
LXEM4-50LW-DFA-EDU			DFA	4,572	33.3	137.3	50°C
LXEM4-50LW-DCA-EDU			DCA	4,638	33.3	139.3	50°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM4-30ML-RFP-EDU	Medium Lumen	30K	RFP	4,533	41.9	108.2	50°C
LXEM4-30ML-RP-EDU			RP	4,714	41.9	112.5	50°C
LXEM4-30ML-RFA-EDU			RFA	4,922	42	117.2	50°C
LXEM4-30ML-RA-EDU			RA	4,924	42	117.2	50°C
LXEM4-30ML-DFA-EDU			DFA	5,160	42	122.9	50°C
LXEM4-30ML-DCA-EDU			DCA	5,238	42	124.7	50°C
LXEM4-35ML-RFP-EDU		35K	RFP	4,688	41.9	111.9	50°C
LXEM4-35ML-RP-EDU			RP	4,875	41.9	116.3	50°C
LXEM4-35ML-RFA-EDU			RFA	5,089	42	121.2	50°C
LXEM4-35ML-RA-EDU			RA	5,091	42	121.2	50°C
LXEM4-35ML-DFA-EDU			DFA	5,336	42	127	50°C
LXEM4-35ML-DCA-EDU			DCA	5,416	42	128.9	50°C
LXEM4-40ML-RFP-EDU		40K	RFP	4,760	41.9	113.6	50°C
LXEM4-40ML-RP-EDU			RP	4,950	41.9	118.1	50°C
LXEM4-40ML-RFA-EDU			RFA	5,168	42	123.1	50°C
LXEM4-40ML-RA-EDU			RA	5,170	42	123.1	50°C
LXEM4-40ML-DFA-EDU			DFA	5,418	42	129	50°C
LXEM4-40ML-DCA-EDU			DCA	5,500	42	130.9	50°C
LXEM4-50ML-RFP-EDU		50K	RFP	4,887	41.9	116.6	50°C
LXEM4-50ML-RP-EDU			RP	5,082	41.9	121.3	50°C
LXEM4-50ML-RFA-EDU			RFA	5,306	42	126.3	50°C
LXEM4-50ML-RA-EDU			RA	5,308	42	126.4	50°C
LXEM4-50ML-DFA-EDU			DFA	5,563	42	132.4	50°C
LXEM4-50ML-DCA-EDU			DCA	5,646	42	134.4	50°C
LXEM4-30HL-RFP-EDU	High Lumen	30K	RFP	5,449	47.4	115	45°C
LXEM4-30HL-RP-EDU			RP	5,648	47.2	119.7	45°C
LXEM4-30HL-RFA-EDU			RFA	5,926	47.4	125	45°C
LXEM4-30HL-RA-EDU			RA	5,932	47.3	125.4	45°C
LXEM4-30HL-DFA-EDU			DFA	6,214	47.3	131.4	45°C
LXEM4-30HL-DCA-EDU			DCA	6,273	47.4	132.4	45°C
LXEM4-35HL-RFP-EDU		35K	RFP	5,634	47.4	118.9	45°C
LXEM4-35HL-RP-EDU			RP	5,840	47.2	123.7	45°C
LXEM4-35HL-RFA-EDU			RFA	6,127	47.4	129.3	45°C
LXEM4-35HL-RA-EDU			RA	6,133	47.3	129.7	45°C
LXEM4-35HL-DFA-EDU			DFA	6,425	47.3	135.8	45°C
LXEM4-35HL-DCA-EDU			DCA	6,487	47.4	136.9	45°C
LXEM4-40HL-RFP-EDU		40K	RFP	5,721	47.4	120.7	45°C
LXEM4-40HL-RP-EDU			RP	5,931	47.2	125.7	45°C
LXEM4-40HL-RFA-EDU			RFA	6,222	47.4	131.3	45°C
LXEM4-40HL-RA-EDU			RA	6,228	47.3	131.7	45°C
LXEM4-40HL-DFA-EDU			DFA	6,525	47.3	137.9	45°C
LXEM4-40HL-DCA-EDU			DCA	6,587	47.4	139	45°C
LXEM4-50HL-RFP-EDU		50K	RFP	5,874	47.4	123.9	45°C
LXEM4-50HL-RP-EDU			RP	6,089	47.2	129	45°C
LXEM4-50HL-RFA-EDU			RFA	6,388	47.4	134.8	45°C
LXEM4-50HL-RA-EDU			RA	6,394	47.3	135.2	45°C
LXEM4-50HL-DFA-EDU			DFA	6,699	47.3	141.6	45°C
LXEM4-50HL-DCA-EDU			DCA	6,763	47.4	142.7	45°C
LXEM4-30VL-RP-EDU	Very High Lumen	30K	RP	7,086	61.6	115	40°C
LXEM4-30VL-RA-EDU			RA	7,373	61.7	119.5	40°C
LXEM4-30VL-RFP-EDU			RFP	7,388	61.6	119.9	40°C
LXEM4-30VL-RFA-EDU			RFA	7,395	61.6	120	40°C
LXEM4-30VL-DFA-EDU			DFA	7,756	61.7	125.7	40°C
LXEM4-30VL-DCA-EDU			DCA	7,806	61.7	126.5	40°C
LXEM4-35VL-RP-EDU		35K	RP	7,327	61.6	118.9	40°C
LXEM4-35VL-RA-EDU			RA	7,624	61.7	123.6	40°C
LXEM4-35VL-RFP-EDU			RFP	7,639	61.6	124	40°C
LXEM4-35VL-RFA-EDU			RFA	7,646	61.6	124.1	40°C
LXEM4-35VL-DFA-EDU			DFA	8,020	61.7	130	40°C
LXEM4-35VL-DCA-EDU			DCA	8,072	61.7	130.8	40°C
LXEM4-40VL-RP-EDU		40K	RP	7,440	61.6	120.8	40°C
LXEM4-40VL-RA-EDU			RA	7,742	61.7	125.5	40°C
LXEM4-40VL-RFP-EDU			RFP	7,757	61.6	125.9	40°C
LXEM4-40VL-RFA-EDU			RFA	7,764	61.6	126	40°C
LXEM4-40VL-DFA-EDU			DFA	8,144	61.7	132	40°C
LXEM4-40VL-DCA-EDU			DCA	8,197	61.7	132.8	40°C
LXEM4-50VL-RP-EDU		50K	RP	7,639	61.6	124	40°C
LXEM4-50VL-RA-EDU			RA	7,948	61.7	128.8	40°C
LXEM4-50VL-RFP-EDU			RFP	7,964	61.6	129.3	40°C
LXEM4-50VL-RFA-EDU			RFA	7,971	61.6	129.4	40°C
LXEM4-50VL-DFA-EDU			DFA	8,361	61.7	135.5	40°C
LXEM4-50VL-DCA-EDU			DCA	8,415	61.7	136.4	40°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM4-30XL-RFP-EDU	Xtra High Lumen	30K	RFP	9,059	91.3	99.2	30°C
LXEM4-30XL-RP-EDU			RP	9,448	91.2	103.6	30°C
LXEM4-30XL-RFA-EDU			RFA	9,779	91.2	107.2	30°C
LXEM4-30XL-RA-EDU			RA	9,839	91.4	107.7	30°C
LXEM4-30XL-DFA-EDU			DFA	10,358	91.4	113.3	30°C
LXEM4-30XL-DCA-EDU			DCA	10,424	91.5	113.9	30°C
LXEM4-35XL-RFP-EDU		35K	RFP	9,367	91.3	102.6	30°C
LXEM4-35XL-RP-EDU			RP	9,769	91.2	107.1	30°C
LXEM4-35XL-RFA-EDU			RFA	10,111	91.2	110.9	30°C
LXEM4-35XL-RA-EDU			RA	10,174	91.4	111.3	30°C
LXEM4-35XL-DFA-EDU			DFA	10,710	91.4	117.2	30°C
LXEM4-35XL-DCA-EDU			DCA	10,778	91.5	117.8	30°C
LXEM4-40XL-RFP-EDU		40K	RFP	9,512	91.3	104.2	30°C
LXEM4-40XL-RP-EDU			RP	9,920	91.2	108.8	30°C
LXEM4-40XL-RFA-EDU			RFA	10,268	91.2	112.6	30°C
LXEM4-40XL-RA-EDU			RA	10,331	91.4	113	30°C
LXEM4-40XL-DFA-EDU			DFA	10,876	91.4	119	30°C
LXEM4-40XL-DCA-EDU			DCA	10,945	91.5	119.6	30°C
LXEM4-50XL-RFP-EDU		50K	RFP	9,765	91.3	107	30°C
LXEM4-50XL-RP-EDU			RP	10,184	91.2	111.7	30°C
LXEM4-50XL-RFA-EDU			RFA	10,542	91.2	115.6	30°C
LXEM4-50XL-RA-EDU			RA	10,607	91.4	116	30°C
LXEM4-50XL-DFA-EDU			DFA	11,166	91.4	122.2	30°C
LXEM4-50XL-DCA-EDU			DCA	11,237	91.5	122.8	30°C
LXEM8-30VW-RA-EDU	Very Low Watt	30K	RA	6,078	48.8	124.6	50°C
LXEM8-30VW-RFA-EDU			RFA	6,096	49	124.4	50°C
LXEM8-30VW-DCA-EDU			DCA	6,360	48.8	130.3	50°C
LXEM8-30VW-DFA-EDU			DFA	6,369	48.8	130.5	50°C
LXEM8-35VW-RA-EDU		35K	RA	6,285	48.8	128.8	50°C
LXEM8-35VW-RFA-EDU			RFA	6,303	49	128.6	50°C
LXEM8-35VW-DCA-EDU			DCA	6,576	48.8	134.8	50°C
LXEM8-35VW-DFA-EDU			DFA	6,585	48.8	134.9	50°C
LXEM8-40VW-RA-EDU		40K	RA	6,382	48.8	130.8	50°C
LXEM8-40VW-RFA-EDU			RFA	6,400	49	130.6	50°C
LXEM8-40VW-DCA-EDU			DCA	6,678	48.8	136.8	50°C
LXEM8-40VW-DFA-EDU			DFA	6,687	48.8	137	50°C
LXEM8-50VW-RA-EDU		50K	RA	6,553	48.8	134.3	50°C
LXEM8-50VW-RFA-EDU			RFA	6,571	49	134.1	50°C
LXEM8-50VW-DCA-EDU			DCA	6,856	48.8	140.5	50°C
LXEM8-50VW-DFA-EDU			DFA	6,866	48.8	140.7	50°C
LXEM8-30LW-RFA-EDU	Low Watt	30K	RFA	8,095	66.6	121.5	50°C
LXEM8-30LW-RA-EDU			RA	8,109	66.6	121.8	50°C
LXEM8-30LW-DFA-EDU			DFA	8,482	66.6	127.4	50°C
LXEM8-30LW-DCA-EDU			DCA	8,605	66.6	129.2	50°C
LXEM8-35LW-RFA-EDU		35K	RFA	8,370	66.6	125.7	50°C
LXEM8-35LW-RA-EDU			RA	8,385	66.6	125.9	50°C
LXEM8-35LW-DFA-EDU			DFA	8,770	66.6	131.7	50°C
LXEM8-35LW-DCA-EDU			DCA	8,898	66.6	133.6	50°C
LXEM8-40LW-RFA-EDU		40K	RFA	8,500	66.6	127.6	50°C
LXEM8-40LW-RA-EDU			RA	8,514	66.6	127.8	50°C
LXEM8-40LW-DFA-EDU			DFA	8,906	66.6	133.7	50°C
LXEM8-40LW-DCA-EDU			DCA	9,035	66.6	135.7	50°C
LXEM8-50LW-RFA-EDU		50K	RFA	8,727	66.6	131	50°C
LXEM8-50LW-RA-EDU			RA	8,741	66.6	131.3	50°C
LXEM8-50LW-DFA-EDU			DFA	9,143	66.6	137.3	50°C
LXEM8-50LW-DCA-EDU			DCA	9,276	66.6	139.3	50°C
LXEM8-30ML-RFA-EDU	Medium Lumen	30K	RFA	9,844	84	117.2	50°C
LXEM8-30ML-RA-EDU			RA	9,847	84	117.2	50°C
LXEM8-30ML-DFA-EDU			DFA	10,320	84	122.9	50°C
LXEM8-30ML-DCA-EDU			DCA	10,476	84	124.7	50°C
LXEM8-35ML-RFA-EDU		35K	RFA	10,179	84	121.2	50°C
LXEM8-35ML-RA-EDU			RA	10,182	84	121.2	50°C
LXEM8-35ML-DFA-EDU			DFA	10,671	84	127	50°C
LXEM8-35ML-DCA-EDU			DCA	10,832	84	128.9	50°C
LXEM8-40ML-RFA-EDU		40K	RFA	10,336	84	123.1	50°C
LXEM8-40ML-RA-EDU			RA	10,340	84	123.1	50°C
LXEM8-40ML-DFA-EDU			DFA	10,836	84	129	50°C
LXEM8-40ML-DCA-EDU			DCA	10,999	84	130.9	50°C
LXEM8-50ML-RFA-EDU		50K	RFA	10,612	84	126.3	50°C
LXEM8-50ML-RA-EDU			RA	10,616	84	126.4	50°C
LXEM8-50ML-DFA-EDU			DFA	11,125	84	132.4	50°C
LXEM8-50ML-DCA-EDU			DCA	11,293	84	134.4	50°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Columbia  
LIGHTING

LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM8-30HL-RFA-EDU	High Lumen	30K	RFA	11,851	94.8	125	45°C
LXEM8-30HL-RA-EDU			RA	11,863	94.6	125.4	45°C
LXEM8-30HL-DFA-EDU			DFA	12,428	94.6	131.4	45°C
LXEM8-30HL-DCA-EDU			DCA	12,547	94.8	132.4	45°C
LXEM8-35HL-RFA-EDU		35K	RFA	12,254	94.8	129.3	45°C
LXEM8-35HL-RA-EDU			RA	12,267	94.6	129.7	45°C
LXEM8-35HL-DFA-EDU			DFA	12,851	94.6	135.8	45°C
LXEM8-35HL-DCA-EDU			DCA	12,973	94.8	136.9	45°C
LXEM8-40HL-RFA-EDU		40K	RFA	12,444	94.8	131.3	45°C
LXEM8-40HL-RA-EDU			RA	12,456	94.6	131.7	45°C
LXEM8-40HL-DFA-EDU			DFA	13,049	94.6	137.9	45°C
LXEM8-40HL-DCA-EDU			DCA	13,174	94.8	139	45°C
LXEM8-50HL-RFA-EDU		50K	RFA	12,776	94.8	134.8	45°C
LXEM8-50HL-RA-EDU			RA	12,789	94.6	135.2	45°C
LXEM8-50HL-DFA-EDU			DFA	13,397	94.6	141.6	45°C
LXEM8-50HL-DCA-EDU			DCA	13,525	94.8	142.7	45°C
LXEM8-30VL-RA-EDU	Very High Lumen	30K	RA	14,747	123.4	119.5	40°C
LXEM8-30VL-RFA-EDU			RFA	14,789	123.2	120	40°C
LXEM8-30VL-DFA-EDU			DFA	15,512	123.4	125.7	40°C
LXEM8-30VL-DCA-EDU			DCA	15,613	123.4	126.5	40°C
LXEM8-35VL-RA-EDU		35K	RA	15,248	123.4	123.6	40°C
LXEM8-35VL-RFA-EDU			RFA	15,292	123.2	124.1	40°C
LXEM8-35VL-DFA-EDU			DFA	16,040	123.4	130	40°C
LXEM8-35VL-DCA-EDU			DCA	16,143	123.4	130.8	40°C
LXEM8-40VL-RA-EDU		40K	RA	15,484	123.4	125.5	40°C
LXEM8-40VL-RFA-EDU			RFA	15,529	123.2	126	40°C
LXEM8-40VL-DFA-EDU			DFA	16,288	123.4	132	40°C
LXEM8-40VL-DCA-EDU			DCA	16,393	123.4	132.8	40°C
LXEM8-50VL-RA-EDU		50K	RA	15,897	123.4	128.8	40°C
LXEM8-50VL-RFA-EDU			RFA	15,943	123.2	129.4	40°C
LXEM8-50VL-DFA-EDU			DFA	16,722	123.4	135.5	40°C
LXEM8-50VL-DCA-EDU			DCA	16,830	123.4	136.4	40°C
LXEM8-30XL-RFA-EDU	Xtra High Lumen	30K	RFA	19,558	182.4	107.2	30°C
LXEM8-30XL-RA-EDU			RA	19,678	182.8	107.7	30°C
LXEM8-30XL-DFA-EDU			DFA	20,716	182.8	113.9	30°C
LXEM8-30XL-DCA-EDU			DCA	20,847	183	113.9	30°C
LXEM8-35XL-RFA-EDU		35K	RFA	20,223	182.4	110.9	30°C
LXEM8-35XL-RA-EDU			RA	20,348	182.8	111.3	30°C
LXEM8-35XL-DFA-EDU			DFA	21,420	182.8	117.2	30°C
LXEM8-35XL-DCA-EDU			DCA	21,556	183	117.8	30°C
LXEM8-40XL-RFA-EDU		40K	RFA	20,536	182.4	112.6	30°C
LXEM8-40XL-RA-EDU			RA	20,662	182.8	113	30°C
LXEM8-40XL-DFA-EDU			DFA	21,752	182.8	119	30°C
LXEM8-40XL-DCA-EDU			DCA	21,889	183	119.6	30°C
LXEM8-50XL-RFA-EDU		50K	RFA	21,083	182.4	115.6	30°C
LXEM8-50XL-RA-EDU			RA	21,213	182.8	116	30°C
LXEM8-50XL-DFA-EDU			DFA	22,332	182.8	122.2	30°C
LXEM8-50XL-DCA-EDU			DCA	22,473	183	122.8	30°C

Columbia  
LIGHTING

LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:

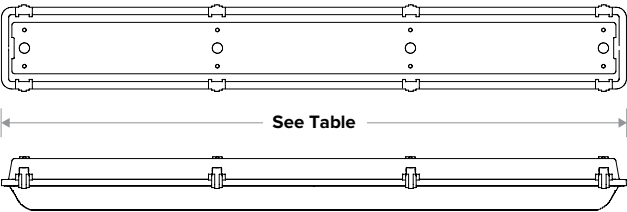
LOCATION:

TYPE:

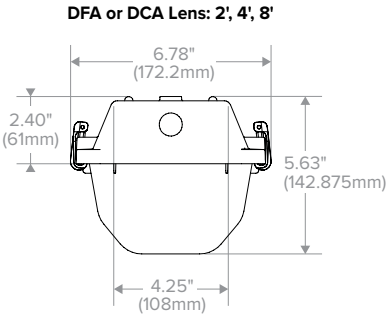
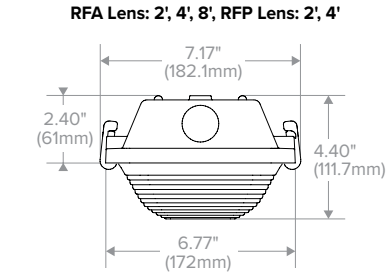
PROJECT:

CATALOG #:

DIMENSIONS



LXEM LENGTH DIMENSIONS								
Size	Lens	Length	Size	Lens	Length	Size	Lens	Length
2'	RFA	27 <sup>7</sup> / <sub>8</sub> "	4'	RFA	51 <sup>1</sup> / <sub>2</sub> "	8'	RFA	100"
	RA	27 <sup>7</sup> / <sub>8</sub> "		RA	51 <sup>1</sup> / <sub>2</sub> "		RA	N/A
	DFA	27 <sup>7</sup> / <sub>8</sub> "		DFA	51 <sup>1</sup> / <sub>2</sub> "		DFA	100"
	DCA	27 <sup>7</sup> / <sub>8</sub> "		DCA	51 <sup>1</sup> / <sub>2</sub> "		DCA	100"
	RFP	27 <sup>7</sup> / <sub>8</sub> "		RFP	51 <sup>1</sup> / <sub>2</sub> "		RFP	N/A
	RP	27 <sup>7</sup> / <sub>8</sub> "		RP	51 <sup>1</sup> / <sub>2</sub> "		RP	N/A



**NOTE:** All dimensions are in inches; dimensions and specifications are subject to change without notice. Please consult factory or check sample for verification.

Columbia  
LIGHTING

LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

PHOTOMETRY

LXEM4-50ML-RFA-EDU

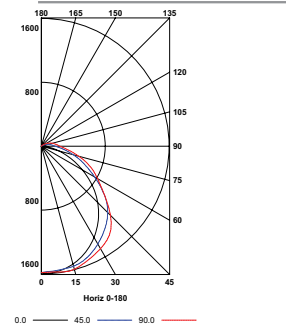
LUMINAIRE DATA

Test No.	17905
Description	LXEM LED Enclosed and Gasketed, Extreme Environment 7" x 51" LED with frosted ribbed acrylic lens
Delivered Lumens	5306
Watts	42.00
Efficacy	126
Mounting	Surface
Spacing Criterion	0° = 1.24 90° = 1.40

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-30	1268	23.9
0-40	2105	39.7
0-60	3766	71.0
0-90	5025	94.7
0-180	5306	100.0

POLAR GRAPH



LXEM4-40HL-DFA-EDU

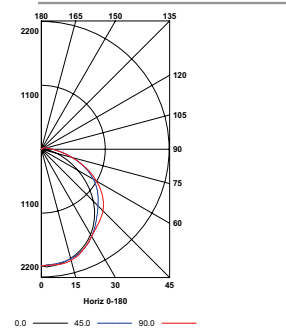
LUMINAIRE DATA

Test No.	17989
Description	LXEM LED Enclosed and Gasketed, Extreme Environment 7" x 51" LED with deep frosted acrylic lens
Delivered Lumens	6525
Watts	47.30
Efficacy	138
Mounting	Surface
Spacing Criterion	0° = 1.25 90° = 1.28

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-30	1583	24.3
0-40	2594	39.8
0-60	4661	71.4
0-90	6235	95.6
0-180	6525	100.0

POLAR GRAPH



LXEM4-50XL-RA-EDU

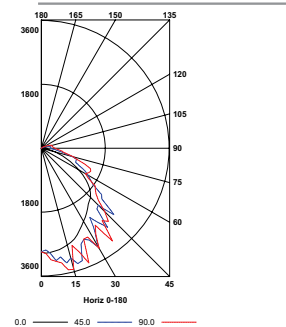
LUMINAIRE DATA

Test No.	18012
Description	LXEM LED Enclosed and Gasketed, Extreme Environment 7" x 51" LED with ribbed clear acrylic lens
Delivered Lumens	10607
Watts	91.40
Efficacy	116
Mounting	Surface
Spacing Criterion	0° = 1.21 90° = 1.38

ZONAL LUMEN SUMMARY

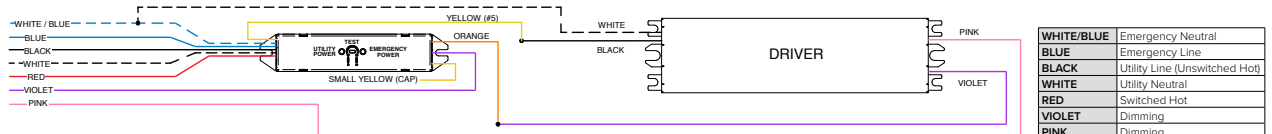
Zone	Lumens	% Luminaire
0-30	2547	24
0-40	4252	40.1
0-60	7643	72.1
0-90	10073	95
0-180	10607	100.0

POLAR GRAPH



ADDITIONAL INFORMATION

DTS WIRING DIAGRAM (0-10V DIMMING DRIVER SHOWN)





**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**LXEM4-40LW-RP-EDU-ELL14-TP**

**TYPE: SPE**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025



**Columbia**  
LIGHTING

**LXEM**

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
CATALOG #: \_\_\_\_\_

## FEATURES

- Available in 2', 4', or 8' lengths
- IP65, IP67 and IP66 all models with standard polyacetal (POM) latches
- NEMA 4X housing
- Fiberglass housing with F1 weatherability rating, standard
- IK10 rated when ordered with polycarbonate lens
- Impact modified acrylic lens equivalent to 100% DR
- UL Sanitation Certified per NSF Standards
- Includes stainless steel surface mounting brackets
- -20°C up to +50°C ambient operation; see table provided for details



## SPECIFICATIONS

### CONSTRUCTION

- Housing is formed from UL 5VA fiberglass
- F1 weatherability rating, suitable for indoor or outdoor use with respect to exposure to UV light
- Pour-in-place non-porous gasketing assures seal
- LED affixed to removable heat sinked gear tray
- 14 Latches per 8'; 8 per 4'; 6 per 2'
- Latches are provided tamper resistance ready, tamper resistant screws by others
- Latches are standard polyacetal (POM), optional in stainless steel
- Access openings are provided for electrical connection
- White painted parts are treated with a five-stage phosphate bonding process and finished with high reflectance baked enamel

### OPTICS

- Lineal ribbed frosted acrylic lens impact modified equivalent to 100% DR; modification adds flexibility to reduce impact breakage compared to standard acrylic formulations
- Optional ribbed polycarbonate lens or deep acrylic
- All lenses available in clear or frost

### ELECTRICAL

- Long life 60,000 hour LEDs at L80 for reduced maintenance
- Extra High Lumen packages (XL) rated L70 at 60,000 hours
- 80 CRI
- Driver options include fixed output for on/off function, step dimming (high/low/off) or continuous 0-10V dimming
- QR code label affixed to housing for easy traceability

### CERTIFICATIONS

- All luminaires are built to UL 1598 and 2108 standards, and bear appropriate cCSAus labels
- CSA certified to UL 924 standards with battery pack or DTS (Dimming Bypass Module) options
- Wet Location label standard
- UL Sanitation certified to NSF standards
- Ingress protection IP65 and IP67 standard; IP66 on certain models

### CERTIFICATIONS (CONTINUED)

- DLC® (DesignLights Consortium) Qualified. Please refer to the DLC website for specific product qualifications at [www.designlights.org](http://www.designlights.org)
- The DTS, Dimming Bypass Module, is for emergency circuit control loads including sensors and wireless systems CSA certified to UL 924. See page 10 for wiring diagram.
- This product qualifies as a "designated country construction material" per FAR 52.225-11 Buy American-Construction Materials under Trade Agreements effective 06/01/2020.

### WARRANTY

- 5 year warranty

KEY DATA	
Lumen Range	2145–22,473
Wattage Range	20-183
Efficacy Range (LPW)	99-147
Reported Life (Hours)	L80/60,000

Columbia  
LIGHTING

LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

ORDERING GUIDE

Example: LXEM4-35HL-RFA-EDU

CATALOG #

LXEM							
Model	Size	Color Temp	Nominal Lumens		Shielding	Driver	Voltage
LXEM	2 2' 1,2,3,4	30 3000K	VW 2' (2,145-2,708)	HL 2' (4,254-5,416)	RFA Ribbed Frosted Acrylic	E Fixed Output	U 120-277V
LED Enclosed and Gasketed	4 4'	35 3500K	4' (2,802-3,433)	4' (5,449-6,763)	RA Ribbed Clear Acrylic <sup>5</sup>	ED 0-10V Dimming	347 347V
	8 8'	40 4000K	8' (6,078-6,866)	8' (11,851-13,525)	DFA Deep Frosted Acrylic	ED1 0-10V 1% Dimming <sup>7</sup>	
		50 5000K	LW 2' (2,738-3,529)	VL 4' (7,086-8,415)	DCA Deep Clear Acrylic <sup>5</sup>	ESD Step Dimming <sup>7</sup>	
			4' (3,726-4,922)	8' (14,747-16,830)	RFP Ribbed Frosted Polycarbonate <sup>6</sup>		
			8' (8,095-9,276)		RP Ribbed Clear Polycarbonate <sup>5,6</sup>		
			ML 2' (3,862-4,921)	XL 4' (9,059-11,237)			
			4' (4,533-5,646)	8' (19,558-22,473)			
			8' (9,844-11,293)				

Options	
ELL14	Emergency Battery Pack Installed, 1400 Lumens <sup>3,7,8</sup>
GLR	Fast Blow Fuse
DTS	Dimming Bypass Module <sup>3,8,9</sup>
OCM	Microwave Occupancy Sensor <sup>8,13</sup>
SSL	Stainless Steel Tamper Resistance Ready Latches
TP	Tamper Proof Latches
F3C8W	3-Wire 8' Wet Cord
F3C15W	3-Wire 15' Wet Cord
F4C8W	4-Wire 8' Wet Cord
F4C15W	4-Wire 15' Wet Cord
F5C8W	5-Wire 8' Wet Cord
F5C15W	5-Wire 15' Wet Cord
F6C6W	6-Wire 6' Wet Cord
SWH	Single Wet Hub ½" NPT Hub
DWH	Dual Wet Hub ½" NPT Hub
ZRE	ControlScope® compatible <sup>8,10</sup>

Accessories	
<input type="checkbox"/> XEDPM	Dual Pendant Brackets (pendant by others) <sup>11</sup>
<input type="checkbox"/> XEHC	Chain Hanger Kit (Includes 14" Chain)
<input type="checkbox"/> XE45MB	45° Mounting Bracket <sup>12</sup>
<input type="checkbox"/> XE45MBSS	45° Stainless Steel Mounting Bracket <sup>12</sup>

Sensor kits (Order Separately)					
All sensor kits include On/Off Occupancy & Daylight.					
Daylight activation requires setting of dip-switches on site.					
120V/277V	Catalog #	# Relays	Lens Type	Voltage	Wet Label
	<input type="checkbox"/> OS1360WLK	1	360°	120/277	Yes
	<input type="checkbox"/> OS2360WLK	2	360°	120/277	Yes
	<input type="checkbox"/> OS1AWLK	1	Aisle	120/277	Yes
	<input type="checkbox"/> OS2AWLK	2	Aisle	120/277	Yes

Notes:

- 1 VL and XL not available in 2' size

2 Not available with battery pack or DTS

3 Not available with XL lumen package

4 Not available with VL lumen package

5 Clear lenses (RA, DCA and RP) may cause noticeable light patterns on lit surfaces. See ies files for exact distribution

6 2' and 4' only. 8' not available

7 See table for availability
- 8 Not available in 347V

9 For emergency circuit control loads including sensors and wireless systems listed to UL924. Only available with 0-10V drivers. See page 10 for wiring diagram

10 Registered trademark of Daintree Networks, used by permission

11 Requires ⅜" OD threaded rod by others

12 2 required for 8' fixture

13 OCM option uses Wattstopper FM-105



**LXEM**

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

**PRODUCT EXCEPTIONS & DETAILS**

Options listed below are available for the outputs as shown.

DRIVER AVAILABILITY TABLE							
Length	Output	Nominal Lumen Range	ESD Available	ED1 Available	347V Available	347V with ESD Available	347V with ED1 Available
2'	VW	2,145–2,708	Y	Y	Y	N/A	Y
	LW	2,738–3,529	Y	Y	Y	N/A	Y
	ML	3,862–4,921	Y	Y	Y	N/A	Y
	HL	4,254–5,416	Y	Y	Y	N/A	Y
4'	VW	2,802–3,433	Y	Y	Y	N/A	Y
	LW	3,726–4,922	Y	Y	Y	N/A	Y
	ML	4,533–5,646	Y	Y	Y	N/A	Y
	HL	5,449–6,763	Y	Y	Y	N/A	Y
	VL	7,086–8,415	Y	Y	Y	N/A	N/A
	XL	9,059–11,237	N/A	Y	Y	N/A	N/A
8'	VW	6,078–6,866	Y	Y	Y	N/A	Y
	LW	8,095–9,276	Y	Y	Y	N/A	Y
	ML	9,844–11,293	Y	Y	Y	N/A	Y
	HL	11,851–13,525	Y	Y	Y	N/A	Y
	VL	14,747–16,830	Y	Y	Y	N/A	N/A
	XL	19,558–22,473	N/A	Y	Y	N/A	N/A

MAX. AMBIENT OPERATING TEMP.							
Length	Output	Nominal Lumen Range	Watts	LPW	Max Ambient Operating Temperature (C°) (Universal Voltage)	ELL14 (with Universal Voltage)	347V
2'	VW	2,145–2,708	21	102–130	40	NA	35
	LW	2,738–3,529	26	105–135	40	NA	35
	ML	3,862–4,921	39	100–128	40	NA	35
	HL	4,254–5,416	44	97–123	35	NA	30
4'	VW	2,802–3,433	25	114–141	50	45	45
	LW	3,726–4,922	33	112–139	50	45	45
	ML	4,533–5,646	42	108–134	50	45	45
	HL	5,449–6,763	47	115–143	45	45	35
	VL	7,086–8,415	62	115–136	40	40	35
	XL	9,059–11,237	92	99–123	30	NA	25
8'	VW	6,078–6,866	49	124–141	50	45	45
	LW	8,095–9,276	67	122–139	50	45	45
	ML	9,844–11,293	84	117–134	50	45	45
	HL	11,851–13,525	95	125–143	45	45	35
	VL	14,747–16,830	123	120–136	40	40	35
	XL	19,558–22,473	183	107–123	30	NA	25



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM2-30VW-RFP-EDU	Very Low Watt	30K	RFP	2,145	21.1	101.6	40°C
LXEM2-30VW-RA-EDU			RA	2,365	20.8	113.7	40°C
LXEM2-30VW-RP-EDU			RP	2,373	20.8	114.1	40°C
LXEM2-30VW-RFA-EDU			RFA	2,448	20.8	117.7	40°C
LXEM2-30VW-DFA-EDU			DFA	2,467	20.8	118.6	40°C
LXEM2-30VW-DCA-EDU			DCA	2,512	20.8	120.8	40°C
LXEM2-35VW-RFP-EDU		35K	RFP	2,217	21.1	105.1	40°C
LXEM2-35VW-RA-EDU			RA	2,446	20.8	117.6	40°C
LXEM2-35VW-RP-EDU			RP	2,454	20.8	118	40°C
LXEM2-35VW-RFA-EDU			RFA	2,531	20.8	121.7	40°C
LXEM2-35VW-DFA-EDU			DFA	2,551	20.8	122.6	40°C
LXEM2-35VW-DCA-EDU			DCA	2,598	20.8	124.9	40°C
LXEM2-40VW-RFP-EDU		40K	RFP	2,252	21.1	106.7	40°C
LXEM2-40VW-RA-EDU			RA	2,484	20.8	119.4	40°C
LXEM2-40VW-RP-EDU			RP	2,492	20.8	119.8	40°C
LXEM2-40VW-RFA-EDU			RFA	2,571	20.8	123.6	40°C
LXEM2-40VW-DFA-EDU			DFA	2,590	20.8	124.5	40°C
LXEM2-40VW-DCA-EDU			DCA	2,638	20.8	126.8	40°C
LXEM2-50VW-RFP-EDU		50K	RFP	2,312	21.1	109.6	40°C
LXEM2-50VW-RA-EDU			RA	2,550	20.8	122.6	40°C
LXEM2-50VW-RP-EDU			RP	2,558	20.8	123	40°C
LXEM2-50VW-RFA-EDU			RFA	2,639	20.8	126.9	40°C
LXEM2-50VW-DFA-EDU			DFA	2,659	20.8	127.8	40°C
LXEM2-50VW-DCA-EDU			DCA	2,708	20.8	130.2	40°C
LXEM2-30LW-RFP-EDU	Low Watt	30K	RFP	2,738	26	105.3	40°C
LXEM2-30LW-RP-EDU			RP	3,049	26.1	116.8	40°C
LXEM2-30LW-RA-EDU			RA	3,144	26	120.9	40°C
LXEM2-30LW-RFA-EDU			RFA	3,180	26.2	121.4	40°C
LXEM2-30LW-DFA-EDU			DFA	3,239	26.1	124.1	40°C
LXEM2-30LW-DCA-EDU			DCA	3,273	26.1	125.4	40°C
LXEM2-35LW-RFP-EDU		35K	RFP	2,831	26	108.9	40°C
LXEM2-35LW-RP-EDU			RP	3,153	26.1	120.8	40°C
LXEM2-35LW-RA-EDU			RA	3,251	26	125	40°C
LXEM2-35LW-RFA-EDU			RFA	3,289	26.2	125.5	40°C
LXEM2-35LW-DFA-EDU			DFA	3,349	26.1	128.3	40°C
LXEM2-35LW-DCA-EDU			DCA	3,385	26.1	129.7	40°C
LXEM2-40LW-RFP-EDU		40K	RFP	2,875	26	110.6	40°C
LXEM2-40LW-RP-EDU			RP	3,202	26.1	122.7	40°C
LXEM2-40LW-RA-EDU			RA	3,302	26	127	40°C
LXEM2-40LW-RFA-EDU			RFA	3,339	26.2	127.5	40°C
LXEM2-40LW-DFA-EDU			DFA	3,401	26.1	130.3	40°C
LXEM2-40LW-DCA-EDU			DCA	3,437	26.1	131.7	40°C
LXEM2-50LW-RFP-EDU		50K	RFP	2,951	26	113.5	40°C
LXEM2-50LW-RP-EDU			RP	3,287	26.1	125.9	40°C
LXEM2-50LW-RA-EDU			RA	3,390	26	130.4	40°C
LXEM2-50LW-RFA-EDU			RFA	3,428	26.2	130.9	40°C
LXEM2-50LW-DFA-EDU			DFA	3,492	26.1	133.8	40°C
LXEM2-50LW-DCA-EDU			DCA	3,529	26.1	135.2	40°C
LXEM2-30ML-RFP-EDU	Medium Lumen	30K	RFP	3,862	38.5	100.3	40°C
LXEM2-30ML-RP-EDU			RP	4,228	38.5	109.8	40°C
LXEM2-30ML-RFA-EDU			RFA	4,343	38.5	112.8	40°C
LXEM2-30ML-RA-EDU			RA	4,446	38.5	115.5	40°C
LXEM2-30ML-DFA-EDU			DFA	4,526	38.5	117.5	40°C
LXEM2-30ML-DCA-EDU			DCA	4,565	38.5	118.6	40°C
LXEM2-35ML-RFP-EDU		35K	RFP	3,993	38.5	103.7	40°C
LXEM2-35ML-RP-EDU			RP	4,371	38.5	113.5	40°C
LXEM2-35ML-RFA-EDU			RFA	4,490	38.5	116.6	40°C
LXEM2-35ML-RA-EDU			RA	4,597	38.5	119.4	40°C
LXEM2-35ML-DFA-EDU			DFA	4,680	38.5	121.5	40°C
LXEM2-35ML-DCA-EDU			DCA	4,720	38.5	122.6	40°C
LXEM2-40ML-RFP-EDU		40K	RFP	4,055	38.5	105.3	40°C
LXEM2-40ML-RP-EDU			RP	4,439	38.5	115.3	40°C
LXEM2-40ML-RFA-EDU			RFA	4,560	38.5	118.4	40°C
LXEM2-40ML-RA-EDU			RA	4,668	38.5	121.3	40°C
LXEM2-40ML-DFA-EDU			DFA	4,752	38.5	123.4	40°C
LXEM2-40ML-DCA-EDU			DCA	4,793	38.5	124.5	40°C
LXEM2-50ML-RFP-EDU		50K	RFP	4,163	38.5	108.1	40°C
LXEM2-50ML-RP-EDU			RP	4,558	38.5	118.4	40°C
LXEM2-50ML-RFA-EDU			RFA	4,682	38.5	121.6	40°C
LXEM2-50ML-RA-EDU			RA	4,793	38.5	124.5	40°C
LXEM2-50ML-DFA-EDU			DFA	4,879	38.5	126.7	40°C
LXEM2-50ML-DCA-EDU			DCA	4,921	38.5	127.8	40°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM2-30HL-RFP-EDU	High Lumen	30K	RFP	4,254	44.1	96.5	35°C
LXEM2-30HL-RP-EDU			RP	4,700	44.1	106.6	35°C
LXEM2-30HL-RA-EDU			RA	4,868	44.1	110.4	35°C
LXEM2-30HL-RFA-EDU			RFA	4,874	44.1	110.5	35°C
LXEM2-30HL-DFA-EDU			DFA	5,008	44.1	113.6	35°C
LXEM2-30HL-DCA-EDU			DCA	5,024	44.1	113.9	35°C
LXEM2-35HL-RFP-EDU		35K	RFP	4,399	44.1	99.7	35°C
LXEM2-35HL-RP-EDU			RP	4,860	44.1	110.2	35°C
LXEM2-35HL-RA-EDU			RA	5,033	44.1	114.1	35°C
LXEM2-35HL-RFA-EDU			RFA	5,040	44.1	114.3	35°C
LXEM2-35HL-DFA-EDU			DFA	5,179	44.1	117.4	35°C
LXEM2-35HL-DCA-EDU			DCA	5,195	44.1	117.8	35°C
LXEM2-40HL-RFP-EDU		40K	RFP	4,467	44.1	101.3	35°C
LXEM2-40HL-RP-EDU			RP	4,935	44.1	111.9	35°C
LXEM2-40HL-RA-EDU			RA	5,111	44.1	115.9	35°C
LXEM2-40HL-RFA-EDU			RFA	5,117	44.1	116	35°C
LXEM2-40HL-DFA-EDU			DFA	5,259	44.1	119.2	35°C
LXEM2-40HL-DCA-EDU			DCA	5,275	44.1	119.6	35°C
LXEM2-50HL-RFP-EDU		50K	RFP	4,586	44.1	104	35°C
LXEM2-50HL-RP-EDU			RP	5,066	44.1	114.9	35°C
LXEM2-50HL-RA-EDU			RA	5,248	44.1	119	35°C
LXEM2-50HL-RFA-EDU			RFA	5,254	44.1	119.1	35°C
LXEM2-50HL-DFA-EDU			DFA	5,399	44.1	122.4	35°C
LXEM2-50HL-DCA-EDU			DCA	5,416	44.1	122.8	35°C
LXEM4-30VW-RFP-EDU	Very Low Watt	30K	RFP	2,802	24.5	114.4	50°C
LXEM4-30VW-RP-EDU			RP	2,938	24.4	120.4	50°C
LXEM4-30VW-RA-EDU			RA	3,039	24.4	124.6	50°C
LXEM4-30VW-RFA-EDU			RFA	3,048	24.5	124.4	50°C
LXEM4-30VW-DCA-EDU			DCA	3,180	24.4	130.3	50°C
LXEM4-30VW-DFA-EDU			DFA	3,184	24.4	130.5	50°C
LXEM4-35VW-RFP-EDU		35K	RFP	2,897	24.5	118.2	50°C
LXEM4-35VW-RP-EDU			RP	3,038	24.4	124.5	50°C
LXEM4-35VW-RA-EDU			RA	3,143	24.4	128.8	50°C
LXEM4-35VW-RFA-EDU			RFA	3,151	24.5	128.6	50°C
LXEM4-35VW-DCA-EDU			DCA	3,288	24.4	134.8	50°C
LXEM4-35VW-DFA-EDU			DFA	3,293	24.4	134.9	50°C
LXEM4-40VW-RFP-EDU		40K	RFP	2,942	24.5	120.1	50°C
LXEM4-40VW-RP-EDU			RP	3,085	24.4	126.4	50°C
LXEM4-40VW-RA-EDU			RA	3,191	24.4	130.8	50°C
LXEM4-40VW-RFA-EDU			RFA	3,200	24.5	130.6	50°C
LXEM4-40VW-DCA-EDU			DCA	3,339	24.4	136.8	50°C
LXEM4-40VW-DFA-EDU			DFA	3,344	24.4	137	50°C
LXEM4-50VW-RFP-EDU		50K	RFP	3,020	24.5	123.3	50°C
LXEM4-50VW-RP-EDU			RP	3,168	24.4	129.8	50°C
LXEM4-50VW-RA-EDU			RA	3,276	24.4	134.3	50°C
LXEM4-50VW-RFA-EDU			RFA	3,285	24.5	134.1	50°C
LXEM4-50VW-DCA-EDU			DCA	3,428	24.4	140.5	50°C
LXEM4-50VW-DFA-EDU			DFA	3,433	24.4	140.7	50°C
LXEM4-30LW-RFP-EDU	Low Watt	30K	RFP	3,726	33.3	111.9	50°C
LXEM4-30LW-RP-EDU			RP	3,872	33.3	116.3	50°C
LXEM4-30LW-RFA-EDU			RFA	4,048	33.3	121.5	50°C
LXEM4-30LW-RA-EDU			RA	4,054	33.3	121.8	50°C
LXEM4-30LW-DFA-EDU			DFA	4,241	33.3	127.4	50°C
LXEM4-30LW-DCA-EDU			DCA	4,303	33.3	129.2	50°C
LXEM4-35LW-RFP-EDU		35K	RFP	3,853	33.3	115.7	50°C
LXEM4-35LW-RP-EDU			RP	4,004	33.3	120.2	50°C
LXEM4-35LW-RFA-EDU			RFA	4,185	33.3	125.7	50°C
LXEM4-35LW-RA-EDU			RA	4,192	33.3	125.9	50°C
LXEM4-35LW-DFA-EDU			DFA	4,385	33.3	131.7	50°C
LXEM4-35LW-DCA-EDU			DCA	4,449	33.3	133.6	50°C
LXEM4-40LW-RFP-EDU		40K	RFP	3,912	33.3	117.5	50°C
LXEM4-40LW-RP-EDU			RP	4,066	33.3	122.1	50°C
LXEM4-40LW-RFA-EDU			RFA	4,250	33.3	127.6	50°C
LXEM4-40LW-RA-EDU			RA	4,257	33.3	127.8	50°C
LXEM4-40LW-DFA-EDU			DFA	4,453	33.3	133.7	50°C
LXEM4-40LW-DCA-EDU			DCA	4,518	33.3	135.7	50°C
LXEM4-50LW-RFP-EDU		50K	RFP	4,017	33.3	120.6	50°C
LXEM4-50LW-RP-EDU			RP	4,174	33.3	125.3	50°C
LXEM4-50LW-RFA-EDU			RFA	4,363	33.3	131	50°C
LXEM4-50LW-RA-EDU			RA	4,371	33.3	131.3	50°C
LXEM4-50LW-DFA-EDU			DFA	4,572	33.3	137.3	50°C
LXEM4-50LW-DCA-EDU			DCA	4,638	33.3	139.3	50°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM4-30ML-RFP-EDU	Medium Lumen	30K	RFP	4,533	41.9	108.2	50°C
LXEM4-30ML-RP-EDU			RP	4,714	41.9	112.5	50°C
LXEM4-30ML-RFA-EDU			RFA	4,922	42	117.2	50°C
LXEM4-30ML-RA-EDU			RA	4,924	42	117.2	50°C
LXEM4-30ML-DFA-EDU			DFA	5,160	42	122.9	50°C
LXEM4-30ML-DCA-EDU			DCA	5,238	42	124.7	50°C
LXEM4-35ML-RFP-EDU		35K	RFP	4,688	41.9	111.9	50°C
LXEM4-35ML-RP-EDU			RP	4,875	41.9	116.3	50°C
LXEM4-35ML-RFA-EDU			RFA	5,089	42	121.2	50°C
LXEM4-35ML-RA-EDU			RA	5,091	42	121.2	50°C
LXEM4-35ML-DFA-EDU			DFA	5,336	42	127	50°C
LXEM4-35ML-DCA-EDU			DCA	5,416	42	128.9	50°C
LXEM4-40ML-RFP-EDU		40K	RFP	4,760	41.9	113.6	50°C
LXEM4-40ML-RP-EDU			RP	4,950	41.9	118.1	50°C
LXEM4-40ML-RFA-EDU			RFA	5,168	42	123.1	50°C
LXEM4-40ML-RA-EDU			RA	5,170	42	123.1	50°C
LXEM4-40ML-DFA-EDU			DFA	5,418	42	129	50°C
LXEM4-40ML-DCA-EDU			DCA	5,500	42	130.9	50°C
LXEM4-50ML-RFP-EDU		50K	RFP	4,887	41.9	116.6	50°C
LXEM4-50ML-RP-EDU			RP	5,082	41.9	121.3	50°C
LXEM4-50ML-RFA-EDU			RFA	5,306	42	126.3	50°C
LXEM4-50ML-RA-EDU			RA	5,308	42	126.4	50°C
LXEM4-50ML-DFA-EDU			DFA	5,563	42	132.4	50°C
LXEM4-50ML-DCA-EDU			DCA	5,646	42	134.4	50°C
LXEM4-30HL-RFP-EDU	High Lumen	30K	RFP	5,449	47.4	115	45°C
LXEM4-30HL-RP-EDU			RP	5,648	47.2	119.7	45°C
LXEM4-30HL-RFA-EDU			RFA	5,926	47.4	125	45°C
LXEM4-30HL-RA-EDU			RA	5,932	47.3	125.4	45°C
LXEM4-30HL-DFA-EDU			DFA	6,214	47.3	131.4	45°C
LXEM4-30HL-DCA-EDU			DCA	6,273	47.4	132.4	45°C
LXEM4-35HL-RFP-EDU		35K	RFP	5,634	47.4	118.9	45°C
LXEM4-35HL-RP-EDU			RP	5,840	47.2	123.7	45°C
LXEM4-35HL-RFA-EDU			RFA	6,127	47.4	129.3	45°C
LXEM4-35HL-RA-EDU			RA	6,133	47.3	129.7	45°C
LXEM4-35HL-DFA-EDU			DFA	6,425	47.3	135.8	45°C
LXEM4-35HL-DCA-EDU			DCA	6,487	47.4	136.9	45°C
LXEM4-40HL-RFP-EDU		40K	RFP	5,721	47.4	120.7	45°C
LXEM4-40HL-RP-EDU			RP	5,931	47.2	125.7	45°C
LXEM4-40HL-RFA-EDU			RFA	6,222	47.4	131.3	45°C
LXEM4-40HL-RA-EDU			RA	6,228	47.3	131.7	45°C
LXEM4-40HL-DFA-EDU			DFA	6,525	47.3	137.9	45°C
LXEM4-40HL-DCA-EDU			DCA	6,587	47.4	139	45°C
LXEM4-50HL-RFP-EDU		50K	RFP	5,874	47.4	123.9	45°C
LXEM4-50HL-RP-EDU			RP	6,089	47.2	129	45°C
LXEM4-50HL-RFA-EDU			RFA	6,388	47.4	134.8	45°C
LXEM4-50HL-RA-EDU			RA	6,394	47.3	135.2	45°C
LXEM4-50HL-DFA-EDU			DFA	6,699	47.3	141.6	45°C
LXEM4-50HL-DCA-EDU			DCA	6,763	47.4	142.7	45°C
LXEM4-30VL-RP-EDU	Very High Lumen	30K	RP	7,086	61.6	115	40°C
LXEM4-30VL-RA-EDU			RA	7,373	61.7	119.5	40°C
LXEM4-30VL-RFP-EDU			RFP	7,388	61.6	119.9	40°C
LXEM4-30VL-RFA-EDU			RFA	7,395	61.6	120	40°C
LXEM4-30VL-DFA-EDU			DFA	7,756	61.7	125.7	40°C
LXEM4-30VL-DCA-EDU			DCA	7,806	61.7	126.5	40°C
LXEM4-35VL-RP-EDU		35K	RP	7,327	61.6	118.9	40°C
LXEM4-35VL-RA-EDU			RA	7,624	61.7	123.6	40°C
LXEM4-35VL-RFP-EDU			RFP	7,639	61.6	124	40°C
LXEM4-35VL-RFA-EDU			RFA	7,646	61.6	124.1	40°C
LXEM4-35VL-DFA-EDU			DFA	8,020	61.7	130	40°C
LXEM4-35VL-DCA-EDU			DCA	8,072	61.7	130.8	40°C
LXEM4-40VL-RP-EDU		40K	RP	7,440	61.6	120.8	40°C
LXEM4-40VL-RA-EDU			RA	7,742	61.7	125.5	40°C
LXEM4-40VL-RFP-EDU			RFP	7,757	61.6	125.9	40°C
LXEM4-40VL-RFA-EDU			RFA	7,764	61.6	126	40°C
LXEM4-40VL-DFA-EDU			DFA	8,144	61.7	132	40°C
LXEM4-40VL-DCA-EDU			DCA	8,197	61.7	132.8	40°C
LXEM4-50VL-RP-EDU		50K	RP	7,639	61.6	124	40°C
LXEM4-50VL-RA-EDU			RA	7,948	61.7	128.8	40°C
LXEM4-50VL-RFP-EDU			RFP	7,964	61.6	129.3	40°C
LXEM4-50VL-RFA-EDU			RFA	7,971	61.6	129.4	40°C
LXEM4-50VL-DFA-EDU			DFA	8,361	61.7	135.5	40°C
LXEM4-50VL-DCA-EDU			DCA	8,415	61.7	136.4	40°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM4-30XL-RFP-EDU	Xtra High Lumen	30K	RFP	9,059	91.3	99.2	30°C
LXEM4-30XL-RP-EDU			RP	9,448	91.2	103.6	30°C
LXEM4-30XL-RFA-EDU			RFA	9,779	91.2	107.2	30°C
LXEM4-30XL-RA-EDU			RA	9,839	91.4	107.7	30°C
LXEM4-30XL-DFA-EDU			DFA	10,358	91.4	113.3	30°C
LXEM4-30XL-DCA-EDU			DCA	10,424	91.5	113.9	30°C
LXEM4-35XL-RFP-EDU		35K	RFP	9,367	91.3	102.6	30°C
LXEM4-35XL-RP-EDU			RP	9,769	91.2	107.1	30°C
LXEM4-35XL-RFA-EDU			RFA	10,111	91.2	110.9	30°C
LXEM4-35XL-RA-EDU			RA	10,174	91.4	111.3	30°C
LXEM4-35XL-DFA-EDU			DFA	10,710	91.4	117.2	30°C
LXEM4-35XL-DCA-EDU			DCA	10,778	91.5	117.8	30°C
LXEM4-40XL-RFP-EDU		40K	RFP	9,512	91.3	104.2	30°C
LXEM4-40XL-RP-EDU			RP	9,920	91.2	108.8	30°C
LXEM4-40XL-RFA-EDU			RFA	10,268	91.2	112.6	30°C
LXEM4-40XL-RA-EDU			RA	10,331	91.4	113	30°C
LXEM4-40XL-DFA-EDU			DFA	10,876	91.4	119	30°C
LXEM4-40XL-DCA-EDU			DCA	10,945	91.5	119.6	30°C
LXEM4-50XL-RFP-EDU		50K	RFP	9,765	91.3	107	30°C
LXEM4-50XL-RP-EDU			RP	10,184	91.2	111.7	30°C
LXEM4-50XL-RFA-EDU			RFA	10,542	91.2	115.6	30°C
LXEM4-50XL-RA-EDU			RA	10,607	91.4	116	30°C
LXEM4-50XL-DFA-EDU			DFA	11,166	91.4	122.2	30°C
LXEM4-50XL-DCA-EDU			DCA	11,237	91.5	122.8	30°C
LXEM8-30VW-RA-EDU	Very Low Watt	30K	RA	6,078	48.8	124.6	50°C
LXEM8-30VW-RFA-EDU			RFA	6,096	49	124.4	50°C
LXEM8-30VW-DCA-EDU			DCA	6,360	48.8	130.3	50°C
LXEM8-30VW-DFA-EDU			DFA	6,369	48.8	130.5	50°C
LXEM8-35VW-RA-EDU		35K	RA	6,285	48.8	128.8	50°C
LXEM8-35VW-RFA-EDU			RFA	6,303	49	128.6	50°C
LXEM8-35VW-DCA-EDU			DCA	6,576	48.8	134.8	50°C
LXEM8-35VW-DFA-EDU			DFA	6,585	48.8	134.9	50°C
LXEM8-40VW-RA-EDU		40K	RA	6,382	48.8	130.8	50°C
LXEM8-40VW-RFA-EDU			RFA	6,400	49	130.6	50°C
LXEM8-40VW-DCA-EDU			DCA	6,678	48.8	136.8	50°C
LXEM8-40VW-DFA-EDU			DFA	6,687	48.8	137	50°C
LXEM8-50VW-RA-EDU		50K	RA	6,553	48.8	134.3	50°C
LXEM8-50VW-RFA-EDU			RFA	6,571	49	134.1	50°C
LXEM8-50VW-DCA-EDU			DCA	6,856	48.8	140.5	50°C
LXEM8-50VW-DFA-EDU			DFA	6,866	48.8	140.7	50°C
LXEM8-30LW-RFA-EDU	Low Watt	30K	RFA	8,095	66.6	121.5	50°C
LXEM8-30LW-RA-EDU			RA	8,109	66.6	121.8	50°C
LXEM8-30LW-DFA-EDU			DFA	8,482	66.6	127.4	50°C
LXEM8-30LW-DCA-EDU			DCA	8,605	66.6	129.2	50°C
LXEM8-35LW-RFA-EDU		35K	RFA	8,370	66.6	125.7	50°C
LXEM8-35LW-RA-EDU			RA	8,385	66.6	125.9	50°C
LXEM8-35LW-DFA-EDU			DFA	8,770	66.6	131.7	50°C
LXEM8-35LW-DCA-EDU			DCA	8,898	66.6	133.6	50°C
LXEM8-40LW-RFA-EDU		40K	RFA	8,500	66.6	127.6	50°C
LXEM8-40LW-RA-EDU			RA	8,514	66.6	127.8	50°C
LXEM8-40LW-DFA-EDU			DFA	8,906	66.6	133.7	50°C
LXEM8-40LW-DCA-EDU			DCA	9,035	66.6	135.7	50°C
LXEM8-50LW-RFA-EDU		50K	RFA	8,727	66.6	131	50°C
LXEM8-50LW-RA-EDU			RA	8,741	66.6	131.3	50°C
LXEM8-50LW-DFA-EDU			DFA	9,143	66.6	137.3	50°C
LXEM8-50LW-DCA-EDU			DCA	9,276	66.6	139.3	50°C
LXEM8-30ML-RFA-EDU	Medium Lumen	30K	RFA	9,844	84	117.2	50°C
LXEM8-30ML-RA-EDU			RA	9,847	84	117.2	50°C
LXEM8-30ML-DFA-EDU			DFA	10,320	84	122.9	50°C
LXEM8-30ML-DCA-EDU			DCA	10,476	84	124.7	50°C
LXEM8-35ML-RFA-EDU		35K	RFA	10,179	84	121.2	50°C
LXEM8-35ML-RA-EDU			RA	10,182	84	121.2	50°C
LXEM8-35ML-DFA-EDU			DFA	10,671	84	127	50°C
LXEM8-35ML-DCA-EDU			DCA	10,832	84	128.9	50°C
LXEM8-40ML-RFA-EDU		40K	RFA	10,336	84	123.1	50°C
LXEM8-40ML-RA-EDU			RA	10,340	84	123.1	50°C
LXEM8-40ML-DFA-EDU			DFA	10,836	84	129	50°C
LXEM8-40ML-DCA-EDU			DCA	10,999	84	130.9	50°C
LXEM8-50ML-RFA-EDU		50K	RFA	10,612	84	126.3	50°C
LXEM8-50ML-RA-EDU			RA	10,616	84	126.4	50°C
LXEM8-50ML-DFA-EDU			DFA	11,125	84	132.4	50°C
LXEM8-50ML-DCA-EDU			DCA	11,293	84	134.4	50°C



currentlighting.com/columbialighting

© 2023 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

PRODUCT AVAILABILITY 80 CRI							
Lumen Package	Output	Color	Lens	Lumens	Watts	LPW	Max Ambient Operating Temp
LXEM8-30HL-RFA-EDU	High Lumen	30K	RFA	11,851	94.8	125	45°C
LXEM8-30HL-RA-EDU			RA	11,863	94.6	125.4	45°C
LXEM8-30HL-DFA-EDU			DFA	12,428	94.6	131.4	45°C
LXEM8-30HL-DCA-EDU			DCA	12,547	94.8	132.4	45°C
LXEM8-35HL-RFA-EDU		35K	RFA	12,254	94.8	129.3	45°C
LXEM8-35HL-RA-EDU			RA	12,267	94.6	129.7	45°C
LXEM8-35HL-DFA-EDU			DFA	12,851	94.6	135.8	45°C
LXEM8-35HL-DCA-EDU			DCA	12,973	94.8	136.9	45°C
LXEM8-40HL-RFA-EDU		40K	RFA	12,444	94.8	131.3	45°C
LXEM8-40HL-RA-EDU			RA	12,456	94.6	131.7	45°C
LXEM8-40HL-DFA-EDU			DFA	13,049	94.6	137.9	45°C
LXEM8-40HL-DCA-EDU			DCA	13,174	94.8	139	45°C
LXEM8-50HL-RFA-EDU		50K	RFA	12,776	94.8	134.8	45°C
LXEM8-50HL-RA-EDU			RA	12,789	94.6	135.2	45°C
LXEM8-50HL-DFA-EDU			DFA	13,397	94.6	141.6	45°C
LXEM8-50HL-DCA-EDU			DCA	13,525	94.8	142.7	45°C
LXEM8-30VL-RA-EDU	Very High Lumen	30K	RA	14,747	123.4	119.5	40°C
LXEM8-30VL-RFA-EDU			RFA	14,789	123.2	120	40°C
LXEM8-30VL-DFA-EDU			DFA	15,512	123.4	125.7	40°C
LXEM8-30VL-DCA-EDU			DCA	15,613	123.4	126.5	40°C
LXEM8-35VL-RA-EDU		35K	RA	15,248	123.4	123.6	40°C
LXEM8-35VL-RFA-EDU			RFA	15,292	123.2	124.1	40°C
LXEM8-35VL-DFA-EDU			DFA	16,040	123.4	130	40°C
LXEM8-35VL-DCA-EDU			DCA	16,143	123.4	130.8	40°C
LXEM8-40VL-RA-EDU		40K	RA	15,484	123.4	125.5	40°C
LXEM8-40VL-RFA-EDU			RFA	15,529	123.2	126	40°C
LXEM8-40VL-DFA-EDU			DFA	16,288	123.4	132	40°C
LXEM8-40VL-DCA-EDU			DCA	16,393	123.4	132.8	40°C
LXEM8-50VL-RA-EDU		50K	RA	15,897	123.4	128.8	40°C
LXEM8-50VL-RFA-EDU			RFA	15,943	123.2	129.4	40°C
LXEM8-50VL-DFA-EDU			DFA	16,722	123.4	135.5	40°C
LXEM8-50VL-DCA-EDU			DCA	16,830	123.4	136.4	40°C
LXEM8-30XL-RFA-EDU	Xtra High Lumen	30K	RFA	19,558	182.4	107.2	30°C
LXEM8-30XL-RA-EDU			RA	19,678	182.8	107.7	30°C
LXEM8-30XL-DFA-EDU			DFA	20,716	182.8	113.9	30°C
LXEM8-30XL-DCA-EDU			DCA	20,847	183	113.9	30°C
LXEM8-35XL-RFA-EDU		35K	RFA	20,223	182.4	110.9	30°C
LXEM8-35XL-RA-EDU			RA	20,348	182.8	111.3	30°C
LXEM8-35XL-DFA-EDU			DFA	21,420	182.8	117.2	30°C
LXEM8-35XL-DCA-EDU			DCA	21,556	183	117.8	30°C
LXEM8-40XL-RFA-EDU		40K	RFA	20,536	182.4	112.6	30°C
LXEM8-40XL-RA-EDU			RA	20,662	182.8	113	30°C
LXEM8-40XL-DFA-EDU			DFA	21,752	182.8	119	30°C
LXEM8-40XL-DCA-EDU			DCA	21,889	183	119.6	30°C
LXEM8-50XL-RFA-EDU		50K	RFA	21,083	182.4	115.6	30°C
LXEM8-50XL-RA-EDU			RA	21,213	182.8	116	30°C
LXEM8-50XL-DFA-EDU			DFA	22,332	182.8	122.2	30°C
LXEM8-50XL-DCA-EDU			DCA	22,473	183	122.8	30°C





Columbia  
LIGHTING

LXEM

ENCLOSED AND GASKETED FIBERGLASS EXTREME ENVIRONMENT

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

PHOTOMETRY

LXEM4-50ML-RFA-EDU

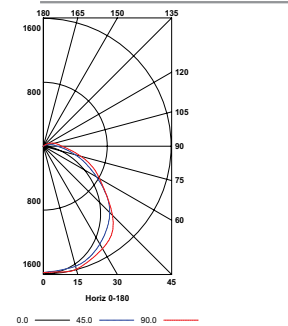
LUMINAIRE DATA

Test No.	17905
Description	LXEM LED Enclosed and Gasketed, Extreme Environment 7" x 51" LED with frosted ribbed acrylic lens
Delivered Lumens	5306
Watts	42.00
Efficacy	126
Mounting	Surface
Spacing Criterion	0° = 1.24 90° = 1.40

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-30	1268	23.9
0-40	2105	39.7
0-60	3766	71.0
0-90	5025	94.7
0-180	5306	100.0

POLAR GRAPH



LXEM4-40HL-DFA-EDU

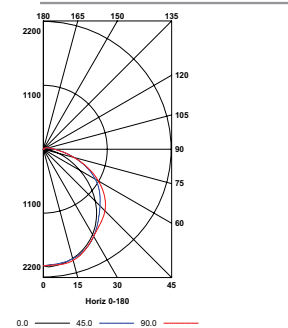
LUMINAIRE DATA

Test No.	17989
Description	LXEM LED Enclosed and Gasketed, Extreme Environment 7" x 51" LED with deep frosted acrylic lens
Delivered Lumens	6525
Watts	47.30
Efficacy	138
Mounting	Surface
Spacing Criterion	0° = 1.25 90° = 1.28

ZONAL LUMEN SUMMARY

Zone	Lumens	% Luminaire
0-30	1583	24.3
0-40	2594	39.8
0-60	4661	71.4
0-90	6235	95.6
0-180	6525	100.0

POLAR GRAPH



LXEM4-50XL-RA-EDU

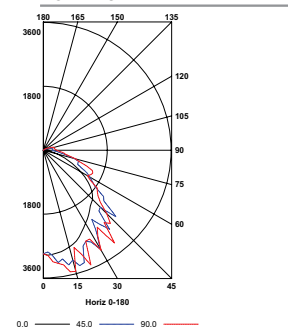
LUMINAIRE DATA

Test No.	18012
Description	LXEM LED Enclosed and Gasketed, Extreme Environment 7" x 51" LED with ribbed clear acrylic lens
Delivered Lumens	10607
Watts	91.40
Efficacy	116
Mounting	Surface
Spacing Criterion	0° = 1.21 90° = 1.38

ZONAL LUMEN SUMMARY

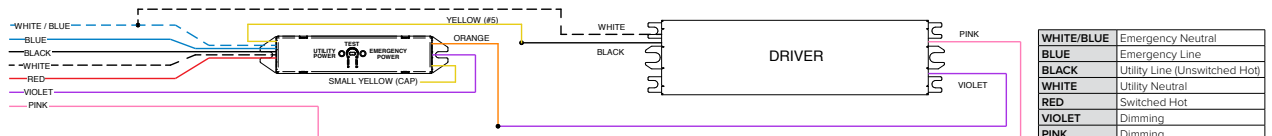
Zone	Lumens	% Luminaire
0-30	2547	24
0-40	4252	40.1
0-60	7643	72.1
0-90	10073	95
0-180	10607	100.0

POLAR GRAPH



ADDITIONAL INFORMATION

DTS WIRING DIAGRAM (0-10V DIMMING DRIVER SHOWN)





**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**MPS4-40HL-CW-EDU**

**TYPE: ST4**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

Columbia  
LIGHTING

MPS

MULTIPURPOSE LINEAR

## FEATURES

- Uniform end-to-end lens brightness with optional continuous row mounting that gives an uninterrupted ribbon of light
- Superior color consistency within a 3-step MacAdam ellipse and greater than 80 CRI
- Available in 2', 4' or 8' lengths
- Optional 90 or 120 min integral emergency battery pack (CEC Title 20 Compliant)
- Curved and flat acrylic and curved polycarbonate lens options or a no lens (NL) version. Wide and Narrow distributions available
- Modular replaceable LED boards and driver accessible for future maintenance or upgrades
- Surface mount, wall mount or suspended mounting



## CONTROLS TECHNOLOGY



## SPECIFICATIONS

### CONSTRUCTION

- Housing, wireway, and ends are formed from code-gauge steel
- Housing components act as heat sink for LED heat dissipation
- White painted parts are treated with a five stage phosphate bonding process and finished with high reflectance baked enamel

### OPTICS

- Available with or without frosted lens

### INSTALLATION

- Knockouts are provided for electrical access and mounting
- WARNING** – Removing the lens during installation exposes the LEDs and due to their fragility they could be damaged. Handle the LED reflector plate with care, do not rest the LED reflector plate upside down directly on its LEDs as this could result in damage. Damage to LEDs from mishandling during installation will not be covered under warranty

### ELECTRICAL

- Long-life LEDs are rated for 60,000 hours at L80 lumen maintenance
- Driver options include fixed output for on/off function, step dimming (high/low/off), or continuous 0–10V dimming
- Superior drivers and long-life LEDs provide quality illumination for prolonged service life

### ELECTRICAL (CONTINUED)

- Drivers < 10% THD at 120V, power factor > 0.95
- Lumen packages up to 10,000 lumens rated to 40°C (104°F) max ambient. Lumen packages up to 5,000 lumens rated to 50°C (122°F) max ambient. Minimum ambient temperature -20°C (-4°F)

### CONTROLS

- NX Lighting Controls provides options for standalone and networked integrated sensor with wired or wireless connectivity for NX system deployments
- NX Connect is a standalone wireless deployment for room based applications using wireless enabled and battery operated devices
- SpectraSync (TM) Color Tuning Technology offers a tunable white solution and integrates seamlessly into a variety of control systems



## SERVICE PROGRAMS

STOCK QS10

End View Curve Lens	C	B	Typical Dimensions and Weights			
			Sizes	(B) Width Inches (mm)	(C) Height Inches (mm)	Weight lbs (kg)
End View Flat Lens	C	B	Curve Lens	Flat Lens	Curve Lens	Flat Lens
			2'			4.0 (1.8)
			4'	3.11 (79)	3.00 (76)	6.0 (2.7)
			8'			12.0 (5.4)

### CERTIFICATIONS

- All luminaires are built to UL 1598 standards, and bear appropriate cCSAus labels
- Emergency battery pack options are California Energy Commission (CEC) Title 20 compliant
- CSA certified to UL 924 standards with battery pack or DLS (Dimming Bypass Module) options
- DLC® (DesignLights Consortium) Qualified, Please refer to the DLC website for specific product qualifications at [www.designlights.org](http://www.designlights.org)
- Adheres to LM79, LM80, and TM21 industry standards
- The DTS, Dimming Bypass Module, is for emergency circuit control loads including sensors and wireless systems CSA certified to UL 924. See wiring diagram.
- Product configurations not including battery packs or controls meet federal procurement law requirements under the Trade Agreements Act (FAR 52.225-11) [See Buy America\(n\) Solutions](http://SeeBuyAmerica(n).Solutions)

### WARRANTY

- 5 year warranty

## STOCK GUIDE


Catalog No.	UPC	Description	Weight (lbs)	Pallet Qty	DLC QPL
<input type="checkbox"/> MPS4-35ML-CW-EDU	078531138714	4', 80 CRI, 3500K, 4556 Lumens, Curved Frosted Acrylic Wide Distribution Lens, 0-10V Dimming Driver, 120-277V, 40W, 114 LPW, White	6.1	56	PKQ78077
<input type="checkbox"/> MPS4-35ML-FW-EDU	603134946413	4', 80 CRI, 3500K, 4230 Lumens, Flat Frosted Acrylic Wide Distribution Lens, 0-10V Dimming Driver, 120-277V, 31W, 134 LPW, White	6.1	56	P9P5CV62
<input type="checkbox"/> MPS4-40ML-CW-EDU	078531138721	4', 80 CRI, 4000K, 4614 Lumens, Curved Frosted Acrylic Wide Distribution Lens, 0-10V Dimming Driver, 120-277V, 40W, 115 LPW, White	6.1	56	P04CB2S2
<input type="checkbox"/> MPS4-40ML-FW-EDU	603134946420	4', 80 CRI, 3500K, 4277 Lumens, Flat Frosted Acrylic Wide Distribution Lens, 0-10V Dimming Driver, 120-277V, 31W, 135 LPW, White	6.1	56	PLLGKQU6
<input type="checkbox"/> MPS8-50ML-CW-EDU	078531138752	8', 80 CRI, 5000K, 9532 Lumens, Curved Frosted Acrylic Wide Distribution Lens, 0-10V Dimming Driver, 120-277V, 80W, 119 LPW, White	13.6	56	PSCRP7L
<input type="checkbox"/> CSHC	078531000868	Chain Hanging Assembly - (2) 14" Chains and V-Hooks	0.2	N/A	N/A

Current

[currentlighting.com/columbialighting](http://currentlighting.com/columbialighting)

© 2025 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.

Page 1 of 12  
Rev 04/01/25  
COL\_MPS\_spec\_R13

Submitted by FRM Lighting and Controls		<b>Catalog Number:</b> MPS4-40HL-CW-EDU		<b>Type:</b>  <b>ST4</b>  FRM-GREENVILLE25-161113	
		<b>Job Name:</b> HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK IMPROVEMENTS Engineer: DEVITA & ASSOCIATES, INC. (GREENVILLE)			
		<b>Notes:</b>			

Columbia  
LIGHTING

MPS  
MULTIPURPOSE LINEAR

## ORDERING GUIDE

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

Gray Shading = Service Program  
Limit of 150 Luminaires 

Example: MPS4-40ML-CW-EDU

MPS														
Model	Size <sup>1</sup>	CRI	Color Temp		Nominal Lumens	Lens	Distribution	Driver <sup>4</sup>						
MPS MultiPurpose Linear	2' 2"	Blank >80	30	3000K	XW 4' (2600), 8' (5200)	C Curve, Frosted Acrylic	N Narrow Distribution <sup>3</sup>	ED	0-10V Dimming					
	4' 4"	9 90	35	3500K	VW 2'(1600), 4'(3300), 8' (6600)	F Flat, Frosted Acrylic	W Wide Distribution	ED1	0-10V 1% Dimming					
	8' 8"		40	4000K	MW 2'(2200), 4'(3600), 8' (7200)	NL No Lens		EDD	0-10V Dim-to-Off					
			50	5000K	LW 2'(2400), 4'(4000), 8' (7900)	CP Curve, Frosted Polycarbonate		ESD	Step Dimming <sup>5,9</sup>					
			2765T	2700K-6500K SpectraSync™ Tunable White <sup>2</sup>	ML 2'(3400), 4'(4500), 8' (8900)			LUTH	Hi-lume 1% EcoSystem LED driver with Soft-on, Fade-to-Black dimming technology <sup>5,6</sup>					
				HL 2'(3700), 4'(5800), 8' (11,500)				DALIP	Powered by DALI <sup>5</sup>					
				VL 2' (4400), 4' (6800), 8' (13,500)										
				XL 2' (5400), 4' (7800), 8' (15,500)										
				UL 2'(6200), 4'(10,000), 8'(20,000)										

Voltage	Options		Control Options <sup>12, 22, 23, 24</sup>	
U 120V-277V 347 347V (ED, ED1 only)	ELL14	10W Emergency Battery Pack (CEC Title 20 Compliant) Installed <sup>5, 7, 8</sup>	<b>NX Lighting Controls</b>	
	ELL14H2	9W Emergency Battery Pack (CEC Title 20 Compliant) Installed, 2-Hour Run Time <sup>5, 7, 8, 10</sup>	<b>Networked Wireless</b>	
	DTS	Dimming Bypass Module <sup>5, 11</sup>	<b>NXW</b> NX Networked Wireless Radio Module NXRM2 and Bluetooth Programming, without Sensor <sup>25, 26</sup>	
	MPSCE	Injection Molded ABS Material Curve Endcap <sup>12</sup>	<b>NXWSM</b> NX Networked Wireless Enabled Integral NXSMP2-SMI PIR Occupancy Sensor with Automatic Dimming Photocell and Bluetooth Programming <sup>25, 26</sup>	
	MPSCE-MB	Injection Molded ABS Material Curve Endcap, Matte Black <sup>13</sup>	<b>Networked Wired</b>	
	MPSFE	Injection Molded ABS Material Flat Endcap <sup>12</sup>	<b>NXE</b> NX Wired Dual RJ45 SmartPORTS , without Sensor <sup>25, 26</sup>	
	MPSFE-MB	Injection Molded ABS Material Flat Endcap, Matte Black <sup>13</sup>	<b>NXESM</b> NX Wired Dual RJ45 SmartPORTS & Integral NXSMP2-SMI PIR Occupancy Sensor with Automatic Dimming Photocell and Bluetooth Programming <sup>25, 26</sup>	
	MB	Matte Black	<b>Independent Control</b>	
	SLV	Silver	<b>NXCS</b> NX Connect NXC-WIZ20 Wireless Indoor Occupancy & Photocell Sensor <sup>5, 27, 28, 29</sup>	
	PAF	Painted After Fabrication	<b>BTSL</b> Bluetooth Programmable, BTSMP-LMI PIR Occupancy Sensor with Automatic Dimming Photocell and 360° Lens <sup>25, 26</sup>	
	MST	MASTER fixture that controls one or more SATELLITE fixtures in a continuous row application <sup>14, 15, 16, 17, 18, 19, 20</sup>	<b>Other Lighting Controls</b>	
	SAT	SATELLITE fixture controlled by MASTER fixture in a continuous row application <sup>15, 16, 17, 18, 19, 20</sup>	<b>Networked Wireless</b>	
	INT	Intermediate (provides ends with wiring access for continuous row mounting) <sup>19, 20, 21</sup>	<b>LVR</b> Lutron Vive Integral Fixture Control DFCSJ-OEM-RF (RF only) <sup>5, 27, 28, 30</sup>	
	EOR	End of Row (provides end wiring access for continuous row mounting) <sup>19, 20, 21</sup>	<b>LVS</b> Lutron Vive Integral Fixture Control DFCSJ-OEM-OCC (RF with daylight and occupancy sensing) <sup>5, 27, 28, 30</sup>	
	GLR	Fast Blow Fuse <sup>5</sup>	<b>AWNRR</b> Lutron Athena Integral Fixture Control A-WN-DO1-RF-WH (RF only) <sup>5, 25, 28</sup>	
			<b>AWNS</b> Lutron Athena Integral Fixture Control A-WN-DO1-OCC-WH with Daylight and Occupancy Sensing <sup>5, 25, 28</sup>	
			<b>Independent Control</b>	
			<b>ODPG</b> Occupancy and Daylight Sensors w/ Grouping, Philips SNS200 <sup>5, 27, 28</sup>	
			<b>ZLS05</b> Occupancy & Daylight Sensor, Leviton ZLS05 <sup>5, 25, 28</sup>	

- Notes:
- Refer to Row Mount Ordering Instructions for Continuous Row applications
  - Refer to SpectraSync and NX Availability table. Only available with ED driver and 80 CRI.
  - Only available with Curve, Frosted Acrylic lens option
  - Dimming curves may vary dependent upon lumen output and driver option chosen. Separate dimming circuits are recommended if multiple driver options are chosen
  - Not available in 347V
  - Not available with 2ft: VW, MW, LW lumen packages, 4ft: XW, VL lumen packages or 8ft: MW, VL lumen packages
  - To determine lumen output in emergency mode, multiply the battery pack wattage by the fixture lumens per watt (LPW)
  - Not available with 2ft fixture. Not available with thru wire and XL or UL lumen package on 4ft and 8ft fixtures
  - Max ambient temperature, 25°C
  - Not available for use in Canada
  - For emergency circuit control loads including sensors and wireless systems CSA certified to UL 924. See wiring diagram. Cannot be combined with SpectraSync or Controls options in 2ft fixture
  - PAF option included when this option is chosen
  - Only available with MB or SLV finish options

- Continuous Row Options**
- Not available with INT option
  - One MST fixture can control multiple SAT fixtures but a SAT fixture can only be controlled by one MST fixture
  - Only available with NX Networked, NX Wired and NX Wireless Controls, consult factory for applications
  - Not available with LUTH
  - Not available with DTS
  - All fixtures in a continuous row application must use the same driver type and voltage
  - Quick connect wiring harness included
  - Suspension support required at every fixture coupling, see Mounting Accessories Guide
- All Controls**
- Control Options include injection molded ABS end cap
  - Dry location rated only
  - Minimum ambient temperature: 0°C (32°F)
- NX Lighting Controls**
- Only available with ED, ED1 or EDD driver options
  - Not available in 2ft when combined with SpectraSync
- Other Lighting Controls Options**
- Only available with DALIP driver option
  - Not available with SpectraSync
  - Not available with 2ft: VW, MW and LW lumen packages or 4ft: XW lumen package
  - Vive is a trademark of Lutron Electronics Co., Inc.

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**  
MPS4-40HL-CW-EDU

Notes:

**Type:****ST4**

FRM-GREENVILLE25-161113

**Columbia**  
LIGHTING

**MPS**

MULTIPURPOSE LINEAR

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

**ORDERING GUIDE (CONTINUED)****Accessories**

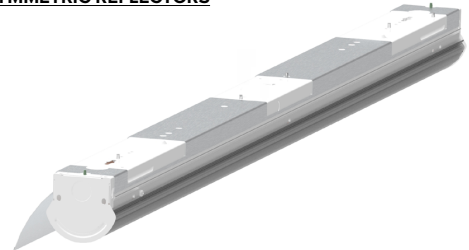
<input type="checkbox"/> S18	18" Stem, Canopy
<input type="checkbox"/> SS18	18" Swivel Stem—45° Swivel
<input type="checkbox"/> CM24SCF3-KIT	24" Adjustable Cable Mounting Kit, 3-wire feed
<input type="checkbox"/> CM48SCF3-KIT	48" Adjustable Cable Mounting Kit, 3-wire feed
<input type="checkbox"/> CM24NF-KIT	Single Point Non-Feed Cable Mount with Canopy, Single-24"
<input type="checkbox"/> CM48NF-KIT	Single Point Non-Feed Cable Mount with Canopy, Single-48"
<input type="checkbox"/> CSHC	Chain Hanger Assembly
<input type="checkbox"/> MPSZT	Zip Tee Hanger - 1½" Spacer on T-Bar Ceiling
<input type="checkbox"/> MPSTH	Slide Tong Hanger
<input type="checkbox"/> MPSCRK-C	Continuous Row Kit, Curve
<input type="checkbox"/> MPSCRK-F	Continuous Row Kit, Flat
<input type="checkbox"/> MPSWG2	2' Wire Guard
<input type="checkbox"/> MPSWG4	4' Wire Guard <sup>1</sup>
<input type="checkbox"/> MPSCE	Injection Molded ABS Material Curve Endcap
<input type="checkbox"/> MPSCE-MB	Injection Molded ABS Material Curve Endcap, Matte Black
<input type="checkbox"/> MPSFE	Injection Molded ABS Material Flat Endcap
<input type="checkbox"/> MPSFE-MB	Injection Molded ABS Material Flat Endcap, Matte Black
<input type="checkbox"/> REFL-MPS4 STL SLD W16	4' Symmetric Reflector Solid <sup>1</sup>
<input type="checkbox"/> REFL-MPS4 STL SLTD W16	4' Symmetric Reflector Slotted <sup>1</sup>
<input type="checkbox"/> REFL-MPS4 STL SLD ASYM W16	4' Asymmetric Reflector Solid <sup>1</sup>
<input type="checkbox"/> CBL-HB-120-6Y-PAD	10ft Adjustable 10' aircraft cable Y hanger paddle ends (1 pair, must be used in conjunction with MPSTH accessory)

Notes:

1 Two Required for 8' fixture

**SYMMETRIC REFLECTORS**

**REFL-MPS4 STL SLD W16**  
4' Symmetric Reflector Solid

**ASYMMETRIC REFLECTORS**

**REFL-MPS4 STL SLD ASYM W16**  
4' Asymmetric Reflector Solid

**CONTINUOUS ROW MOUNT EXAMPLE GUIDE**

Continuous Row Length	MPS4	MPS8	MPSCRK-*	CM**SCF*-KIT	CM**NF-KIT
12' — Option 1	1	1	1	1	1
12' — Option 2	3	0	2	1	1
16' — Option 1	0	2	1	1	1
16' — Option 2	2	1	2	1	2
32' — Option 1	0	4	3	2	1
32' — Option 2	2	3	4	2	1



MPS  
MULTIPURPOSE LINEAR

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

DELIVERED LUMENS

STANDARD EFFICACY PERFORMANCE TABLE — 2'						
FIXTURE	COLOR	LENS	DISTRIBUTION	LUMENS	WATTS	LPW
MPS2-VW	3500K	CURVE	WIDE	1560	10.4	150
			NARROW	1544	10.4	149
		FLAT	WIDE	1513	10.4	146
	4000K	CURVE	WIDE	1669	10.4	161
			NARROW	1587	10.4	153
		FLAT	WIDE	1571	10.4	151
MPS2-MW	3500K	CURVE	WIDE	1539	10.4	148
			NARROW	1698	10.4	163
		FLAT	WIDE	2069	13.6	153
	4000K	CURVE	WIDE	2048	13.6	151
			NARROW	2007	13.6	148
		FLAT	WIDE	2214	13.6	163
MPS2-LW	3500K	CURVE	WIDE	2104	13.6	155
			NARROW	2083	13.6	153
		FLAT	WIDE	2041	13.6	150
	4000K	CURVE	WIDE	2251	13.6	166
			NARROW	2639	17.2	153
		FLAT	WIDE	2613	17.2	152
MPS2-ML	3500K	CURVE	WIDE	2560	17.2	149
			NARROW	2824	17.2	164
		FLAT	WIDE	2683	17.2	156
	4000K	CURVE	WIDE	2656	17.2	154
			NARROW	2603	17.2	151
		FLAT	WIDE	2871	17.2	167
MPS2-HL	3500K	CURVE	WIDE	3262	21.5	152
			NARROW	3229	21.5	150
		FLAT	WIDE	3164	21.5	147
	4000K	CURVE	WIDE	3490	21.5	162
			NARROW	3317	21.5	155
		FLAT	WIDE	3284	21.5	153
MPS2-VL	3500K	CURVE	WIDE	3217	21.5	150
			NARROW	3549	21.5	165
		FLAT	WIDE	3617	24.1	150
	4000K	CURVE	WIDE	3581	24.1	149
			NARROW	3508	24.1	146
		FLAT	WIDE	3870	24.1	161
MPS2-XL	3500K	CURVE	WIDE	3678	24.1	153
			NARROW	3641	24.1	151
		FLAT	WIDE	3568	24.1	148
	4000K	CURVE	WIDE	3935	24.1	163
			NARROW	4433	28.1	158
		FLAT	WIDE	4389	28.1	156
MPS2-UL	3500K	CURVE	WIDE	4300	28.1	153
			NARROW	4743	28.1	169
		FLAT	WIDE	4508	28.1	160
	4000K	CURVE	WIDE	4463	28.1	159
			NARROW	4824	28.1	172
		FLAT	WIDE	5409	34.9	155
MPS4-VW	3500K	CURVE	WIDE	5355	34.9	153
			NARROW	5247	34.9	150
		FLAT	WIDE	5788	34.9	166
	4000K	CURVE	WIDE	5500	34.9	158
			NARROW	5445	34.9	156
		FLAT	WIDE	5335	34.9	153
MPS4-MW	3500K	CURVE	WIDE	5885	34.9	169
			NARROW	6202	40.6	153
		FLAT	WIDE	6140	40.6	151
	4000K	CURVE	WIDE	6016	40.6	148
			NARROW	6636	40.6	163
		FLAT	WIDE	6307	40.6	153
MPS4-LW	3500K	CURVE	WIDE	6244	40.6	154
			NARROW	6118	40.6	151
		FLAT	WIDE	6748	40.6	166
MPS4-ML	3500K	CURVE	WIDE	6118	40.6	151
			NARROW	6748	40.6	166
		FLAT	WIDE	6118	40.6	151
	4000K	CURVE	WIDE	6118	40.6	151
			NARROW	6748	40.6	166
		FLAT	WIDE	6118	40.6	151

STANDARD EFFICACY PERFORMANCE TABLE — 4'						
FIXTURE	COLOR	LENS	DISTRIBUTION	LUMENS	WATTS	LPW
MPS4-XW	3500K	CURVE	WIDE	2560	16.2	158
			NARROW	2534	16.2	156
		FLAT	WIDE	2483	16.2	153
	4000K	CURVE	WIDE	2739	16.2	169
			NARROW	2603	16.2	161
		FLAT	WIDE	2577	16.2	159
MPS4-VW	3500K	CURVE	WIDE	2525	16.2	156
			NARROW	2785	16.2	172
		FLAT	WIDE	3271	20.5	160
	4000K	CURVE	WIDE	3238	20.5	158
			NARROW	3173	20.5	155
		FLAT	WIDE	3500	20.5	171
MPS4-MW	3500K	CURVE	WIDE	3326	20.5	162
			NARROW	3293	20.5	161
		FLAT	WIDE	3226	20.5	157
	4000K	CURVE	WIDE	3559	20.5	174
			NARROW	3659	23.0	159
		FLAT	WIDE	3622	23.0	157
MPS4-LW	3500K	CURVE	WIDE	3549	23.0	154
			NARROW	3915	23.0	170
		FLAT	WIDE	3721	23.0	162
	4000K	CURVE	WIDE	3684	23.0	160
			NARROW	3609	23.0	157
		FLAT	WIDE	3981	23.0	173
MPS4-ML	3500K	CURVE	WIDE	4270	26.9	159
			NARROW	4227	26.9	157
		FLAT	WIDE	4142	26.9	154
	4000K	CURVE	WIDE	4569	26.9	170
			NARROW	4342	26.9	161
		FLAT	WIDE	4299	26.9	160
MPS4-VL	3500K	CURVE	WIDE	4212	26.9	157
			NARROW	4646	26.9	173
		FLAT	WIDE	4941	31.2	158
	4000K	CURVE	WIDE	4892	31.2	157
			NARROW	4793	31.2	154
		FLAT	WIDE	5287	31.2	169
MPS4-XL	3500K	CURVE	WIDE	5025	31.2	161
			NARROW	4975	31.2	159
		FLAT	WIDE	4874	31.2	156
	4000K	CURVE	WIDE	5377	31.2	172
			NARROW	5918	37.6	157
		FLAT	WIDE	5859	37.6	156
MPS4-UL	3500K	CURVE	WIDE	5740	37.6	153
			NARROW	6332	37.6	168
		FLAT	WIDE	6018	37.6	160
	4000K	CURVE	WIDE	5958	37.6	158
			NARROW	5837	37.6	155
		FLAT	WIDE	6439	37.6	171
MPS4-XL	3500K	CURVE	WIDE	7128	46.5	153
			NARROW	7057	46.5	152
		FLAT	WIDE	6914	46.5	149
	4000K	CURVE	WIDE	7627	46.5	164
			NARROW	7249	46.5	156
		FLAT	WIDE	7177	46.5	154
MPS4-UL	3500K	CURVE	WIDE	7032	46.5	151
			NARROW	7756	46.5	167
		FLAT	WIDE	8715	55.1	158
	4000K	CURVE	WIDE	8628	55.1	157
			NARROW	8454	55.1	153
		FLAT	WIDE	9325	55.1	169
MPS4-UL	3500K	CURVE	WIDE	8863	55.1	161
			NARROW	8774	55.1	159
		FLAT	WIDE	8597	55.1	156
	4000K	CURVE	WIDE	9483	55.1	172
			NARROW	10168	65.6	155
		FLAT	WIDE	10066	65.6	153
MPS4-UL	3500K	CURVE	WIDE	9863	65.6	150
			NARROW	10880	65.6	166
		FLAT	WIDE	10340	65.6	158
	4000K	CURVE	WIDE	10237	65.6	156
			NARROW	10030	65.6	153
		FLAT	WIDE	11064	65.6	169



currentlighting.com/columbialighting

© 2025 HL Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



MPS  
MULTIPURPOSE LINEAR

DATE: | LOCATION:

TYPE: | PROJECT:

CATALOG #:

DELIVERED LUMENS (CONTINUED)

STANDARD EFFICACY PERFORMANCE TABLE — 8'						
FIXTURE	COLOR	LENS	DISTRIBUTION	LUMENS	WATTS	LPW
MPS8-XW	3500K	CURVE	WIDE	5120	31.2	164
			NARROW	5069	31.2	162
		FLAT	WIDE	4966	31.2	159
			NO LENS	5478	31.2	176
	4000K	CURVE	WIDE	5207	31.2	167
			NARROW	5155	31.2	165
		FLAT	WIDE	5051	31.2	162
			NO LENS	5571	31.2	179
MPS8-VW	3500K	CURVE	WIDE	6542	39.7	165
			NARROW	6477	39.7	163
		FLAT	WIDE	6346	39.7	160
			NO LENS	7000	39.7	176
	4000K	CURVE	WIDE	6653	39.7	168
			NARROW	6586	39.7	166
		FLAT	WIDE	6453	39.7	163
			NO LENS	7119	39.7	179
MPS8-MW	3500K	CURVE	WIDE	7318	44.7	164
			NARROW	7245	44.7	162
		FLAT	WIDE	7098	44.7	159
			NO LENS	7830	44.7	175
	4000K	CURVE	WIDE	7442	44.7	166
			NARROW	7368	44.7	165
		FLAT	WIDE	7219	44.7	161
			NO LENS	7963	44.7	178
MPS8-LW	3500K	CURVE	WIDE	8539	52.8	162
			NARROW	8454	52.8	160
		FLAT	WIDE	8283	52.8	157
			NO LENS	9137	52.8	173
	4000K	CURVE	WIDE	8684	52.8	164
			NARROW	8597	52.8	163
		FLAT	WIDE	8423	52.8	160
			NO LENS	9292	52.8	176
MPS8-ML	3500K	CURVE	WIDE	9882	61.5	161
			NARROW	9783	61.5	159
		FLAT	WIDE	9586	61.5	156
			NO LENS	10574	61.5	172
	4000K	CURVE	WIDE	10049	61.5	163
			NARROW	9949	61.5	162
		FLAT	WIDE	9748	61.5	158
			NO LENS	10752	61.5	175
MPS8-HL	3500K	CURVE	WIDE	11835	75.0	158
			NARROW	11717	75.0	156
		FLAT	WIDE	11480	75.0	153
			NO LENS	12663	75.0	169
	4000K	CURVE	WIDE	12036	75.0	160
			NARROW	11916	75.0	159
		FLAT	WIDE	11675	75.0	156
			NO LENS	12879	75.0	172
MPS8-VL	3500K	CURVE	WIDE	14257	93.1	153
			NARROW	14114	93.1	152
		FLAT	WIDE	13829	93.1	149
			NO LENS	15255	93.1	164
	4000K	CURVE	WIDE	14498	93.1	156
			NARROW	14353	93.1	154
		FLAT	WIDE	14063	93.1	151
			NO LENS	15513	93.1	167
MPS8-XL	3500K	CURVE	WIDE	17431	110.8	157
			NARROW	17257	110.8	156
		FLAT	WIDE	16908	110.8	153
			NO LENS	18651	110.8	168
	4000K	CURVE	WIDE	17726	110.8	160
			NARROW	17549	110.8	158
		FLAT	WIDE	17194	110.8	155
			NO LENS	18967	110.8	171
MPS8-UL	3500K	CURVE	WIDE	20336	131.3	155
			NARROW	20133	131.3	153
		FLAT	WIDE	19726	131.3	150
			NO LENS	21760	131.3	166
	4000K	CURVE	WIDE	20680	131.3	158
			NARROW	20473	131.3	156
		FLAT	WIDE	20060	131.3	153
			NO LENS	22128	131.3	169



currentlighting.com/columbialighting

© 2025 HU Solutions, Inc. All rights reserved. Information and specifications subject to change without notice. All values are design or typical values when measured under laboratory conditions.



**Columbia**  
LIGHTING

**MPS**  
MULTIPURPOSE LINEAR

DATE:

LOCATION:

TYPE:

PROJECT:

CATALOG #:

**AMBIENT TEMPERATURE RATINGS**

TEMPERATURE TABLE (C°) — 2', 4' & 8'						
80 CRI, Ceiling/Surface Mount						
Size	Lumen Package		Without Battery		With ELL14	With ELL14ST
			ED/ED1/EDD	ED347	ED/ED1/EDD	ED/ED1/EDD
2'	VW	1600	35	35	--	--
	MW	2200	35	35	--	--
	LW	2400	35	35	--	--
	ML	3400	35	35	--	--
	HL	3700	35	35	--	--
	VL	4400	35	35	--	--
	XL	5400	35	35	--	--
	UL	6200	35	35	--	--
4'	XW	2600	50	50	35	50
	VW	3300	50	50	35	50
	MW	3600	50	50	35	50
	LW	4000	50	50	35	50
	ML	4500	50	50	35	50
	HL	5800	45	45	35	40
	VL	6800	45	45	35	40
	XL	7800	45	45	35	40
8'	UL	10000	45	45	35	40
	XW	5200	50	50	35	50
	VW	6600	50	50	35	50
	MW	7200	50	50	35	50
	LW	7900	50	50	35	50
	ML	8900	50	50	35	50
	HL	11500	45	45	35	40
	VL	13500	45	45	35	40
	XL	15500	45	45	35	40
	UL	20000	45	45	35	40

Minimum ambient temperature is -30°C without battery and 0°C with battery

**PROJECTED LUMEN MAINTENANCE**

Calculation Method	Ambient Temp	25,000 hrs	50,000 hrs	60,000 hrs *
TM-21-11	25C/77F	0.93	0.86	0.84
TM-21-22	25C/77F	0.93	0.86	0.84

\* Lumen maintenance values calculated per TM-21 using six times the LM-80 test time for the LED and in-situ thermal testing of the luminaire.

Columbia  
LIGHTING

**MPS**  
MULTIPURPOSE LINEAR

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

### SPECTRASYNCTM COLOR TUNING TECHNOLOGY

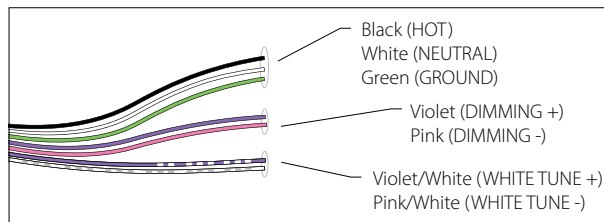
Control your space based on the needs of the application, specific activities throughout the day and preferences of the occupants with distinct SpectraSync™ Color Tuning Technologies.



SPECTRASYNCTM COLOR TUNING TECHNOLOGY		
Mode	Kelvin Range	Description
Tunable White	2700K–6500K	Offers users the ability to tailor CCT to their personal preference, enhancing task visibility, material and colors or the aesthetics of the space

#### SpectraSync Tunable White

Requires two 0–10V controllers, one for intensity and one for CCT.  
Minimum 5% dimming.

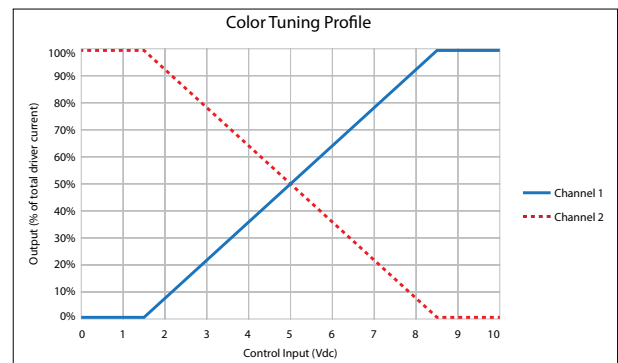


SpectraSync Tunable White luminaires are provided with two 0–10V circuits. The violet and pink circuit is for wiring to any qualified 0–10V controller for dimming. The violet/white and grey/white circuit is for wiring to any qualified 0–10V controller for Tunable White CCT control.

#### Controller Manufacturer Data

SpectraSync Tunable White was designed to be used with sinking style dimmers (provided by others) and is compatible with:

- NX Lighting Controls Room Controller (NXRC) and In-fixture Controllers (NXFM)
- Lutron: DDTV, DVSTV, and NDTV dimmers
- Wattstopper: ADF120277 and CD4BL (Titan) dimmers



To enable scheduling and for use with NX wall control preset stations please refer to NX SpectraSync technical sheet.

### SPECTRASYNCTM AND NX AVAILABILITY TABLE



		Only With 80 CRI			Only With 80 CRI		
		No Battery Pack			With Battery Pack		
Size	Lumen package	CTC	NX	CTC+NX	CTC	NX	CTC+NX
2ft	VW	Y	Y	N	—	—	—
	MW	Y	Y	N	—	—	—
	LW	Y	Y	N	—	—	—
	ML	N	Y	N	—	—	—
	HL, VL, XL, UL	N	Y	N	—	—	—
4ft	XW	Y	Y	Y	Y	Y	Y
	VW	Y	Y	Y	Y	Y	Y
	MW	Y	Y	Y	Y	Y	Y
	LW	Y	Y	Y	Y	Y	Y
	ML	Y	Y	Y	Y	Y	Y
	HL	Y	Y	Y	Y	Y	Y
	VL	N	Y	N	N	Y	N
	XL, UL	N	Y	N	N	Y	N
	XW	Y	Y	Y	Y	Y	Y
8ft	VW	Y	Y	Y	Y	Y	Y
	MW	N	Y	N	N	Y	N
	LW	N	Y	N	N	Y	N
	ML	N	Y	N	N	Y	N
	HL	N	Y	N	N	Y	N
	VL	N	Y	N	N	Y	N
	XL, UL	N	Y	N	N	Y	N
	XW	Y	Y	Y	Y	Y	Y
	VW	Y	Y	Y	Y	Y	Y

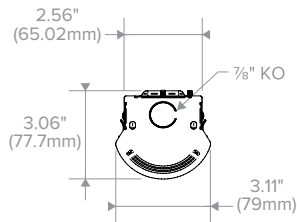
**Columbia**  
LIGHTING

**MPS**  
MULTIPURPOSE LINEAR

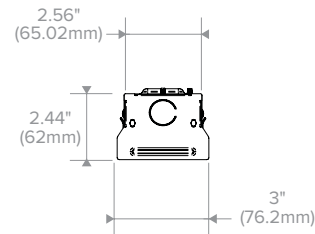
DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
 TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
 CATALOG #: \_\_\_\_\_

### DIMENSIONS

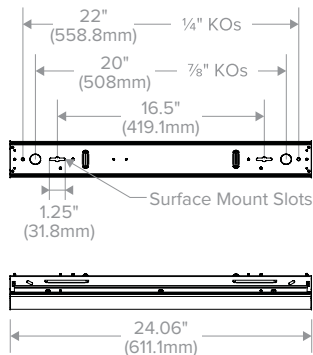
#### MPS END View - Curve Lens



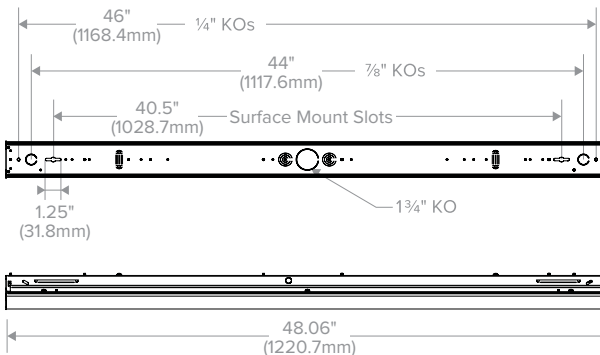
#### MPS END View - FLAT Lens



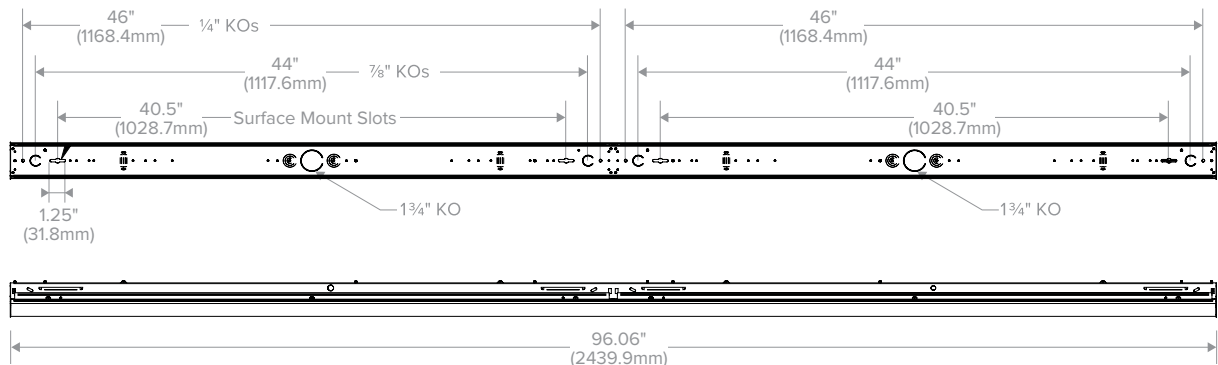
#### MPS 2' Dimensions



#### MPS 4' Dimensions



#### MPS 8' Dimensions



Columbia  
LIGHTING

MPS  
MULTIPURPOSE LINEAR

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

PHOTOMETRY

MPS4-40ML-CW-EDU

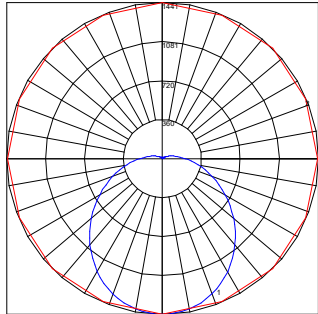
LUMINAIRE DATA

Test No.	23.0113
Description	4' Multi-Purpose Strip-Light w/ Diffuse, Curved Acrylic Lens
Delivered Lumens	5025
Watts	31.2
Efficacy	161
Mounting	Surface
Spacing Criterion	0° = 1.20 90° = 1.32

ZONAL LUMEN SUMMARY

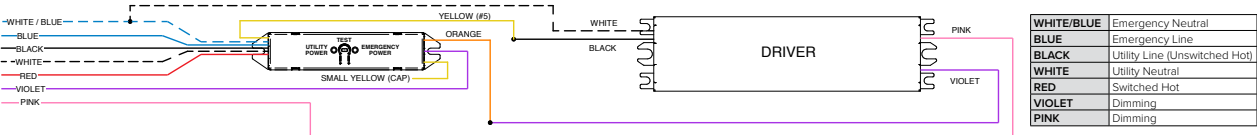
Zone	Lumens	% Luminaire
0-30	1145.29	22.8
0-40	1872.04	37.3
0-60	3334.68	66.4
0-90	4648.46	92.5
0-180	5024.73	100.0

POLAR GRAPH



Maximum Candela = 1440.943 Located At Horizontal Angle = 45, Vertical Angle = 2.5  
# 1 - Vertical Plane Through Horizontal Angles (45 - 225) (Through Max. Cd.)  
# 2 - Horizontal Cone Through Vertical Angle (2.5) (Through Max. Cd.)

DTS WIRING DIAGRAM (0-10V DIMMING DRIVER SHOWN)





**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**TRP1-24L-25-4K7-4W-120-DBT-PCU-E**

**TYPE: WPE**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

TRP1-24L-25-4K7-4W-120-DBT-PCU-  
E

Notes:

**Type:****WPE**

FRM-GREENVILLE25-161113

**GEOPAK SERIES 1**

SIZE 1 - TRP1/QSP1/RD1

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

CATALOG #: \_\_\_\_\_

**FEATURES**

- GeoPak Series consists of three compact Geometric wall-pack shapes in four popular finishes
- 24 mid-power LEDs create 3115 lumens in AC and 1628 lumens in emergency mode
- Environmentally friendly, long-life Lithium Iron Phosphate battery
- Standard Battery Temperature Range: 0°C to 40°C, Optional Heater: -30°C to 40°C
- Zero uplight distributions

**SPECIFICATIONS****CONSTRUCTION**

- Housing is made from die-cast aluminum with a hinged back-plate for ease of installation and maintenance
- Powder paint finish provides durability in outdoor environments. Tested to meet 1000 hour salt spray rating.
- Wet Location Listed to UL924 and UL1598 Standard

**OPTICS**

- 24 mid power LEDs delivering up to 3,000 lumens
- Up to 118 lumens per watt
- Type III and IV distributions for a wide variety of applications
- Zero uplight (UO), dark sky, neighbor friendly

**INSTALLATION**

- Universal plate for mounting to standard 3 1/2" and 4" square electrical boxes. All connections are made from connections at the rear of the unit
- Optional back-box accessory available for surface conduit application.

**ELECTRICAL**

- 120-277 and 347-480V operation, 50/60Hz
- 0-10V dimming driver standard. Dimming leads are extended from the product.
- 10kA surge protector
- Photocell and occupancy sensor options available for complete on/off and dimming control
- Intergral Battery Backup provides emergency lighting for the required 90 minute path of egress
- Includes a long-life Lithium Iron Phosphate battery with optional battery heater for cold temperature application
- Ambient operating temperature -40°C to 40°C
- Button photocontrol is suitable for 120-277V operation
- Please consult brand or sales representative when combining control and electrical options as some combinations may not operate as anticipated depending on your application.

**CERTIFICATIONS**

- Drivers IP66 and RoHS compliant
- Listed to UL1598 and CSAC22.2#250.0-24 for wet location

**WARRANTY**

- 5 year warranty

**KEY DATA**

KEY DATA	
Lumen Range	1720-2896
Wattage Range	15-25
Efficacy Range (LPW)	107-131
Weights lbs. (kg)	10.5–11.5 (4.8–5.2)



# GEOPAK SERIES 1

SIZE 1 - TRP1/QSP1/RD11

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

CATALOG #: \_\_\_\_\_

## ORDERING GUIDE

Example: TRP1-24L-25-4K7-3-UNV-DBT

CATALOG # \_\_\_\_\_

## ORDERING INFORMATION

Series	# LEDs	Wattage	CCT/CRI	Distribution	Voltage
TRP1 Trapezoid	24L 24 LEDs	15 15 watts	3K7 3000K, 70 CRI	3 TYPE III	UNV 120-277V
RD11 Radius		20 20 watts	4K7 4000K, 70 CRI	4W TYPE IV	120 120V
QSP1 Qtr-sphere		25 25 watts	5K7 5000K, 70 CRI	T2 TYPE II	208 208V
			3K8 3000K, 80 CRI	T4F TYPE IV FORWARD	240 240V
			4K8 4000K, 80 CRI		277 277V
			5K8 5000K, 80 CRI		347 347V
					480 480V

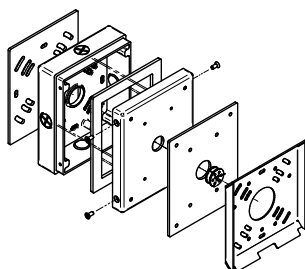
Color	Control Options Network	Options
BLT Black Matte Textured	PC Button Photocontrol	F <sup>4</sup> Fusing (only available with STD fixture configuration, 120-277V only)
BLS Black Gloss Smooth	SCP <sup>2,3</sup> Programmable occupancy sensor, factory default is 10% light output	E <sup>1,5</sup> Battery pack (0°C)
DBT Dark Bronze Matte Textured	Spec SCP/SCO & SWPM Mount Height	EH <sup>1,5</sup> Battery pack (-30°C) with heater
DBS Dark Brone Gloss Smooth	-8F Up to 8ft mount height	
GTT Graphite Matte Textured	-20F Up to 20ft mount height	
LGS Light Grey Gloss Smooth		
PSS Platinum Silver Smooth		
WHT White Matte Textured		
WHS White Gloss Smooth		
VGT Verde Green Textured		
Color Option		
CC Custom Color		

- Notes:
- 1 Voltage specific (120 or 277V only)
  - 2 Must order minimum of one remote control to program dimming settings, 0-10V fully adjustable dimming with automatic daylight calibration and different time delay settings, 120-277V only
  - 3 PCU option not applicable, included in sensor
  - 4 Must specify input voltage (120, 208, 240 or 277)
  - 5 PCU and EH cannot be combined in the QSP1 because of space constraints

## ACCESSORIES (ORDERED SEPARATELY)

Catalog Number	Description
<input type="checkbox"/> SCP-REMOTE*	Remote control for SCP option. Order at least one per
<input type="checkbox"/> WP-BB-XXX	Accessory for conduit entry, replace "xxx" with color option

- Notes:
- \* Must order minimum of one remote control to program dimming settings, 0-10V fully adjustable dimming with automatic daylight calibration and different time delay settings.
- WB-BB Wallpack Back Box





# GEOPAK SERIES 1

SIZE 1 - TRP1/QSP1/RD11

DATE: LOCATION:

TYPE: PROJECT:

CATALOG #:

## PERFORMANCE DATA

Description	Nominal Wattage	System Watts	Dist. Type	5K (5000K NOMINAL 70 CRI)					4K (4000K NOMINAL 70 CRI)					3K (3000K NOMINAL 80 CRI)				
				Lumens	LPW	B	U	G	Lumens	LPW	B	U	G	Lumens	LPW	B	U	G
24L	15	14.9	2	1806	121	1	0	0	1798	121	1	0	0	1728	116	0	0	0
			3	1888	127	0	0	1	1879	126	0	0	1	1807	121	0	0	1
			4F	1782	120	0	0	1	1774	119	0	0	1	1706	114	0	0	1
			4W	1797	121	0	0	1	1789	120	0	0	1	1720	115	0	0	1
	20	20.6	2	2493	121	1	0	1	2481	120	1	0	1	2386	116	1	0	1
			3	2607	131	1	0	1	2594	130	1	0	1	2495	125	1	0	1
			4F	2460	119	1	0	1	2448	119	1	0	1	2354	114	1	0	1
			4W	2481	125	1	0	1	2469	124	1	0	1	2374	119	1	0	1
	25	25.3	2	2770	114	1	0	1	2757	113	1	0	1	2651	109	1	0	1
			3	2896	113	1	0	1	2884	112	1	0	1	2773	110	1	0	1
			4F	2734	112	1	0	1	2720	111	1	0	1	2616	107	1	0	1
			4W	2756	107	1	0	1	2754	107	1	0	1	2640	108	1	0	1

## ELECTRICAL DATA

### INPUT POWER CONSUMPTION

System Watts	Input Voltage (V)	System Power (W)	Current (Amps)
15W	120	14.9	0.125
	277		0.053
	347		0.043
	480		0.031
20W	120	20.6	0.172
	277		0.074
	347		0.059
	480		0.043
25W	120	25.3	0.216
	277		0.091
	347		0.073
	480		0.053

Battery backup units consume additional power during charging (maximum 32.2 watts for E, 50.7 watts for EH)

### LUMINAIRE AMBIENT TEMPERATURE FACTOR (LATF)

Ambient Temperature		Lumen Multiplier
0C	32F	1.03
10C	50F	1.01
20C	68F	1
25C	77F	1
30C	86F	0.99
40C	104F	0.98

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

### INPUT POWER CONSUMPTION

Ambient Temperature	OPERATING HOURS					
	0	25,000	50,000	TM-21-11* L96 60,000	100,000	L70 (Hours)
25C	1	0.97	0.95	0.94	0.91	4,25,000
40C	0.99	0.96	0.94	0.93	0.9	3,70,000





# GEOPAK SERIES 1

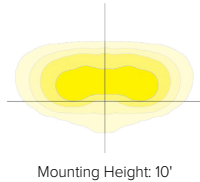
SIZE 1 - TRP1/QSP1/RD1

DATE:	LOCATION:
TYPE:	PROJECT:
CATALOG #:	

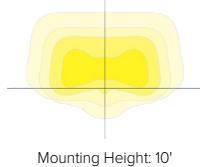
## PHOTOMETRY

The following diagrams represent the general distribution options offered for this product.

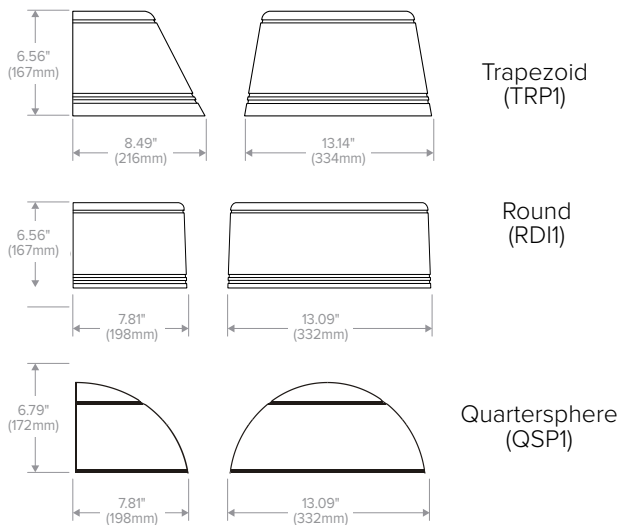
Type III



Type IV (Forward throw)



## DIMENSIONS





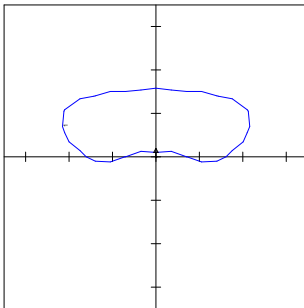
## GEOPAK SERIES 1

SIZE 1 - TRP1/QSP1/RD11

### ADDITIONAL INFORMATION

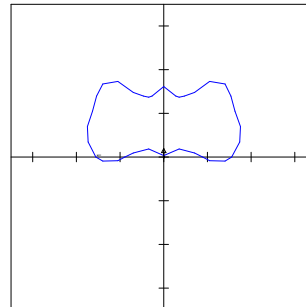
#### GEOPAK - BATTERY BACK UP

Type 3 Emergency Mode



13W battery when powered covers 20' throw to either side of fixture and 15' throw forward at a 10' mounting height.

Type 4 Emergency Mode



13W battery when powered covers 18' throw to either side of fixture and 15' throw forward at a 10' mounting height.

Provides Life Safety Code average illuminance of 1.0 fc. Assumes open space with no obstructions.  
Diagrams for illustration purposes only, please consult factory for application layout.



**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**EVCURWD4I**

**TYPE: XC**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

EVCURWD4I

Notes:

**Type:****XC**

FRM-GREENVILLE25-161113

**EVC Series**

LED EMERGENCY LIGHT/EXIT SIGN

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
CATALOG #: \_\_\_\_\_

**FEATURES**

- Architectural LED based exit and emergency light for wall, ceiling or end mounting commercial applications
- High impact, flame rated and UV stable white thermoplastic housing
- SW- Available with Special Wording
- 2C- 2 circuit operation
- FAP- Fire Alarm Panel
- FM- Flasher Module
- AF- Audible Flasher
- DC- Remote DC Operation
- 24K- 220-240VAC Input
- EV Unit Indoor Emergency Light

**EV<sup>LED</sup>**  
FAMILY

**SPECIFICATIONS****APPLICATION**

- The EVC Series is a compact architectural LED combination exit and emergency light designed for fast installation and reliable service.

**CONSTRUCTION**

- The EVC Series housing and canopy are made from durable injection molded ABS thermoplastic. Lamp-head front halves are made of die-cast aluminum for thermal dissipation
- The back half of the lamp-heads are made of ABS thermo-plastic.
- LED lens are made of acrylic
- The EVC Series has a flame-rated, UV stable thermoplastic housing with a lightly textured white or black finish. Integral LED based lamp-heads are fully adjustable

**ELECTRICAL**

- Unit provides a full 90 minutes of exit and emergency lighting
- Includes micro-controller based 3 stage constant current/constant voltage charger, and a long-life lithium iron phosphate(LiFePO<sub>4</sub>) battery
- The EVC accepts 120/277VAC input at 50 or 60Hz and optional 220-240VAC input at 50 or 60 Hz with self-diagnostics option

**INSTALLATION**

- EVC Series can be wall mounted by use of back-plate with molded-in template, or ceiling and end mounted with the use of supplied canopy to standard 3-½" or 4" square or octagonal electrical boxes
- Conduit entry through a molded-in entry point at the top center
- Pre-stripped AC input leads provided.

**ILLUMINATION**

- The EVC Series provides bright and uniform illumination and increased coverage by using 2 high power LED's which are mounted in a specially designed heat dissipating lamp-head
- Exit cavity illumination by red or green LED's with 10 year lifecycle. Each lamp-head is fully adjustable to the front or rear and side to side by use of a dual axis ratcheting design. Photometrics are available for download on the Dual-Lite website..

**COMPLIANCES**

- Listed to UL924 Standard, NFPA 101, NFPA 70
- Damp Location Listed Optional
- CEC T20 Compliant

**WARRANTY**

- Fixture: 3 years full, 5 years Full with Spectron®
- Battery: 3 years full, 7 years pro-rata
- LED Lifetime Warranty on Emergency Unit

KEY DATA	
Lamp Color	Cool White
Total Lamp Output	88 Lumens per LED
System Efficacy	80lm/W
Rated Lifecycle	> 100,000hrs or 10 years
Input Current Range	
Standard:	120/277VAC, 50 or 60 Hz
Self Diagnostics Option:	220-240VAC, 50 or 60 Hz



## EVC Series

LED EMERGENCY LIGHT/EXIT SIGN

DATE:LOCATION:

TYPE:PROJECT:

CATALOG #:

### ORDERING GUIDE

Example: EVCURWD4-0

CATALOG #

EVC		U									
Model	Faces	Letter Color	Finish	Application		Self-Diagnostic					
EVC	Combination LED Emergency Light/ Exit Sign	U	Universal Face	R	Red	W	White	Blank	Standard Mode	Blank	None
				G	Green	B	Black <sup>1</sup>	D4	2 LED Remote Capacity	I	Self-Diagnostics Spectron® Self Diagnostics <sup>5</sup>
						D	Damp Listed <sup>2</sup>				

O

No Lamp-Heads<sup>3</sup>

FAP

Fire Alarm Panel<sup>15</sup>

FM

Flasher Module<sup>15</sup>

AF

Audible Flasher<sup>15</sup>

24K

220 - 240 VAC  
50, 60 Hz with Spectron®<sup>4</sup>

#### Notes:

- Can only be specified with Spectron® Self-Diagnostics and remote capacity
- Damp Location not available with EVCURW and EVCUGW base models, standard with all other models
- No-head option only available on the EVC with remote capacity
- 24K option only available with Spectron® Self-Diagnostic and remote capacity
- AF, FM and FAP options may not be specified together
- Spectron® Self-Diagnostics only available with damp option
- Black finish only available with damp option

NOTE: Remote Capacity Option will only power the EVR2 and EVO remotes

Note: Remote Capacity models have a minimum run-time of 120 minutes when no remotes are installed

#### Accessories

☐ EV Unit 2 LED Indoor Emergency Light



☐ EVR2 Indoor Remote



☐ EVR2B 2 LED Remote with Black Finish



☐ EVO Outdoor Remote



☐ VRS3 Vandal Resistant Shield



☐ WGLXC Wire Guard (Ceiling Mount)



☐ WGLXE Wire Guard (End Mount)



Reference "Remote Heads and Fixtures" specification sheet for information on matching LED remote heads

### ELECTRONICS

Upon failure of normal utility power, a solid-state transfer switch automatically activates the emergency LED lamp-heads and exit LED's. Upon resumption of normal utility power, the battery is disconnected from the load and recharged through a micro-controller based 3 stage constant current/constant voltage charger. The battery is a maintenance-free Lithium Iron Phosphate (LiFePO4) type which operates at 6.4 VDC. The EVC series accepts dual-voltage input of 120 or 277VAC at 50 or 60 Hz, or an optional 220-240VAC input at 50 or 60 Hz. A low voltage battery disconnect (LVD) feature protects the battery from severe damage during prolonged power failures. Manual testing is available at any time using the push-to-test button. Number of Lamps- 2 High Power LEDs at 1 watt each configured so that if 1 lamp malfunctions, the remaining lamp will continue to provide illumination.

### STANDARD FEATURES INCLUDE

- External push-to-test switch and AC-on indicator
- Battery re-charge within 24 hours
- AC Lock-out circuit
- Low voltage battery disconnect
- Conduit entry located at the top center
- Microprocessor controlled pulse charger

### OPTIONAL SPECTRON FEATURE

- Self-diagnostics monitors LED status, LED load transfer circuit, battery capacity and charger function and displays any fault detection by means of a flashing code
- Self-Test feature automatically runs a 1 minute test once a month and an alternating 30 or 60 minute test once every 6 months. Multi-color LED indicator provides visible fault detection and charging status.
- User initiated 1 or 90-minute system test feature
- 15 minute re-transfer delay
- Automatic unit transfer in brown-out conditions (below 80% of nominal AC input voltage)

### OPERATING TEMPERATURE RANGE

- Standard: 68°F to 86°F (20° to 30°C)
- Damp Listed: 50°F to 104°F (10° to 40°C)

### WEIGHT

2.0 lbs

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

EVCURWD4I

Notes:

**Type:****XC**

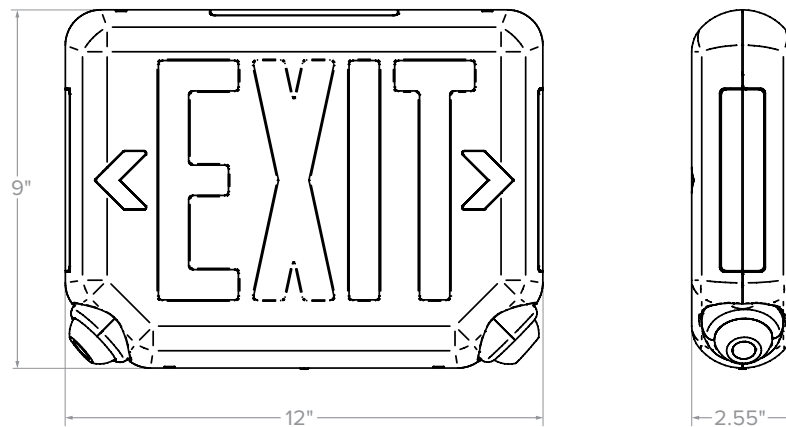
FRM-GREENVILLE25-161113

**EVC Series**

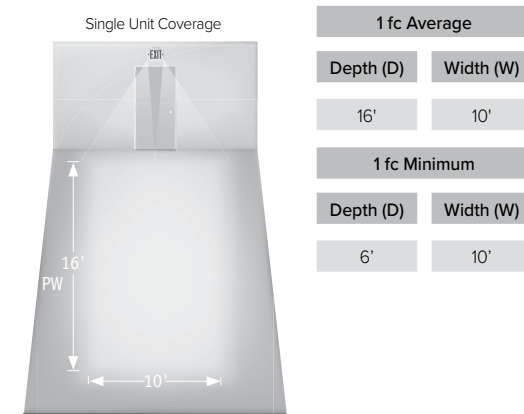
LED EMERGENCY LIGHT/EXIT SIGN

**MAXIMUM POWER CONSUMPTION**

	AC Voltage	Hz.	Amps.	Watts	Power Factor
EVC	120	60	0.021	1.65	0.65
	277	60	0.017	2.42	0.52

**DIMENSIONS**

Overall height with Canopy is 9.8"

**APPLICATION INFORMATION**

Meets Life Safety Code minimum illuminance of 0.1 fc and average illuminance of 1.0 fc. Assumes open space with no obstructions, mounting height of 7.5', ceiling height of 9' and reflectances of 80/50/20. Photometry files available on the Dual-Lite web site ([www.dual-lite.com](http://www.dual-lite.com)).



**Date: May 30, 2025**

Job Name: HISTORIC LITTLE MOUNTAIN NEWBERRY COUNTY REUNION PARK  
IMPROVEMENTS

**EVODB**

**TYPE: XR**

Bid Date: Jun 11, 2025

Submittal Date: May 30, 2025

**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

EVODB

Notes:

**Type:**

XR

FRM-GREENVILLE25-161113

**EVO Series**

OUTDOOR LED REMOTE

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_  
TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_  
CATALOG #: \_\_\_\_\_

**FEATURES**

- High Performance LED
- Architectural remote for the Evolution family
- Durable die-cast construction
- Fully gasketed, waterproof construction
- Single or double lamp-heads
- Corrosion resistant black or white finish

**EV<sup>o</sup>LED**  
FAMILY

**SPECIFICATIONS****APPLICATION**

- The EVO outdoor LED remote is a single or double head LED based remote which accepts DC input from an EV emergency light with remote capacity (EV4 model)
- The EVO is best utilized as an over the door path of egress light for emergency operation
- The EVO uses a single 3 watt rated LED per lamp-head and can be located up to 50' from the external power source
- Available in white or black corrosion resistant finish
- Lamp housing and mounting plate are made of durable die-cast aluminum

**INPUT POWER REQUIREMENTS**

- **THE EVO REMOTE CAN ONLY ACCEPT INPUT POWER FROM THE EV4D, EV4DI EMERGENCY LIGHT OR EVC-D4 COMBO WITH REMOTE CAPACITY.**
- **THE EVO WILL NOT WORK WITH ANY OTHER EMERGENCY UNITS.**

- The EVO receives 4.8Vdc provided exclusively from the EV4D or EV4DI emergency light at 1W per head
- The EVO can also be powered at 2W per head from the EV4D-02L-0 or EV4DI-02L-0 no-head emergency light

**SPECIFIC LED INFORMATION**

- Lamp Color: Cool White
- Total Lamp Output:  
88 lumens per head at 1W  
145 lumens per head at 2W
- System Efficacy: 80 Lumens per LED
- Rated LED Lamplife: Greater than 100,000 hrs.
- **Note:** When the EVO is driven from the EV4D-02L-0 (no-head option), the lamp wattage is 2 watts per head, and lumen output is 145 lumens per head.

**WARRANTY**

- LED Lifetime Warranty
- Full 3 year warranty

**KEY DATA**

Lamp Color	Cool White, 5000K
Total Lamp Output	88 lumens per head at 1W
	145 lumens per head at 2W
System Efficacy (LPW)	80
Rated LED Lifecycle (Hours)	> 100,000



**Job Name:**

HISTORIC LITTLE MOUNTAIN NEWBERRY  
COUNTY REUNION PARK IMPROVEMENTS  
Engineer: DEVITA & ASSOCIATES, INC.  
(GREENVILLE)

**Catalog Number:**

EVODB

Notes:

**Type:****XR**

FRM-GREENVILLE25-161113

**EVO Series**

OUTDOOR LED REMOTE

DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

TYPE: \_\_\_\_\_ PROJECT: \_\_\_\_\_

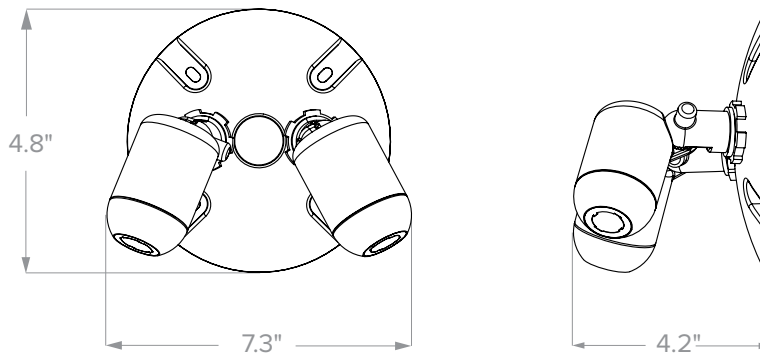
CATALOG #: \_\_\_\_\_

**ORDERING GUIDE**

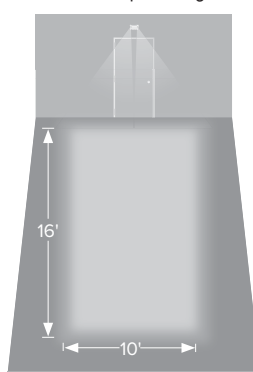
Example: EVODB

CATALOG #

EVO		
Model	Heads	Finish
<b>EVO</b> EV Series Outdoor Remote	<b>S</b> Single	<b>Blank</b> White
	<b>D</b> Double	<b>B</b> Black

**ADDITIONAL ORDERING INFORMATION****DIMENSIONS****APPLICATION INFORMATION**

Double Lamp Coverage



1 fc Average	
Depth (D)	Width (W)
16'	10'

1 fc Minimum	
Depth (D)	Width (W)
6'	10'

Meets Life Safety Code minimum illuminance of 0.1 fc and average illuminance of 1.0 fc.  
Assumes open space with no obstructions, mounting height of 7.5', ceiling height of 9'  
and reflectances of 80/50/20.  
Photometry files available on the Dual-Lite web site.

# PRIOR APPROVALS

May 23 2025

**Project Number:** PJ00122179

LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS



**- Prepared By -**

DEBBIE PARHAM - SESCO - South Carolina

864-675-9250

[dparham@sescolighting.com](mailto:dparham@sescolighting.com)

39 Pelham Davis Circle

Greenville, SC 29615, USA



## PRIOR APPROVALS

### LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS

Project Number PJ00122179

## Table of Contents

### Datasheets

New Section			
Type	Manufacturer	Model Number	Pg.
SC	ELITE LIGHTING	<a href="#">OVR-103-LED-4000/6000/8000L-DIM10-MVOLT-30K/40K/50K-STD FINISH-PC-MS</a>	2
SP/SPE	ELITE LIGHTING	<a href="#">4-OWVS1-LED-4000L/5000L/6000L-DIM10-MVOLT-35K/40K/50K-85-TPS (SPE WITH O-EMG-LED-10W)</a>	4
ST4	ELITE LIGHTING	<a href="#">4-OEC4-LED-3000L/4000L/5000L-DIM10-MVOLT-35K/40K/50K-85</a>	8



# **PRIOR APPROVALS**

## **LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS**

Project Number PJ00122179

**Datasheets**

**New Section**



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS

**Manufacturer :** ELITE LIGHTING

**Model Number :** OVR-103-LED-4000/6000/8000L-DIM10-MVOLT-30K/40K/50K-STD  
FINISH-PC-MS

**Type :**  
**SC**

# OVR-103-LED

LED Small Square Canopy CCT/Lumen  
select LED Series

<b>Catalog Number:</b>	
<b>Project Name:</b>	
<b>Note:</b>	<b>Type:</b>



## APPLICATIONS:

The Oracle LED Canopy Light is designed to provide an aesthetically pleasing low-profile luminaire that produces a high light output while keeping energy and maintenance costs low. Easily access field-adjustable 3-Color SeleCCT from 3000K - 4000K - 5000K, ideal for parking garages, walkways, storage areas, underpasses, and stairwells.

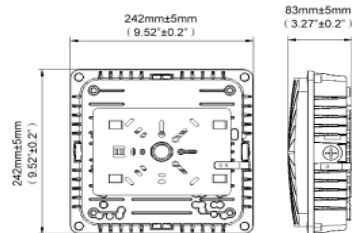
## FEATURES:

- Sealed die-casting profile for outdoor applications.
- Input Voltage MVOLT
- Lumen output from 4000 - 8000Lm with efficacy up to 141 lm/W.
- Increase energy savings with optional bi-level motion sensor.
- Replacing 100W MH and 175 W MH saving over 75% energy consumption.
- Operating temperature is -40°C to 40°C (-40°F to 104°F).
- UL/cUL wet location.
- CCT Option Easily access field-adjustable 3-Color SeleCCT from 3000K-4000K-5000K or switch without lowering the luminaire from the ceiling.
- Surface mount with J-BOX; Pendant installation with 3/4 inch conduit.

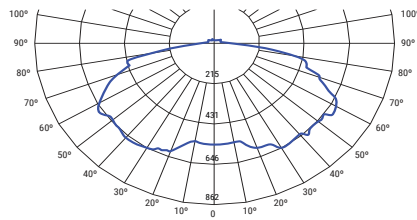
## SPECIFICATIONS:

<b>LUMENS</b>	4000 / 6000 / 8000 lumens
<b>WATTAGE</b>	28W / 40W / 60W
<b>CCT</b>	30K-40K-50K
<b>CRI</b>	80
<b>LIGHT EFFICIENCY</b>	130 lumens/watt
<b>VOLTAGE</b>	MVOLT
<b>POWER FREQUENCY</b>	50/60 Hz
<b>FINISH</b>	Bronze, White, Black
<b>APPLICABLE ENVIRONMENT</b>	Dry/Damp/Wet location
<b>WORKING TEMPERATURE</b>	-40°C to 40°C

## DIMENSION:



## PHOTOMETRICS:



B	U	G
1	3	2



0-10V DIMMING

\* For list of qualified DLC fixture, please consult factory

Ordering Guide Example: **OVR-103-LED-4000/6000/8000L-DIM10-MVOLT-30K/40K/50K**

OVR-103-LED							
SERIES	PERFORMANCE	DIMMING	VOLTAGE	CCT	FINISH	EMERGENCY	OPTION
OVR-103-LED	4000L/6000L/8000L	DIM10 - 0-10V Dimming	MVOLT	30K/40K/50K	BZ - Bronze WH - White BK - Black	10-EMG-LED	Blank Without function PC Photocell SPD 10KSPD MS Motion sensor

\*\* DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at [www.designlights.org](http://www.designlights.org) to confirm which versions are qualified.



Submittal form is available @ [www.oraclelighting.com](http://www.oraclelighting.com)  
Tel: 323-888-1973 • Fax: 323-888-1977

Specifications and Dimensions  
subject to change without notice.

Issued-B1118-Rev. 1



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
**Manufacturer :** ELITE LIGHTING  
**Model Number :** OVR-103-LED-4000/6000/8000L-DIM10-MVOLT-30K/40K/50K-STD  
FINISH-PC-MS






**Type :**  
**SC**

# OVR-103-LED

LED Small Square Canopy CCT/Lumen  
select LED Series

<b>Catalog Number:</b>	
<b>Project Name:</b>	
<b>Note:</b>	<b>Type:</b>

## ACCESSORY

MODEL	SPD	Photocell	Motion Sensor	Motion Sensor	EM Driver
IMAGE					

\*\* DesignLights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified.  
Please check the DLC Qualified Products List at [www.designlights.org](http://www.designlights.org) to confirm which versions are qualified.



Submittal form is available @ [www.oraclelighting.com](http://www.oraclelighting.com)  
Tel: 323-888-1973 • Fax: 323-888-1977

Specifications and Dimensions  
subject to change without notice.

Issued-B1118-Rev. 1



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
**Manufacturer :** ELITE LIGHTING  
**Model Number :** 4-OWVS1-LED-4000L/5000L/6000L-DIM10-MVOLT-35K/40K/50K-85-TPS  
(SPE WITH O-EMG-LED-10W)

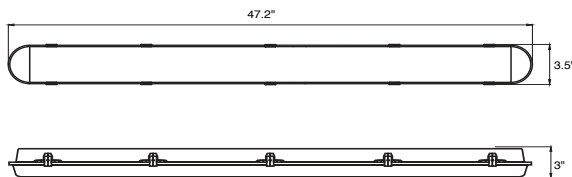
**Type :**  
**SP/SPE**



**OWVS1-LED** 4'  
Vapor Tight Luminaire



**EASY 3 COLORS  
SELECTOR**  
3500K • 4000K • 5000K



NOMINAL LUMENS	DELIVERED LUMENS	WATTAGE
4000L	4762	33
5000L	5293	36
6000L	6268	46

Based on 4000K, 85+ CRI. Actual wattage may vary +/- 5%

#### FEATURES

The OWVS LED Vapor Tight is a wet location luminaire designed to withstand exposure to harsh weather and areas where water might be a hazard. Qualifies as emergency lighting, which lights a safe path of egress for evacuation. Shallow, lightweight design permits quick, easy installation. A wide beam spread and excellent glare control make it perfect for a number of egress lighting applications. Complies with building and safety codes to safely light parking garages, schools, car washes, corridors, hallways, stairways, food processing, cold storage, and other industrial facilities.

LUMENS	4000L/5000L/6000L
CCT	35K/40K/50K
CRI	85+
COLOR QUALITY	3 Step MacAdam Ellipse
LENGTH	4' or 8'
MOUNTING	Surface
DIMMING & CONTROL	0-10V Flicker Free 10% Dimming Standard (DIM10)
OPERATING TEMPERATURE	-40°C to 50°C
EMERGENCY	10W - Up to 1000L output
LIFETIME	L70 at 100,000 Hours
PHOTOMETRIC TESTS	In Accordance with IES LM79-08, LM80 and TM-30, TM-21



[www.iuseelite.com](http://www.iuseelite.com)

Due to the changes of constant improvement in LED technology, all details are subject to change without notice. Consult factory for up to date information.



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
**Manufacturer :** ELITE LIGHTING  
**Model Number :** 4-OWVS1-LED-4000L/5000L/6000L-DIM10-MVOLT-35K/40K/50K-85-TPS  
(SPE WITH O-EMG-LED-10W)

**Type :**  
**SP/SPE**



**OWVS1-LED** 4'  
Vapor Tight Luminaire

#### MAINTENANCE

Two-piece, snap-together design for fast, easy installation. Simple two-piece design consists of housing and optical assembly to streamline installation process.

#### OPTICS

Polycarbonate lens.

#### MOUNTING

Suitable for suspension by V-hook or surface mounting. All required hardware is included (less chain, cable).

#### CONSTRUCTION

One-piece, durable fiberglass housing. Continuous one-piece gasket provides airtight seal, keeping out condensation, humidity, dirt, and dust. Stainless steel latches securely attach to the housing, keeping the housing and lens securely in place.

#### DRIVER ELECTRICAL INFORMATION

Powered by high-quality constant-current power LED drivers rated for 50 to 60Hz at 120/277V input. Available in 347V, produce less than 20% THD, and have a power factor of .90 to 1.00.

#### DIMMING & DRIVER INFORMATION

DIM10 - Flicker Free 10% Dimming Standard (DIM10) 0-10V dimming on either MVOLT 120, 277 or 347V.

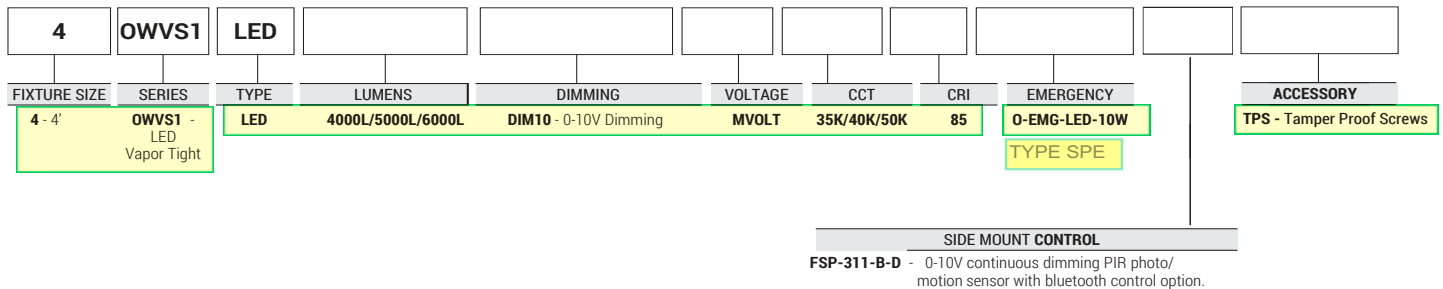
#### WARRANTY

Five-year warranty for parts and components. (Labor not included).

#### LISTINGS

UL/C-UL listed to US and Canadian standard  
IP65 Rated  
ANSI/UL 8750  
ANSI/UL 1598  
DLC listed

Example: **4-OWVS1-LED-4000L/5000L/6000L-DIM10-MVOLT-35K/40K/50K-85**



www.iuseelite.com

Due to the changes of constant improvement in LED technology, all details are subject to change without notice. Consult factory for up to date information.





Job Name : LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
Manufacturer : ELITE LIGHTING  
Model Number : 4-OWVS1-LED-4000L/5000L/6000L-DIM10-MVOLT-35K/40K/50K-85-TPS  
(SPE WITH O-EMG-LED-10W)

Type :  
**SP/SPE**

**ORACLE**  
LIGHTING  
By Elite Lighting

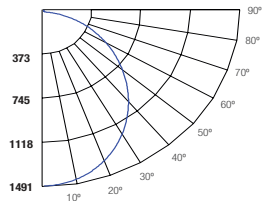
**OWVS1-LED**  
Vapor Tight Luminaire 4'

**4-OWVS1-LED-4000L-5000L-6000L-DIM10-MVOLT-35K-40K-50K-85(4000L)**

TEST NO.: **EL092920113**

INPUT WATTS: **33** LUMENS: 4762 CRI: **85** EFFICACY: **142** CCT: **3500K** SPACING CRITERIA: **1.36**

**Candle Power Distribution (Candelas)**



**Zonal Lumens Summary**

Zone	Lumens	%Lamp	%Fixt
0-20	538.29	11.3	11.3
0-30	1136.12	23.9	23.9
0-40	1850.01	38.8	38.8
0-60	3279.34	68.9	68.9
0-80	4247.42	89.2	89.2
0-90	4480.4	94.1	94.1

**Luminance (Average candela/M<sup>2</sup>)**

Angle in Degrees	Average 0°	Average 45°	Average 90°
45	25387	24360	23311
55	26070	24111	21874
65	27837	24686	20151
75	33032	27865	17814
85	65551	50266	13361

**Lumens Per Zone**

Zone	Lumens
0-10	139.9
10-20	398.39
20-30	597.83
30-40	713.89
40-50	740.44
50-60	688.88
60-70	566.35
70-80	401.74
80-90	232.97

**Candela Tabulation**

Q	
0	1481.981
5	1478.08
15	1415.56
25	1302.81
35	1159.73
45	1001.59
55	834.29
65	656.39
75	477
85	318.76
90	251.93

**Coefficients of Utilization - Zonal Cavity Method**

Effective Floor Cavity Reflectance 0.20

RC	80%				70%				50%				30%				10%				0%	
	RW	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	0%		
ROOM CAVITY RATIO	0	118	118	118	118	114	114	114	114	108	108	108	102	102	102	97	97	97	94			
	1	106	100	96	91	102	98	93	89	89	85	87	84	82	83	80	78	75	72			
	2	96	87	79	73	92	84	78	72	80	74	69	76	71	67	72	68	64	62			
	3	87	76	67	60	84	74	66	59	70	63	58	66	61	56	63	58	54	52			
	4	80	67	58	51	77	65	57	50	62	55	49	59	53	47	56	51	46	46			
	5	73	60	50	44	70	58	50	43	55	48	42	53	46	41	50	45	40	38			
	6	67	54	45	38	65	52	44	38	50	42	37	48	41	36	46	40	35	34			
	7	62	49	40	33	60	48	39	33	45	38	32	43	37	32	42	36	31	29			
	8	58	44	36	30	56	43	35	29	42	34	29	40	33	28	38	32	28	26			
	9	54	41	32	27	53	40	32	26	38	31	26	37	30	26	35	29	26	23			
	10	51	38	30	24	49	37	29	24	35	28	24	34	28	23	33	27	23	21			

RC - Ceiling Cavity Reflectance

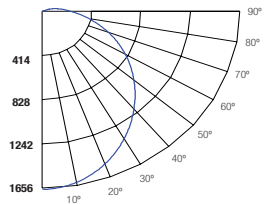
RW - Wall Reflectance

**4-OWVS1-LED-4000L-5000L-6000L-DIM10-MVOLT-35K-40K-50K-85(5000L)**

TEST NO.: **EL092920114**

INPUT WATTS: **35.8** LUMENS: 5293 CRI: **85** EFFICACY: **148** CCT: **3500K** SPACING CRITERIA: **1.36**

**Candle Power Distribution (Candelas)**



**Zonal Lumens Summary**

Zone	Lumens	%Lamp	%Fixt
0-20	600.8	11.3	11.4
0-30	1267.51	23.9	23.9
0-40	2061.99	39	39
0-60	3643.27	68.8	68.8
0-80	4715.13	89.1	89.1
0-90	4975.22	94	94

**Luminance (Average candela/M<sup>2</sup>)**

Angle in Degrees	Average 0°	Average 45°	Average 90°
45	28079	27006	26044
55	28666	26553	24462
65	30520	26958	22533
75	36098	29797	19935
85	70851	51977	15201

**Lumens Per Zone**

Zone	Lumens
0-10	156.19
10-20	444.61
20-30	666.71
30-40	794.49
40-50	820.64
50-60	760.64
60-70	626.4
70-80	445.46
80-90	260.09

**Candela Tabulation**

Q	
0	1653.99
5	1645.71
15	1575.69
25	1451.32
35	1289.94
45	1107.77
55	917.36
65	719.66
75	521.27
85	344.53
90	271.14

**Coefficients of Utilization - Zonal Cavity Method**

Effective Floor Cavity Reflectance 0.20

RC	80%				70%				50%				30%				10%				0%
	RW	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	30%	10%	50%	30%	10%	0%			
0	118	118	118	118	118	114	114	114	114	108	108	108	102	102	102	97	97	97	94		
1	106	100	96	91	93	102	98	93	89	89	85	87	84	82	83	80	78	75	72		
2	96	87	79	73	72	84	78	72	80	74	69	76	71	67	72	68	64	62	59		
3	87	76	67	60	84	74	66	59	70	63	58	66	61	56	63	58	54	51	48		
4	80	67	58	51	77	65	57	50	62	55	49	59	53	48	56	51	46	44	41		
5	73	60	51	44	70	58	50	43	55	48	42	53	46	41	50	45	40	38	35		
6	67	54	45	38	65	52	44	38	50	42	37	48	41	36	46	40	35	33	30		
7	62	49	40	33	60	48	39	33	45	38	32	44	37	32	42	36	31	29	26		
8	58	44	36	30	56	43	35	30	42	34	29	40	33	28	38	32	28	26	23		
9	54	41	32	27	53	40	32	27	38	31	26	37	30	26	35	29	25	23	20		
10	51	38	30	24	49	37	29	24	35	28	24	34	28	23	33	27	23	21	18		

RC - Ceiling Cavity Reflectance

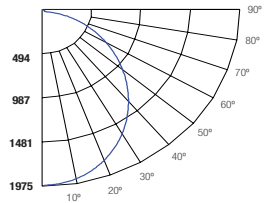
RW - Wall Reflectance

**4-OWVS1-LED-4000L-5000L-6000L-DIM10-MVOLT-35K-40K-50K-85(6000L)**

TEST NO.: **EL092920115**

INPUT WATTS: **45.8** LUMENS: 6268 CRI: **85** EFFICACY: **137** CCT: **3500K** SPACING CRITERIA: **1.36**

**Candle Power Distribution (Candelas)**



**Zonal Lumens Summary**

Zone	Lumens	%Lamp	%Fixt
0-20	709.63	11.3	11.3
0-30	1497.81	23.9	23.9
0-40	2438.94	38.9	38.9
0-60	4315.35	68.9	68.9
0-80	5589.6	89.2	89.2
0-90	5896.05	94.1	94.1

**Luminance (Average candela/M<sup>2</sup>)**

Angle in Degrees	Average 0°	Average 45°	Average 90°
45	33502	32111	30720
55	34391	31779	28838
65	36716	32557	26562
75	43610	36656	23464
85	85332	66304	17615

**Lumens Per Zone**

Zone	Lumens
0-10	184.44
10-20	525.19
20-30	788.18
30-40	941.13
40-50	974.79
50-60	901.63
60-70	745.75
70-80	528.5
80-90	306.45

**Candela Tabulation**

Q	
0	1953.643
5	1950.65
15	1868.46
25	1719.1
35	1530.95
45	1321.74
55	1100.59
65	865.75
75	629.75
85	414.95
90	332.04

**Coefficients of Utilization - Zonal Cavity Method**

Effective Floor Cavity Reflectance 0.20

RC	80%				70%				50%				30%				10%				0%
	RW	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	0%		
ROOM CAVITY RATIO	0	118	118	118	118	114	114	114	114	108	108	108	102	102	102	97	97	97	94		
	1	106	96	91	86	102	93	88	83	95	87	82	89	80	75	79	89	84	80		
	2	96	87	79	73	92	84	78	72	80	74	69	76	71	67	72	68	64	62		
	3	87	76	67	60	84	74	66	59	70	63	58	66	61	56	63	58	54	52		
	4	80	68	57	51	77	65	57	50	62	55	48	59	53	48	56	51	46	44		
	5	73	60	50	44	70	58	50	43	55	48	42	53	46	41	50	45	40	38		
	6	67	54	45	38	65	52	44	38	50	42	37	48	41	36	46	40	35	34		
	7	62	49	40	33	60	48	39	33	45	38	32	43	37	32	42	36	31	29		
	8	58	44	36	30	56	43	35	30	42	34	29	40	33	28	38	32	28	26		
	9	54	41	32	27	53	40	32	27	38	31	26	37	30	26	35	29	25	23		
	10	51	38	30	24	49	37	29	24	35	28	24	34	28	23	33	27	23	21		

RC - Ceiling Cavity Reflectance

RW - Wall Reflectance



www.iuseelite.com

Due to the changes of constant improvement in LED technology, all details are subject to change without notice. Consult factory for up to date information.



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS

**Manufacturer :** ELITE LIGHTING

**Model Number :** 4-OWVS1-LED-4000L/5000L/6000L-DIM10-MVOLT-35K/40K/50K-85-TPS  
(SPE WITH O-EMG-LED-10W)

**Type :**  
**SP/SPE**



**OWVS1-LED** 4'  
Vapor Tight Luminaire

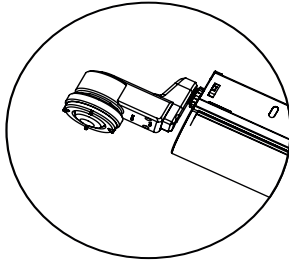
#### INTEGRATED SENSOR AND CONTROL OPTIONS

With the Integratedtion of controls, Elite Lighting now offers its products with controls-ready performance that increases energy efficiency, smarter space planning, and the enhancement of safety and productivity in the workplace. By utilizing these controls, Elite Lighting luminaires enable your customer's facility to run smarter, with the use of an easily controlled system through any platform.

Luminaire will be shipped with Powerpacks pre-installed, ready to be Integrated to designated contol systems  
Luminaire will be shipped with Sensors installed on the luminaire, allowing for individual luminaire control. Luminaires will be ready to be Integrated with designated control systems  
Luminaire will be shipped with Sensors to be remotely installed on the ceiling. Luminaires will be ready to be Integrated with designated control systems

BRAND	
PIR INTEGRATED SENSOR	FSP-311-B-D 0-10V continuous dimming PIR photo/motion sensor with bluetooth control option.

#### SIDE MOUNT



**LEGRAND**  
 FSP-311-B-D  
0-10V continuous dimming PIR photo/motion sensor with bluetooth control option.



[www.iuseelite.com](http://www.iuseelite.com)

Due to the changes of constant improvement in LED technology, all details are subject to change without notice. Consult factory for up to date information.



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
**Manufacturer :** ELITE LIGHTING  
**Model Number :** 4-OEC4-LED-3000L/4000L/5000L-DIM10-MVOLT-35K/40K/50K-85

**Type :**  
**ST4**



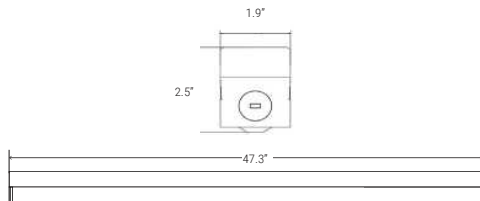
## OEC4-LED

### 4' LED Strip Light with Multi-Lumen and Multi-CCT



**EASY 3 COLORS  
SELECTOR**  
3500K • 4000K • 5000K

#### DIMENSIONS



NOMINAL LUMENS	DELIVERED LUMENS	WATTAGE
8000	8090	62W
7000	7180	54W
6000	6103	46W
5000	5323	43W
4000	4117	30W
3000	3526	25W

Based on 4000K, 85+ CRI. Actual wattage may vary +/- 5%

#### FEATURES

Like the original OEC LED strip light, this square lensed variant of the OEC is versatile, and available in single pendant or continuous mounting with a form factor that ensures continuous illumination. A square, thermally resistant acrylic lens delivers low-glare, even illumination for comfortable environments. Suitable for either suspended or surface mounting, it's slim profile makes the OEC ideal for illuminating a variety of narrow applications such as aisles, hallways, corridors, parking garages, as well as education, healthcare, and transportation applications.

LUMENS	3000L/4000L/5000L 6000L/7000L/8000L
CCT	35K/40K/50K
CRI	85+ Standard
COLOR QUALITY	3 Step MacAdam Ellipse
LENGTH	2', 4' or 8'
MOUNTING	Surface, Suspended
DIMMING	0-10V Flicker Free 10% Dimming Standard (DIM10)
EMERGENCY	10W - Up to 1000L output
OPERATING TEMPERATURE	-20 °C (-4 °F) to 50°C (122 °F)
LIFETIME	L70 at 100,000 Hours
PHOTOMETRIC TESTS	In accordance with IES LM79-08, LM80 and TM-30, TM-21



www.iuseelite.com

Due to the constant improvement in LED technology and methods, all details are subject to change without notice. Consult factory for up-to-date information.  
MM10824



**Job Name :** LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
**Manufacturer :** ELITE LIGHTING  
**Model Number :** 4-OEC4-LED-3000L/4000L/5000L-DIM10-MVOLT-35K/40K/50K-85

**Type :**  
**ST4**



By Elite Lighting

## OEC4-LED

### 4' LED Strip Light with Multi-Lumen and Multi-CCT

#### OPTICS

Features high-efficacy, micro-power LEDs with a lumen Maintenance of L70 > 100,000 hours.  
A thermally resistant acrylic lens is warp, expansion, and contraction resistant.

#### CONSTRUCTION

Housing constructed via sheet metal stamping. Conveniently placed multi-lumen and multi-CCT switches on side of fixture allow for in-field adjustments.

#### MOUNTING

Suitable for surface and suspended mounting. Continuous row mounting available. See order chart below.

#### OPTIONS & ACCESSORIES

Multiple wiring, wire guard, control, and emergency options available to order. See order chart below.

#### DIMMING & DRIVER INFORMATION

**DIM10** - Flicker Free 1% Dimming Standard (DIM10) 0-10V dimming on either MVOLT - 120, 277V. The dim voltage threshold of optional 12V AUX integrated driver ranges from 0.1V to 0.5V.

#### WARRANTY

5-year warranty for parts and components (labor not included).

#### LISTING

c-UL-us - Listed for Feed Through Wiring.  
c-UL-us - Listed for Damp Location.  
Listed for DLC, California Title 24 compliant.

Example: 4-OEC4-LED-3000L/4000L/5000L-DIM10-MVOLT-35K/40K/50K-85

4	OEC4-LED										
LENGTH	SERIES	LUMENS	DIMMING	VOLTAGE	CCT	CRI	EMERGENCY				
4 - 4'	OEC4-LED General Lighting	3000L/4000L/5000L 6000L/7000L/8000L	DIM10 - 0-10V Dimming	MVOLT	35K/40K/50K	85	0-EMG-LED-10W				
								<b>MOUNTING</b> CRM Continuous Row Mounting			
								<b>WIRING OPTIONS</b> FBF - Internal Fast Blow Fuse SBF - Internal Slow Blow Fuse RIS - Radio Interference Suppressor			
								<b>OTHER OPTIONS</b> OCGSS - Cable Gripper Suspension Kit GSSP - Cable Gripper Suspension with paddle OCGSS - V-Hook Suspension Kit WG - WireGuard USA - Made in America Compliance S05 - Power cord with 5 conductors for 0-10v dimming fixtures S06 - Power cord with 6 conductors for 0-10V dimming and with emergency			
								<b>SIDE MOUNT CONTROL</b> FSP-311-B-D - 0-10V continuous dimming PIR photo/ motion sensor with bluetooth control option.			



www.iuseelite.com

Due to the constant improvement in LED technology and methods, all details are subject to change without notice. Consult factory for up-to-date information.  
100824



Job Name : LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
Manufacturer : ELITE LIGHTING  
Model Number : 4-OEC4-LED-3000L/4000L/5000L-DIM10-MVOLT-35K/40K/50K-85

Type :  
**ST4**



## OEC4-LED

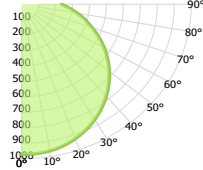
4' LED Strip Light with Multi-Lumen and Multi-CCT

### 4-OEC4-LED-3000L-4000L-5000L-DIM10-MVOLT-35K-40K-50K-85(3000L)

TEST NO.: **EL02132331**

INPUT WATTS: **25.5** LUMENS: **3526** EFFICACY: **138** BEAM ANGLE: **128** SPACING CRITERIA: **1.31**

#### CANDELA DISTRIBUTION



#### CANDELA TABLE

	0°	90°
0°	971	973
10°	962	949
20°	925	893
30°	861	809
40°	776	690
50°	674	552
60°	560	403
70°	442	245
80°	333	95
90°	236	3

#### LUMINANCE (cd/sq.m)

	0.00°	90.00°
0.00°	607	608
45.00°	642	551
55.00°	674	522
65.00°	741	480
75.00°	940	405
85.00°	2016	237

#### LUMENS PER ZONE

ZONE	LUMENS
0° - 10°	92
10° - 20°	264
20° - 30°	404
30° - 40°	493
40° - 50°	522
50° - 60°	491
60° - 70°	411
70° - 80°	296
80° - 90°	179

#### ZONAL LUMEN SUMMARY

ZONE	UMENS	% LUMINAIRE
0° - 20°	356	10%
0° - 30°	760	22%
0° - 40°	1253	36%
0° - 60°	2266	64%
0° - 80°	2972	84%
0° - 90°	3152	89%

#### CONE OF LIGHT

MOUNTING HEIGHT	FC AT BEAM CENTER	BEAM DIA. 0° -180°	BEAM DIA. 90° -270°
6.0 m	27.0 lx	24.8 m	17.2 m
8.0 m	15.2 lx	33.0 m	22.9 m
10.0 m	9.7 lx	41.3 m	28.7 m
12.0 m	6.7 lx	49.6 m	34.4 m
14.0 m	5.0 lx	57.8 m	40.1 m
16.0 m	3.8 lx	66.1 m	45.9 m
18.0 m	3.0 lx	74.3 m	51.6 m
20.0 m	2.4 lx	82.6 m	57.4 m

#### INDOOR COEFFICIENTS OF UTILIZATION

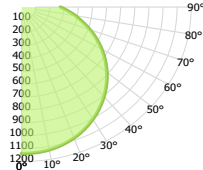
pf	80%			70%			20%			50%			30%			10%			0%
pc	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	0%
pw	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	0%
0	117	117	117	117	113	113	113	113	105	105	105	98	98	98	92	92	92	89	89
1	105	99	94	90	101	96	91	87	90	86	83	84	81	78	78	76	74	71	71
2	94	85	78	72	91	83	76	70	77	72	67	72	68	64	68	64	61	58	58
3	86	75	66	59	82	72	64	58	68	61	55	63	58	53	59	55	51	48	48
4	78	66	57	50	75	64	55	49	60	52	47	56	50	45	53	48	43	41	41
5	72	58	49	42	69	57	48	42	53	46	40	50	44	39	47	42	37	35	35
6	66	52	43	37	64	51	42	36	48	41	35	45	39	34	43	37	33	30	30
7	61	47	38	32	59	46	38	32	44	36	31	41	35	30	39	33	29	27	27
8	57	43	35	29	55	42	34	28	40	33	27	38	31	27	36	30	26	24	24
9	53	40	31	26	51	39	31	25	37	30	25	35	28	24	33	27	23	21	21
10	50	36	28	23	48	36	28	23	34	27	22	32	26	22	31	25	21	19	19

### 4-OEC4-LED-3000L-4000L-5000L-DIM10-MVOLT-35K-40K-50K-85(4000L)

TEST NO.: **EL02132331**

INPUT WATTS: **30.8** LUMENS: **4117** EFFICACY: **134** BEAM ANGLE: **128** SPACING CRITERIA: **1.31**

#### CANDELA DISTRIBUTION



#### CANDELA TABLE

	0°	90°
0°	1137	1136
10°	1126	1109
20°	1082	1037
30°	1007	929
40°	906	806
50°	787	646
60°	655	471
70°	515	287
80°	387	111
90°	274	3

#### LUMINANCE (cd/sq.m)

	0.00°	90.00°
0.00°	710	710
45.00°	750	643
55.00°	787	610
65.00°	865	562
75.00°	1078	474
85.00°	2344	281

#### LUMENS PER ZONE

ZONE	LUMENS
0° - 10°	108
10° - 20°	309
20° - 30°	470
30° - 40°	573
40° - 50°	610
50° - 60°	575
60° - 70°	480
70° - 80°	345
80° - 90°	210

#### ZONAL LUMEN SUMMARY

ZONE	UMENS	% LUMINAIRE
0° - 20°	417	10%
0° - 30°	887	22%
0° - 40°	1460	35%
0° - 60°	2645	64%
0° - 80°	3470	84%
0° - 90°	3680	89%

#### CONE OF LIGHT

MOUNTING HEIGHT	FC AT BEAM CENTER	BEAM DIA. 0° -180°	BEAM DIA. 90° -270°
6.0 m	31.6 lx	24.8 m	17.2 m
8.0 m	17.8 lx	33.1 m	22.9 m
10.0 m	11.4 lx	41.3 m	28.7 m
12.0 m	7.9 lx	49.6 m	34.4 m
14.0 m	5.8 lx	57.9 m	40.1 m
16.0 m	4.4 lx	66.2 m	45.9 m
18.0 m	3.5 lx	74.4 m	51.6 m
20.0 m	2.8 lx	82.7 m	57.4 m

#### INDOOR COEFFICIENTS OF UTILIZATION

pf	80%			70%			20%			50%			30%			10%			0%
pc	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	0%
pw	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	0%
0	117	117	117	117	113	113	113	113	105	105	105	98	98	98	92	92	92	89	89
1	105	99	94	90	101	96	91	87	89	86	83	84	81	78	78	76	74	71	71
2	94	85	78	72	91	83	76	70	77	72	67	72	68	64	68	64	61	58	58
3	86	75	66	59	82	72	64	58	68	61	55	63	58	53	59	55	51	48	48
4	78	66	57	49	75	64	55	49	60	52	47	56	50	45	53	48	43	41	41
5	72	58	49	42	69	57	48	42	53	46	40	50	44	39	47	42	37	35	35
6	66	52	43	37	64	51	42	36	48	41	35	45	39	34	43	37	33	30	30
7	61	47	38	32	59	46	38	32	44	36	31	41	35	30	39	33	29	27	27
8	57	43	35	29	55	42	34	28	40	33	27	38	31	27	36	30	26	24	24
9	53	40	31	26	51	39	31	25	37	30	25	35	28	24	33	27	23	21	21
10	50	36	28	23	48	36	28	23	34	27	22	32	26	22	31	25	21	19	19



www.iuseelite.com

Due to the constant improvement in LED technology and methods, all details are subject to change without notice. Consult factory for up-to-date information.  
100824



Job Name : LITTLE MOUNTAIN REUNION PARK IMPROVEMENTS  
Manufacturer : ELITE LIGHTING  
Model Number : 4-OEC4-LED-3000L/4000L/5000L-DIM10-MVOLT-35K/40K/50K-85

Type :  
**ST4**



## OEC4-LED

4' LED Strip Light with Multi-Lumen and Multi-CCT

### 4-OEC4-LED-3000L-4000L-5000L-DIM10-MVOLT-35K-40K-50K-85(5000L)

TEST NO.: **EL02132331**

INPUT WATTS: **43.0**

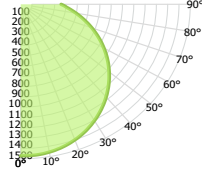
LUMENS: **5323**

EFFICACY: **124**

BEAM ANGLE: **128**

SPACING CRITERIA: **1.31**

#### CANDELA DISTRIBUTION



#### CANDELA TABLE

	0°	90°
0°	1471	1475
10°	1457	1439
20°	1400	1346
30°	1304	1205
40°	1175	1026
50°	1021	837
60°	849	610
70°	669	372
80°	497	144
90°	358	4

#### LUMINANCE (cd/sq.m)

	0.00°	90.00°
0.00°	919	922
10°	973	820
20°	1021	791
30°	1123	728
40°	1403	614
50°	3010	361

#### LUMENS PER ZONE

ZONE	LUMENS
0° - 10°	140
10° - 20°	400
20° - 30°	609
30° - 40°	741
40° - 50°	785
50° - 60°	744
60° - 70°	623
70° - 80°	448
80° - 90°	271

#### ZONAL LUMEN SUMMARY

ZONE	UMENS	% LUMINAIRE
0° - 20°	540	10%
0° - 30°	1149	22%
0° - 40°	1889	35%
0° - 60°	3418	64%
0° - 80°	4488	84%
0° - 90°	4759	89%

#### CONE OF LIGHT

MOUNTING HEIGHT	FC AT BEAM CENTER	BEAM DIA. 0° -180°	BEAM DIA. 90° -270°
6.0 m	40.9 lx	25.0 m	17.2 m
8.0 m	23.0 lx	33.3 m	23.0 m
10.0 m	14.7 lx	41.7 m	28.7 m
12.0 m	10.2 lx	50.0 m	34.4 m
14.0 m	7.5 lx	58.4 m	40.2 m
16.0 m	5.7 lx	66.7 m	45.9 m
18.0 m	4.5 lx	75.0 m	51.7 m
20.0 m	3.7 lx	83.4 m	57.4 m

#### INDOOR COEFFICIENTS OF UTILIZATION

pc pw	80%				70%				20%				50%				30%				10%				0%
	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	50%	30%	10%	0%				
0	117	117	117	117	113	113	113	113	105	105	105	98	98	98	92	92	92	92	92	92	89				
1	105	99	94	90	101	96	91	87	90	86	83	84	81	78	78	76	74	71	74	71	68				
2	94	85	78	72	91	83	76	70	77	72	67	72	68	64	68	64	61	58	61	58	58				
3	86	75	66	59	82	72	64	58	68	61	55	63	58	53	59	55	51	48	51	48	48				
4	78	66	56	49	75	64	55	49	60	52	47	56	50	45	53	48	43	41	43	41	41				
5	72	58	49	42	69	57	48	42	53	46	40	50	44	39	47	42	37	35	37	35	35				
6	66	52	43	37	64	51	42	36	48	41	35	45	39	34	43	37	33	30	33	30	30				
7	61	47	38	32	59	46	38	32	44	36	31	41	35	30	39	33	29	27	29	27	27				
8	57	43	35	29	55	42	34	28	40	33	27	38	31	27	36	30	26	24	26	24	24				
9	53	40	31	26	51	39	31	25	37	30	25	35	28	24	33	27	23	21	23	21	21				
10	50	36	28	23	48	36	28	23	34	27	22	32	26	22	31	25	21	19	21	19	19				

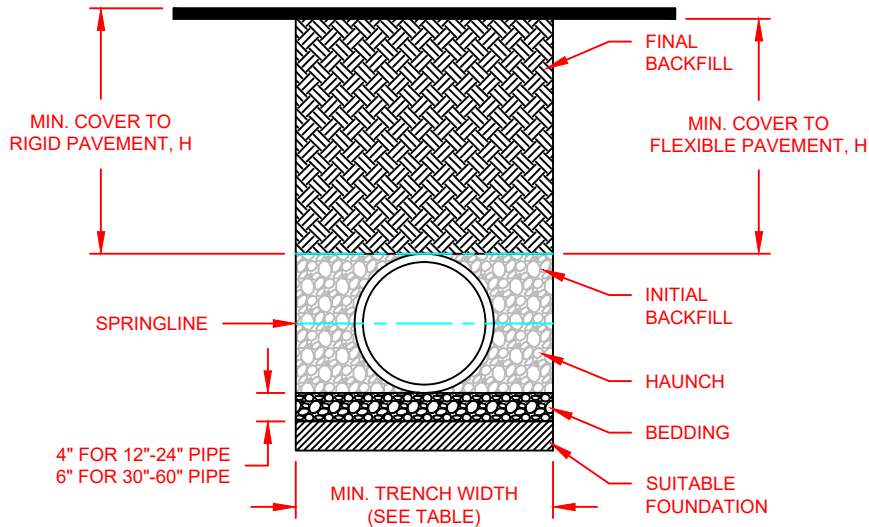


[www.iuseelite.com](http://www.iuseelite.com)

Due to the constant improvement in LED technology and methods, all details are subject to change without notice. Consult factory for up-to-date information.  
100824

# RECOMMENDED MINIMUM TRENCH WIDTHS

PIPE DIAM.	MIN. TRENCH WIDTH
4" (100mm)	21" (533mm)
6" (150mm)	23" (584mm)
8" (200mm)	26" (660mm)
10" (250mm)	28" (711mm)
12" (300mm)	30" (762mm)
15" (375mm)	34" (864mm)
18" (450mm)	39" (991mm)
24" (600mm)	48" (1219mm)
30" (750mm)	56" (1422mm)
36" (900mm)	64" (1626mm)
42" (1050mm)	72" (1829mm)
48" (1200mm)	80" (2032mm)
60" (1500mm)	96" (2438mm)



## MINIMUM RECOMMENDED COVER BASED ON VEHICLE LOADING CONDITIONS\*\*

PIPE DIAM.	SURFACE LIVE LOADING CONDITION	
	H-25	HEAVY CONSTRUCTION (75T AXLE LAOD) *
12" - 48" (300mm - 1200mm)	12" (305mm)	48" (1219mm)
60" (1500mm)	24" (610mm)	60" (1524mm)

\* VEHICLES IN EXCESS OF 75T MAY REQUIRE ADDITIONAL COVER

\*\*SEE BACKFILL REQUIREMENTS IN NOTE 6.

## MAXIMUM RECOMMENDED COVER BASED ON VEHICLE LOADING CONDITIONS

PIPE DIAM.	CLASS I		CLASS II		CLASS III
	COMPACTED	DUMPED	95%	90%	95%
4" (100mm)	34 (10.4m)	16 (4.9m)	23 (7.0m)	16 (4.9m)	17 (5.2m)
6" (150mm)	40 (12.2m)	19 (5.8m)	27 (8.2m)	19 (5.8m)	20 (6.1m)
8" (200mm)	30 (9.1m)	14 (4.3m)	21 (6.4m)	14 (4.3m)	15 (4.6m)
10" (250mm)	34 (10.4m)	16 (4.9m)	23 (7.0m)	16 (4.9m)	17 (5.2m)
12" (300mm)	35 (10.7m)	17 (5.2m)	24 (7.3m)	17 (5.2m)	18 (5.5m)
15" (375mm)	37 (11.3m)	18 (5.5m)	25 (7.6m)	18 (5.5m)	19 (5.8m)
18" (450mm)	32 (9.8m)	15 (4.6m)	22 (6.7m)	15 (4.6m)	16 (4.9m)
24" (600mm)	27 (8.2m)	13 (4.0m)	19 (5.8m)	13 (4.0m)	14 (4.3m)
30" (750mm)	22 (6.7m)	11 (3.4m)	16 (4.9m)	11 (3.4m)	11 (3.4m)
36" (900mm)	26 (7.9m)	12 (3.7m)	18 (5.5m)	12 (3.7m)	13 (4.0m)
42" (1050mm)	24 (7.3m)	11 (3.4m)	17 (5.2m)	11 (3.4m)	12 (3.7m)
48" (1200mm)	23 (7.0m)	11 (3.4m)	16 (4.9m)	11 (3.4m)	12 (3.7m)
60" (1500mm)	26 (7.9m)	12 (3.7m)	18 (5.5m)	12 (3.7m)	13 (4.0m)

FILL HEIGHT TABLE GENERATED USING AASHTO SECTION 12, LOAD RESISTANCE FACTOR DESIGN (LRFD) PROCEDURE WITH THE FOLLOWING ASSUMPTIONS:  
NO HYDROSTATIC PRESSURE,  
UNIT WEIGHT OF SOIL (Ys) = 120 PCF

### NOTES:

- ALL PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST ADDITION
- MEASURES SHOULD BE TAKEN TO PREVENT MIGRATION OF NATIVE FINES INTO BACKFILL MATERIAL, WHEN REQUIRED.
- FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER. AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.
- BEDDING: SUITABLE MATERIAL SHALL BE CLASS I, II OR III. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 4"-24" (100mm-600mm); 6" (150mm) FOR 30"-60" (750mm-1500mm).
- INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I, II OR III IN THE PIPE ZONE EXTENDING TO THE CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.
- MINIMUM COVER: MINIMUM COVER, H, IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" FROM THE TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOTATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER, H, IS 12" UP TO 48" DIAMETER PIPE AND 24" OF COVER FOR 60" DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT. FOR TRAFFIC APPLICATIONS WITH LESS THAN FOUR FEET OF COVER, EMBEDMENT OF THE PIPE SHALL BE USING ONLY A CLASS I OR CLASS II BACKFILL.

© 2020 ADS, INC.

ADVANCED DRAINAGE SYSTEMS, INC. ("ADS") HAS PREPARED THIS DETAIL BASED ON INFORMATION PROVIDED TO ADS. THIS DRAWING IS INTENDED TO DEPICT THE COMPONENTS AS REQUESTED. ADS HAS NOT PERFORMED ANY ENGINEERING OR DESIGN SERVICES FOR THIS PROJECT. NOR HAS ADS INDEPENDENTLY VERIFIED THE INFORMATION SUPPLIED. THE INSTALLATION DETAILS PROVIDED HEREIN ARE GENERAL RECOMMENDATIONS AND ARE NOT SPECIFIC FOR THIS PROJECT. THE DESIGN ENGINEER SHALL REVIEW THESE DETAILS PRIOR TO CONSTRUCTION. IT IS THE DESIGN ENGINEERS RESPONSIBILITY TO ENSURE THE DETAILS PROVIDED HEREIN MEETS OR EXCEEDS THE APPLICABLE NATIONAL, STATE, OR LOCAL REQUIREMENTS AND TO ENSURE THAT THE DETAILS PROVIDED HEREIN ARE ACCEPTABLE FOR THIS PROJECT.

5	INITIAL BACKFILL	JAB	04/02/20	
REV.	DESCRIPTION	BY	MM/DD/YY	CHK'D

### TRENCH INSTALLATION DETAIL (ASTM F2648)

DRAWING NUMBER: STD-101A



4640 TRUEMAN BLVD  
HILLIARD, OHIO 43026

DRAWN BY	JLE
DATE	8/15/13
QTD BY	
SCALE	NTS
SHEET	1 OF 1



- STACK PIPE ON LEVEL GROUND TO PREVENT WARPING OF PRODUCT.
- DO NOT LIFT PIPE BY INSERTING FORKLIFT INTO THE END OF THE PIPE.
- TO PREVENT DAMAGE TO THE BELL OR SPIGOT WHEN MOVING PIPE SECTIONS, DO NOT DRAG OR STRIKE PIPE ENDS AGAINST ANYTHING
- PIPE CAN BE MOVED WITH A BACKHOE AND A NYLON SLING. LIFT 36" AND LARGER DIAMETER PIPE WITH A SLING AT TWO POINTS. SPACED APPROXIMATELY 10 FEET APART. SMALLER DIAMETERS CAN USE ONE LIFT POINT.

STEP 1 : PIPE HANDLING AND STORAGE

TRACKHOE OPERATOR SHALL UNIFORMLY PLACE A SHALLOW LIFT (NOT TO EXCEED 8"), OVER THE PIPE SO WORKERS CAN DIAGONALLY KNIFE OR BOOT PRESS SOIL UNDER PIPE HAUNCHES. PLACING BACKFILL UNDER THE PIPE HAUNCHES HELPS PREVENT THE PIPE FROM SHIFTING DURING BACKFILL COMPACTION. PLACE BACKFILL EVENLY ON BOTH SIDES OF THE PIPE TO PREVENT PIPE DISPLACEMENT. FOR ADDITIONAL GUIDANCE SEE ASTM D2321.

MIDDLE THIRD OF PIPE

SPRINGLINE

HAUNCH\*

BEDDING

SUITABLE FOUNDATION

4" FOR 12"-24" PIPE  
6" FOR 30"-60" PIPE

MINIMUM TRENCH WIDTH

\* HAUNCH BACKFILL PROVIDES SUPPORT FOR SOIL & TRAFFIC LOADS. BACKFILL SHOULD BE WORKED INTO HAUNCH AREA IN 4-6" LIFTS

TRENCH MUST BE WIDE ENOUGH TO FIT PIPE, WORKERS, AND COMPACTION EQUIPMENT.

PIPE DIAMETER	MINIMUM BETWEEN PIPES	MINIMUM TRENCH WIDTH
12"	12"	30"
15"	12"	34"
18"	12"	39"
24"	12"	48"
30"	15"	56"
36"	18"	64"
42"	21"	72"
48"	24"	80"
60"	30"	96"

RECOMMENDED MINIMUM TRENCH WIDTHS, WHEN TRENCH WALLS AND FOUNDATION ARE STABLE. FOR ADDITIONAL TRENCH WIDTH OPTIONS REFER TO ADS INSTALLATION STANDARDS AND ASTM D2321.

STEP 2 : TRENCH WIDTH RECOMMENDATIONS

WHEN COMPACTING OVER THE PIPE WITH LIGHT WEIGHT COMPACTION EQUIPMENT, ENSURE THERE IS 6" MINIMUM COVER.

MEDIUM SIZED COMPACTORS MAY BE USED TO COMPACT BACKFILL IN LIFTS UP SIDES OF PIPE.

STEP 3 : PREPARATION OF BEDDING MATERIAL

USE A CLEAN RAG OR BRUSH TO LIGHTLY LUBRICATE INSIDE THE BELL. CLEAN SPIGOT END OF PIPE. REMOVE PLASTIC WRAP FROM GASKET. DO NOT ALLOW LUBRICATED SECTION TO TOUCH DIRT OR BACKFILL.

THE PIPE BELL SHOULD ALWAYS BE ALIGNED FACING UPSTREAM WITH BEDDING GRADE.

ALIGN PIPE AND PLACE SPIGOT INTO BELL. USING STRAP OR PUSH PIECE, FULLY INSERT SPIGOT INTO BELL. WHEN LEADING BELL EDGE TOUCHES "HOME" MARK JOINT IS FULLY INSERTED. INSIDE JOINT GAPS SHOULD BE TIGHT ON ALL SIDES. SEE MANUFACTURER FOR JOINT TOLERANCE.

PUSH PIECE

NYLON STRAP

STEP 4 : PIPE JOINT ASSEMBLY

1) INSERT PIPE INTO STRUCTURE, WITH PIPE RESTING ON BEDDING. THE PIPE SHOULD BE IN THE APPROXIMATE CENTER OF THE OPENING.

STRUCTURE WALL

FULLY GROUT

PIPE

2) GROUT PIPE INTO CONCRETE STRUCTURE WITH NON-SHRINK GROUT. SOLID MASONRY UNITS, FULLY GROUTED IN PLACE, MAY BE USED TO HELP FILL LARGE VOIDS.

PIPE

STRUCTURE WALL

STEP 5 : PLACING MATERIAL INTO HAUNCH AREA

PLACE BACKFILL AROUND PIPE IN 4"-6" COMPACTED LIFTS OR AS DIRECTED BY THE ONSITE GEOTECHNICAL ENGINEER (LOOSE LIFTS SHALL NOT EXCEED 8"). COMPACT BEDDING AND BACKFILL WITH SMALL TO MEDIUM COMPACTION EQUIPMENT TO SPECIFIED DENSITY. VISUALLY INSPECT THE PIPE TO ENSURE THE APPROPRIATE SHAPE IS MAINTAINED. BACKFILL SHOULD BE NEAR OPTIMUM MOISTURE WHEN COMPACTED. FOR ADDITIONAL GUIDANCE SEE ASTM D2321.

STEP 6 : COMPACT BACKFILL IN LIFTS

MINIMUM COVER VALUES DO NOT ACCOUNT FOR RUTTING OR UNSTABLE SOIL OVER THE PIPE. ADDITIONAL COVER MAY BE REQUIRED TO MAINTAIN THE PIPE'S STRUCTURAL INTEGRITY.

STEP 7 : COMPACT OVER TOP OF PIPE

FINISHED GRADE

PLACE BACKFILL IN 4"-6" COMPACTED LIFTS, TO DENSITY REQUIRED AROUND PIPE IN TABLE 1.

TAKE CARE TO ENSURE THE PIPE IS FULLY SUPPORTED BY BEDDING AND WELL COMPACTED BACKFILL BEFORE GROUTING.

NATIVE SOIL (ENSURE SUITABLE FOUNDATION FOR PIPE & STRUCTURE) FILTER FABRIC SHOULD BE USED WHEN OPEN GRADED STONE IS USED.

STEP 8 : GROUT CONNECTION

STRUCTURE WALL

PIPE TO STRUCTURE CONNECTION PER STEP 8

HP STORM PIPE

COMPACT BACKFILL UNDER AND AROUND STRUCTURE BEFORE PLACING BEDDING AND GROUTING PIPE.

STEP 9 : COMPACT BACKFILL AROUND STRUCTURE

MAXIMUM COVER FOR ADS HP STORM PIPE (FT)								
PIPE DIA	CLASS I		CLASS II		CLASS III		CLASS IV	
	COMPACTED	95% SPD	90% SPD	95% SPD	90% SPD	95% SPD	90% SPD	
12"	41	28	21	20	16	16	16	
15"	42	29	21	21	16	16	16	
18"	44	30	21	22	17	14	14	
24"	37	26	18	19	14	11	11	
30"	39	27	19	19	15	14	14	
36"	28	20	14	14	11	10	10	
42"	30	21	14	15	11	10	10	
48"	29	20	14	14	10	10	10	
60"	29	20	14	14	10	9	9	

FILL HEIGHTS BASED ON CALCULATIONS SHOWN IN THE STRUCTURES SECTION OF THE ADS DRAINAGE HANDBOOK (V2.0.7). CALCULATIONS ASSUME NO HYDROSTATIC PRESSURE AND A DENSITY OF 120 PCF FOR OVER BURDEN MATERIAL. INSTALLATION IN ACCORDANCE WITH ASTM D2321. WITH FILL HEIGHTS AS SHOWN. SEE TABLE 3 FOR SOIL DATA. STANDARD PROCTOR DENSITY USED FOR COMPACTION. INCREASE SOIL CLASS AND/OR COMPACTION EFFORT AS NEEDED TO MEET REQUIRED FILL HEIGHTS ON PROJECT PLANS

MINIMUM COVER FOR ADS HP STORM PIPE (IN)			
PIPE DIA	H20 AXLE LOAD (lbs)	CLASS II @ 90% SPD	CLASS III @ 95% SPD
12" - 48"	32000	12	12
60"	32000	24	24

FOR TRAFFIC APPLICATIONS MINIMUM COVER IS 12" UP TO 48" DIAMETER PIPE AND 24" OF COVER FOR 60" DIAMETER PIPE. MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT (ASPHALT) OR TO TOP OF RIGID PAVEMENT (CONCRETE). MINIMUM COVER VALUES DO NOT ACCOUNT FOR RUTTING OR UNSTABLE SOIL OVER THE PIPE. ADDITIONAL COVER MAY BE REQUIRED TO MAINTAIN THE PIPE'S STRUCTURAL INTEGRITY.

TABLE 1 : MAXIMUM & MINIMUM COVER

MINIMUM COVER FOR CONSTRUCTION VEHICLES									
CONSTRUCTION VEHICLE	VEHICLE DESCRIPTION	MINIMUM TIRE	AXLE LOAD (lbs)	PIPE DIAMETER	TEMPORARY MINIMUM COVER HEIGHTS (in)				
					CLASS I @ 95% SPD	CLASS II @ 90% SPD	CLASS III @ 95% SPD	CLASS III @ 90% SPD	
CAT CT660	DUMP TRUCK	22.5-R11	46000	12"-60"	9	9	12	12	18
CAT 16M3	GRADER	23.5-R25	58753	12"-21" 24"-60"	12	12	15	15	21 24
CAT 730C	ARTICULATED DUMP TRUCK	23.5-R25	74538	12"-15" 18"-60"	15	15	18	18	24 27
CAT CS78B1	ROLLER	84-IN DRUM	74600	12"-21" 24"-60"	15	15	21	21	24 27
KOMATSU WA800-3	WHEEL LOADER	45/65-45	158270	12"-30" 36"-60"	15	15	21	21	30 36

MINIMUM COVER VALUES DO NOT ACCOUNT FOR RUTTING OR UNSTABLE SOIL OVER THE PIPE. ADDITIONAL COVER MAY BE REQUIRED TO MAINTAIN THE PIPE'S STRUCTURAL INTEGRITY.

MINIMUM COVER TO PREVENT PIPE FLOTATION	
NOMINAL DIAMETER (in)	MINIMUM COVER (in)
12	9
15	11
18	13
24	17
30	22
36	25
42	29
48	33
60	40

FLOTATION NOTES:  
THE PIPE IS ASSUMED TO BE EMPTY WITH GROUNDWATER TO THE GRADE SURFACE AND SATURATED SOIL DENSITY OF 130 PCF. IF THE PIPE IS FULL OF WATER THESE VALUES MAY BE ADJUSTED BY THE SITE DESIGN ENGINEER. FOR MORE INFORMATION ON FLOTATION, REFER TO ADS TECH NOTE TN 5.05.

TABLE 2 : MIN. COVER FOR CONSTRUCTION VEHICLES & FLOTATION

ASTM D2321 SOIL CLASS <sup>1</sup>	ASTM D2487 SOIL GROUP <sup>1,2</sup>	AASHTO M145 SOIL GROUPS <sup>1</sup>
STONE BACKFILL		
CLASS I <sup>2</sup>	ANGULAR CRUSHED ROCK, WITH 100% PASSING 1-1/2 IN. SIEVE ≤15% PASSING #4 SIEVE ≤25% PASSING 3/8 IN. SIEVE ≤12% PASSING #200 SIEVE ALL PARTICLE SURFACES SHALL BE FRACTURED.	-
GRAVEL AND SAND BACKFILL		
CLASS II	CLEAN, COARSE GRAINED SOILS: "SW", "SP", "GW", "GP", OR ANY SOIL BEGINNING WITH ONE OF THESE SYMBOLS WITH ≤12% PASSING #200 SIEVE.	A1, A3
COARSE GRAINED SOILS WITH FINES		
CLASS III	COARSE GRAINED SOILS WITH FINES: "GM", "GC", "SM", "SC", OR ANY SOIL BEGINNING WITH ONE OF THESE SYMBOLS, CONTAINING >12% TO <50% PASSING #200 SIEVE; "CL", "ML", OR ANY SOIL BEGINNING WITH ONE OF THESE SYMBOLS, WITH ≥50% TO <70% PASSING #200 SIEVE AND LL < 50	A-2-4, A-2-5, A-2-6, OR A-4 SOILS WITH <70% PASSING #200 SIEVE
FINE-GRAINED INORGANIC SOILS		
CLASS IV	FINE-GRAINED INORGANIC SOILS: "CL", "ML", OR ANY SOIL BEGINNING WITH ONE OF THESE SYMBOLS, WITH >70% PASSING #200 SIEVE AND LL < 50	A-2-7 OR A-4 OR A-6 SOILS WITH ≥70% PASSING #200 SIEVE

<sup>1</sup>SEE ASTM D2321 FOR ADDITIONAL GUIDANCE REGARDING THE USE OF LISTED SOIL AS BACKFILL AROUND THERMOPLASTIC PIPE  
<sup>2</sup>IT IS HIGHLY RECOMMENDED TO WRAP THIS MATERIAL WITH A GEOTEXTILE TO PREVENT MIGRATION OF FINES INTO AND THROUGH VOIDS IN THE BACKFILL.

TABLE 3 : BACKFILL CLASSIFICATIONS

DATE: 10/1/24  
DRAWN: BSW  
REVISION: 2  
DWG NO: STD-1301G  
NOT TO SCALE

HP STORM INSTALLATION GUIDE

4840 TRUEMAN BLVD  
HILLIARD, OH 43026  
ADS  
ADVANCED DRAINAGE SYSTEMS, INC.

SHEET  
1 OF 1

PIPE MUST BE INSTALLED IN ACCORDANCE WITH ASTM D2321. IN ADDITION TO ALL SITE CONDITIONS REQUIRED BY STATE AND LOCAL CODES, INDUSTRY STANDARDS AND GUIDELINES, MANUFACTURERS INSTALLATION RECOMMENDATIONS, CSHA, AND ALL APPLICABLE LAWS.

ADVANCED DRAINAGE SYSTEMS, INC. ("ADS") HAS PREPARED THIS DETAIL BASED ON REFERENCED STANDARDS. ADS HAS NOT PERFORMED ANY ENGINEERING OR DESIGN SERVICES FOR THIS PROJECT. ADS HAS ADS INDEPENDENTLY VERIFIED THE INFORMATION SUPPLIED. THE INSTALLATION DETAILS PROVIDED HEREIN ARE ADVISORY ONLY. THE USER SHALL BE RESPONSIBLE FOR THE DESIGN AND CONSTRUCTION OF THE PROJECT. ADS HAS NO LIABILITY FOR THE DESIGN OR CONSTRUCTION OF THE PROJECT. IT IS THE SITE DESIGN ENGINEER'S RESPONSIBILITY TO ENSURE THE DETAILS PROVIDED HEREIN MEET OR EXCEEDS THE APPLICABLE NATIONAL, STATE, OR LOCAL REQUIREMENTS AND TO ENSURE THAT THE DETAILS PROVIDED HEREIN ARE ACCEPTABLE FOR THIS PROJECT.



# N-12<sup>®</sup> WT IB Pipe

## (per ASTM F2648)

N-12 WT IB pipe (per ASTM F2648) has recycled content and provides material properties to meet or exceed the demands of the market.

N-12 WT IB contains a superior built-in bell-and-spigot joint. An exterior bell wrap provides a quick visual indicator to customers and inspectors that a watertight product is being used. A patented gasket, that meets all requirements of ASTM F477, increases its sealing forces as temporary internal or external hydrostatic pressure increases.

### Applications

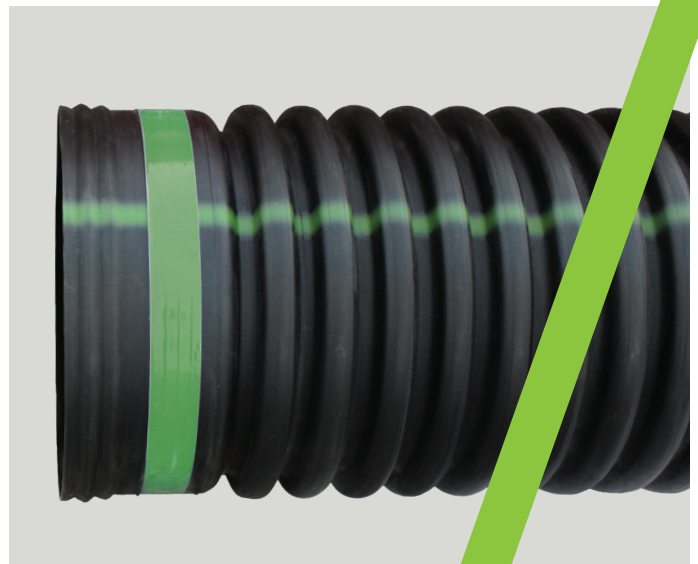
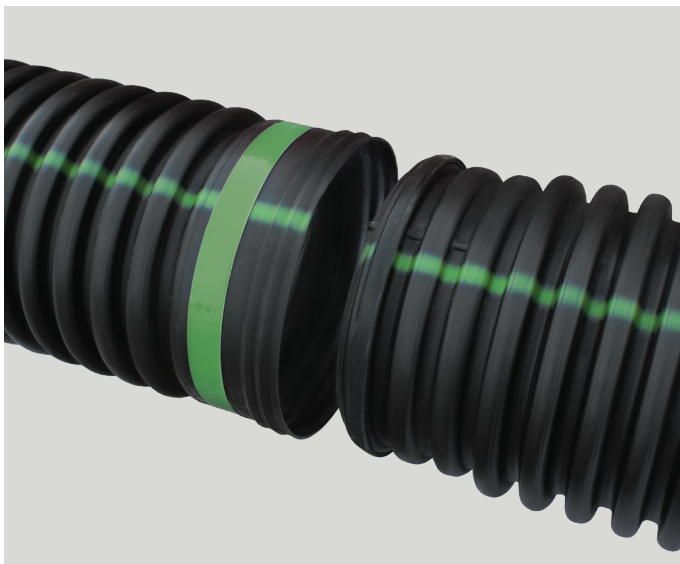
- Storm sewers
- Retention/Detention
- Ditch enclosures
- Culverts & cross drains
- Slope/edge drains
- Mining/Forestry/Industrial

### Features

- 4"-60" (100-1500 mm) diameters available
- Nominal 20' (6 m) and 13' (4 m) lengths available
- Integral bell and factory-installed gasket
- Joint meets or exceeds ASTM D3212 lab test as well as ASTM F2487 and ASTM F1417 watertight field test
- Exceptional joint strength
- Light weight for fast installation times
- Structural strength will support H-25 or HL-93 live loads with 12" (300 mm) minimum cover; 60" (1500 mm) requires 24" (600 mm) cover for H-25 or HL-93 live loads

### Benefits

- Variety of diameters and lengths that will fit any project
- Factory-installed gaskets and built-in bell allow for efficient installation and reduced opportunities for risk
- Installation cost savings from lower shipping costs, reduced labor and less heavy equipment
- Hydraulic efficiency from smooth interior
- Long-term durability of HDPE



# ADS N-12 WT IB Pipe (per ASTM F2648) Specification

## Scope

This specification describes 4- through 60-inch (100 to 1500 mm) ADS N-12 WT IB pipe (per ASTM F2648) for use in gravity-flow land drainage applications.

## Pipe Requirements

ADS N-12 WT IB pipe (per ASTM F2648) shall have a smooth interior and annular exterior corrugations.

- 4- through 60-inch (100 to 1500 mm) shall meet ASTM F2648
- Manning's "n" value for use in design shall be 0.012.

## Joint Performance

4- through 60-inch (100 to 1500 mm) pipe shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

12- through 60-inch (300 to 1500 mm) diameters shall have an exterior bell wrap installed by the manufacturer.

## Fittings

Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM F2306.

## Field Pipe and Joint Performance

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

## Material Properties

Material for pipe production shall be an engineered compound of virgin and recycled high-density polyethylene conforming with the minimum requirements of cell classification 424420C, (ESCR Test Condition B) for 4- through 10-inch (100 to 250 mm) diameters, and 435420C, (ESCR Test Condition B) for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The design engineer shall verify compatibility with overall system including structural, hydraulic, material and installation requirements for a given application.

## Installation

Installation shall be in accordance with ASTM D2321 and ADS' published installation guidelines, with the exception that minimum cover in trafficked areas for 4- through 48-inch (100 to 1200 mm) diameters shall be one foot (0.3 m) , and for 60-inch (1500 mm) diameters, the minimum cover shall be two feet (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1 (compacted) or Class 2 (minimum 90% SPD) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.02. Contact your local ADS representative or visit our website [adspipe.com](http://adspipe.com) for a copy of the latest installation guidelines.

## Pipe Dimensions\*


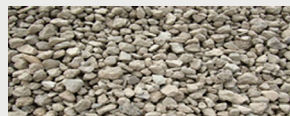



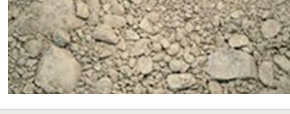
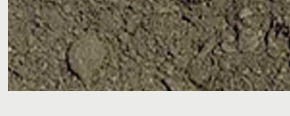







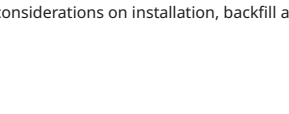
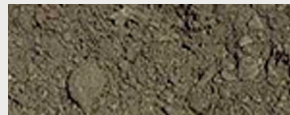




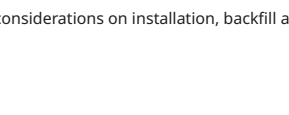
Nominal Diameter													
Pipe I.D. in (mm)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)	15(375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	60 (1500)
Pipe O.D. in (mm)	4.8 (122)	6.9 (175)	9.1 (231)	11.4 (290)	14.5 (368)	18 (457)	22 (559)	28(711)	36 (914)	42 (1067)	48 (1219)	54 (1372)	67 (1702)

\*Check with sales representative for availability by region. \*\*Pipe O.D. values are provided for reference purposes only, values stated for 12- through 60-inch are  $\pm 1$  inch. Contact a sales representative for exact values.



# Classes of Embedment and Backfill Materials



ASTM D2321	ASTM D2487				AASHTO M145	Suitable ADS Pipe Types (See ADS TN 2.01-2.04)	Visual Descriptions
Class	Description	Major Divisions	Notation	Description	Soil Group		
I	Crushed rock, angular (fractured face): 100% passing 1½-inch sieve, < /= 25% passing ¾-inch sieve, < /=15% passing #4 sieve, and < /= 12% passing #200 sieve	N/A²	N/A²	N/A²	-	N-12® HDPE (High-Density Polyethylene) HP Storm (Polypropylene)	
II	Coarse grained soils; SW, SP, GW, GP or any soil beginning with one of these symbols with < /=12% passing #200 sieve. (Materials such as broken coral, shells, and recycled concrete, with < /= 12% passing a #200 sieve are considered to be Class II materials. These materials should only be used when evaluated and approved by the engineer)	Gravels (less than 5% fines)	GW	Well-graded gravel	A1, A3  Refer to LRFD Section 12.12 for additional design commentary	N-12® HDPE (High-Density Polyethylene)  HP Storm (Polypropylene)	
			GP	Poorly-graded gravel			
		Dual Classification Gravels (5 to 12% Fines)	GW-GM, GW-GC	Well-graded gravels with silts or clays			
			GP-GM, GP-GC	Poorly-graded gravels with silts or clays			
		Sands (less than 5% fines)	SW	Well-graded sand			
			SP³	Poorly-graded sand			
		Dual Classification Sands (5 to 12% fines)	SW-SM, SW-SC	Well-graded sands with silts or clays			
			SP-SM, SP-SC³	Poorly-graded sands with silts or clays			
III	Coarse grained soils with fines: GM, GC, SM, SC, or any soil beginning with one of these symbols, containing 12% to 50% passing #200 sieve.	Gravels with fines	GM	Silty gravel	A-2-4, A-2-5, A-2-6, or A-4 or A-6 soils< 70% passing #200 sieve	N-12® HDPE (High-Density Polyethylene)  HP Storm (Polypropylene)	
			GC	Clayey gravel			
		Sands with fines	SM	Silty sand			
			SC	Clayey sand			
	Sandy or gravelly inorganic fine-grained soils; CL, ML, or any soil beginning with one of these symbols, with > /=50% to < /= 70% passing #200 sieve and Liquid Limit < 50.	Lean clay	CL	Sandy or gravelly lean clay			
		Silty clay	CL-ML	Sandy or gravelly silty clay			
		Silt	ML	Sandy or gravelly silt			
IV	Fine-grained inorganic soils; CL, ML, or any soil beginning with one of these symbols, with > 70% passing #200 sieve and Liquid Limit < 50.	Lean Clay	CL	Lean Clay	A-2-7 or A-4 or A-6 soils with > /=70% passing #200 sieve	HP Storm (Polypropylene)	
		Silty Clay	CL-ML	Silty Clay			
		Silt	ML	Silt			
V	Fine-grained inorganic soils, MH, CH, or any soil beginning with one of these symbols and liquid limit ≥ 50	Elastic Silt	MH	Elastic silt, may be sandy or gravelly	A5, A7	Not For Use	
		Fat Clay	CH	Fay clay, may be sandy or gravelly			
	Fine-Grained organic soils; OL, OH or PT. Can include other highly organic soils such as Muck	Organic Silt	OL	Organic silt, may be sandy or gravelly			
		Organic Clay	OH	Organic clay, may be sandy or gravelly			
		Peat	PT	Peat			

(1) Users of this document should refer to ADS Tech Notes 2.01-2.04 for compaction requirements and design considerations for use with compatible backfills. Please consult ADS engineering and ASTM D2321 for additional considerations on installation, backfill and design considerations not listed in ADS Tech Notes 2.01-2.04.

(2) Per ASTM D2487 The USCS Classification System is limited to naturally occurring soils. Typical examples include No. 5, 6, 57 or 67 aggregate per AASHTO M43

(3) Poorly graded fine sands (SP) with more than 50% passing a 100 sieve should be treated as Class III soils.

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL <50%, H = Clay, LL >50%

AASHTO M 43 Table 1 Standard Sizes of Processed Aggregate																
Size Number	Nom. Size, Square Openings in (mm)	4 (100)	3½ (90)	3 (75)	2½ (63)	2 (50)	1½ (37.5)	1 (25)	¾ (19)	½ (12.5)	⅜ (9.5)	No.4 (4.75)	No.8 (2.36)	No.16 (1.18)	No.50 (300 µm)	No.100 (150 µm)
1	3½-1½ (90-37.5)	100	90-100	-	25-60	0	0-15	-	0-5	-	-	-	-	-	-	-
2	2½-1½ (63-37.5)	-	-	100	90-100	35-70	0-15	-	0-5	-	-	-	-	-	-	-
24	2½-¾ (63-19)	-	-	100	90-100	-	25-60	-	0-10	0-5	-	-	-	-	-	-
3	2-1 (50-25)	-	-	-	100	90-100	35-70	0-15	-	0-5	-	-	-	-	-	-
357	2"-No.4 (50-4.75)	-	-	-	100	95-100	-	35-70	-	10-30	-	0-5	-	-	-	-
4	1½-¾ (37.5-19)	-	-	-	-	100	90-100	20-55	0-15	-	0-5	-	-	-	-	-
467	1½"-No.4 (37.5-4.75)	-	-	-	-	100	95-100	-	35-70	-	10-30	0-5	-	-	-	-
5	1-½ (25-12.5)	-	-	-	-	-	100	90-100	20-55	0-10	0-5	-	-	-	-	-
56	1-¾ (25-9.5)	-	-	-	-	-	100	90-100	40-85	10-40	0-15	0-5	-	-	-	-
57	1"-No.4 (25-4.75)	-	-	-	-	-	100	95-100	-	25-60	-	0-10	0-5	-	-	-
6	¾-¾ (19-9.5)	-	-	-	-	-	-	100	90-100	20-55	0-15	0-5	-	-	-	-
67	¾"-No.4 (19-4.75)	-	-	-	-	-	-	100	90-100	-	20-55	0-10	0-5	-	-	-
68	¾"-No.8 (19-2.36)	-	-	-	-	-	-	100	90-100	-	30-65	5-25	0-10	0-5	-	-
7	½"-No.4 (12.5-4.75)	-	-	-	-	-	-	-	100	90-100	40-70	0-15	0-5	-	-	-
78	½"-No.8 (12.5-2.36)	-	-	-	-	-	-	-	100	90-100	40-75	5-25	0-10	0-5	-	-
8	⅜"-No.8 (9.5-2.36)	-	-	-	-	-	-	-	-	100	85-100	10-30	0-10	0-5	-	-
89	⅜"-No.8 (12.5-2.36)	-	-	-	-	-	-	-	-	100	90-100	20-55	5-30	0-10	0-5	-
9	No.4-No.16 (4.75-1.18)	-	-	-	-	-	-	-	-	-	100	85-100	10-40	0-10	0-5	-
10	No.4-0* (4.75)	-	-	-	-	-	-	-	-	-	100	85-100	-	-	-	10-30

\* Screenings

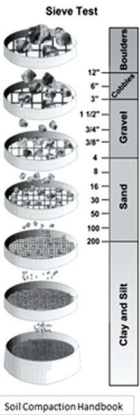
Consistency	Clay						Sand				
	Very Soft	Soft	Med. Soft	Stiff	Very Stiff	Hard	Very Loose	Loose	Medium	Dense	Very Dense
Thumb Penetration	Easily penetrated several inches by thumb. Exudes between thumb and fingers when squeezed in hand.	Easily penetrated one inch by thumb. Molded by light finger pressure.	Can be penetrated over ¼" by thumb with moderate effort. Molded by strong finger pressure.	Indented about ¼" by thumb but penetrated only with great effort.	Readily indented by thumbnail.	Indented with difficulty by thumbnail.	-	-	-	-	-
SPT	<2	2-4	4-8	8-15	15-30	>30	4	4-10	10-30	30-50	50
Field Test	-	-	-	-	-	-	Easily penetrated with ½" reinforcing rod pushed by hand	Easily penetrated with ½" reinforcing rod pushed by hand	Penetrated a foot with ½" reinforcing rod driven with a 5-lb hammer	Penetrated a foot with ½" reinforcing rod driven with a 5-lb hammer	Penetrated only a few inches with ½" reinforcing rod driven with a 5-lb hammer

Source: Geotechnical Gauge: W.F. McCollough

Unified Soil Classification System (USCS)				
		mm	in	Sieve size
Gravel	Boulders	>300	>12	-
	Cobbles	75-300	3-12	-
	Coarse	75-19	3-0.75	-
	Fine	19-4.8	0.75-0.19	¾"-No.4
Sand	Coarse	4.8-2.0	0.19-0.08	No.4-No.10
	Medium	2.0-0.43	0.08-0.02	No.10-No.40
	Fine	0.43-0.08	0.02-0.003	No.40-No.200
Fine	Silts	<0.08	<0.003	<No.200
	Clays	<0.08	<0.003	<No.200



Angular    Sub Angular    Sub Rounded    Rounded



**Gravel Terminology**

- Bank run - the gradation as it exists in nature, with little processing; gravel with sand & clay present (Generally Class 2).
- Crushed gravel - oversized particles are crushed and fed back into the mixture (Generally Class 1 or 2)
- Dense-graded - all particle sizes are present, limited voids content (Generally Class 2)
- Open-graded - screened material with a narrow range of particle sizes and a large voids content (Generally Class 1 or 2 depending on screen size)
- Pea Gravel/River Rock/ Creek Rock - generally rounded, small stones with potentially wide range of stone types 4 sizes (Generally Class 2)



# ADS<sup>®</sup> Storm Pipe Installation Guide

## Important Notes: (Be advised this document does not supercede project specifications.)

- A. This installation guide provides the minimum requirements for proper installation of pipe. Non-adherence to this guide may result in damage to pipe. Replacement of damaged pipes during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the pipe for distortion, damage and joint integrity as work progresses.
- B. Care should be taken in the handling of pipe. To avoid damage to pipe and fittings please follow OSHA safety requirements, do **NOT** drop pipe and avoid any impact to the bell or spigot.



Scan here to visit  
Installation Page

## Job Site Handling



4"-18" (100-450 mm) diameter pipe can be moved by hand.



24"-30" (600-750 mm) diameter pipe requires a backhoe with one nylon sling.



Lift 36"-60" (900-1500 mm) diameter pipe with a sling at two points, spaced 10' (3 m) apart.

## Job Site Storage



Stack pipe in a flat, clear area no higher than 6' (1.8 m). Use securing blocks to ensure pile does not collapse.



While supporting lengths of pipe evenly, alternate bells for each row of pipe.



To prevent damage to the pipe, do not use forklift inside the pipe and avoid direct impacts. Do not drag or strike pipe ends against anything to avoid spigot or bell damage.



## Trench Construction

### Minimum Trench Widths

Diameter in (mm)	Trench Width in (mm)
4-8 (100-200)	*
10 (250)	28 (711)
12 (300)	30 (762)
15 (375)	34 (863)
18 (450)	39 (990)
24 (600)	48 (1219)
30 (750)	56 (1422)
36 (900)	64 (1625)
42 (1050)	72 (1828)
48 (1200)	80 (2032)
60 (1500)	96 (2438)

\* Usually dependent on smallest bucket size available.

## Backfill



### Backfill Material Selection

- Provided ADS minimum recommendations are met, engineered plan set should take precedence.
- Locally available material may be acceptable for backfill use, but must meet one of the acceptable soil classifications in the Classes of Embedment and Backfill Materials table.
- Class I materials can be dumped around pipe. Voids must be eliminated by knifing under and around pipe.
- Non-cohesive sand, sand/gravel mixes and other Class II and III materials must be compacted to a minimum of 85% and 90% standard Proctor density, respectively.
- Inorganic silts, and gravelly, sandy or silty clays, and other Class IV materials are permitted for HP Storm only.
- Flowable fill is an acceptable backfill. Misalignment or flotation may occur unless the pipe is anchored or the flowable fill is poured in lifts.
- **For more information on backfill material, refer to ADS Technical Note 5.02**

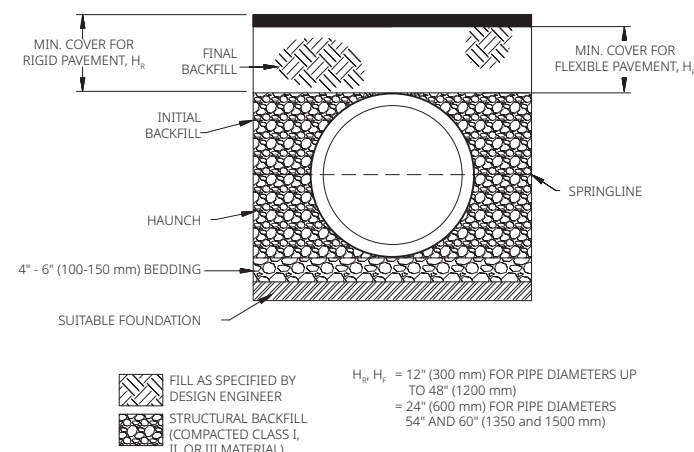


### Dewatering

When groundwater or surface runoff is present, dewatering of the trench shall be performed to maintain the water level below the bedding. A dry trench allows for proper placement and compaction of backfill and minimizes the risk of flotation or alterations in line and grade of the pipe. Typical dewatering methods include sump pumps, well points, deep wells, underdrains or a diversion ditch. Consult the project engineer for appropriate dewatering methods given project conditions. **For more information on flotation, refer to ADS Technical Note 5.05.**

## Backfill Envelope Construction

- If native soil cannot carry load, import, compact and level adequate bedding material as in the accompanying figure.
- The accompanying figure represents typical trench construction applicable to all products. **See applicable standard details** for trench installation details for N-12®, HP Storm and SaniTite® HP.
- Place and compact backfill in layers to meet compaction requirements and project requirements. Note that the large diameter pipes may require layer heights less than those indicated in the table to achieve proper compaction.
- Avoid impacting the pipe directly with compaction equipment. Hand tamper, rammer, small vibrating compactors and walk-behind static rollers may be used for compacting backfill. Heavy-duty compaction or vibratory equipment should have adequate separation from the pipe, typically 3'-4' (0.9-1.2 m).

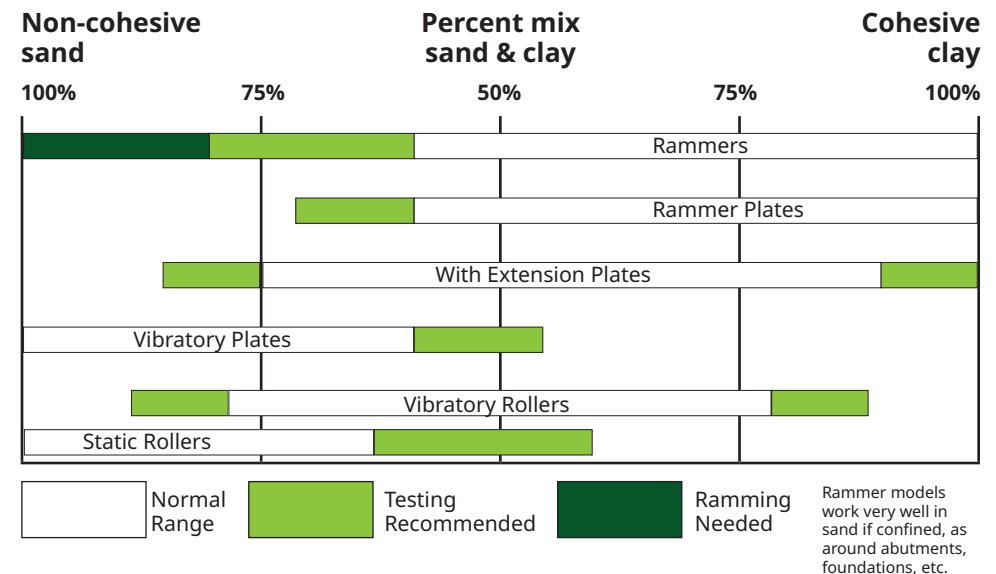


# COMPACTION

Crushed stone or similar materials are usually not compacted, but do require care during installation to eliminate large voids in the backfill envelope. Using a shovel to 'slice' or 'knife' the material under and around the pipe is sufficient.

For other materials, compaction methods will depend primarily on the amount of compaction, or modulus of soil reaction, required and the moisture level of the material. At optimum moisture levels, some Class II and III soils can be compacted to minimum recommended levels simply by walking on each backfill lift. While this technique may not be acceptable for all installations, the point is that compaction need not always require a great deal of extra effort or mechanical equipment.

If, however, mechanical compaction equipment is needed in the backfill envelope or elsewhere on the site, the subsequent paragraphs provide guidance on compaction equipment and the soils for which they are most appropriate.



## MECHANICAL COMPACTION EQUIPMENT

**Hand Tampers:** Haunch layer compaction may require a small (6" x 6" [150 x 150 mm]) tamping mechanism to obtain specified compaction in a confined area. Tampers shall not weigh more than 20 pounds (9 kg).

**Rammers or rammer plates:** Impact action is used to force out air and water from between soil particles to consolidate the fill.

This equipment works well on cohesive or high-clay content soils. For heavy-duty compaction equipment, a minimum of 4' (1.2 m) of backfill shall separate the pipe and equipment. Care should be taken to not use rammer directly on pipe.



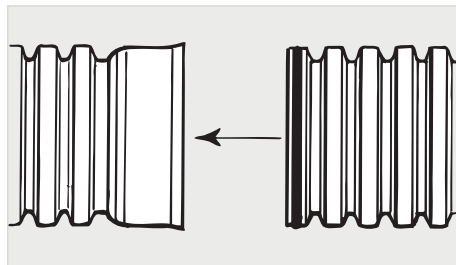
**Static compactors:** Consolidation with static compactors occurs as a result of the rolling weight of the equipment. Sheeps-foot rollers employ projecting feet to concentrate the weight of the machine. Static compactors are most valuable when used on non-cohesive backfill away from the pipe. Other methods of compaction should be used near the pipe.



**Vibrating compactors:** The motion of vibrating rollers of plates "shake" the soil particles into a more dense arrangement and works best with non-cohesive fills. Depending on the size and weight of the machine, vibrating compactors may be used close to the pipe. As always, care should be taken not to impact the pipe directly with a great deal of force.



## Bell and Spigot Joint Assembly



It is recommended to lay pipe starting at the down stream end. Push spigots into bells with bells facing upstream. **Always** push spigot ends into bell.

- Lower pipe into trench
- Inspect bell and spigot; remove foreign matter
- Lubricate bell of pipe
- Remove protective wrap from gasket and lubricate gasket
- Do **NOT** allow lubricated section to touch dirt or backfill. Place spigot into bell and align.

- Small diameter pipe may be joined by hand.
- Ensure bell and spigot are "homed" for tight joining seal. If homing mark isn't present, measure bell depth and mark "homing" mark on appropriate corrugation of the spigot end. Do **NOT** over home the pipe.

Assemble joint using one of the following methods.



### Backhoe & Sling Method

- Wrap nylon sling around pipe with pipe level and hook sling to backhoe bucket
- Pipe 36" (900 mm) or larger should be picked up at 2 points 10' (3 m) apart
- Push strap toward bell of pipe until spigot is inserted into bell

*NOTE: Distance from bedding to bottom of pipe not to exceed 6" (150 mm) for a 20' (6 m) pipe.*



### Bar & Block Method

- Place stub into pipe's bell end
- Place wooden block horizontally across end of stub and use a bar to push against wooden block until pipe is inserted into bell

*NOTE: This method requires use of installation stub. DO NOT push directly against pipe.*

## Installation Stub Fabrication

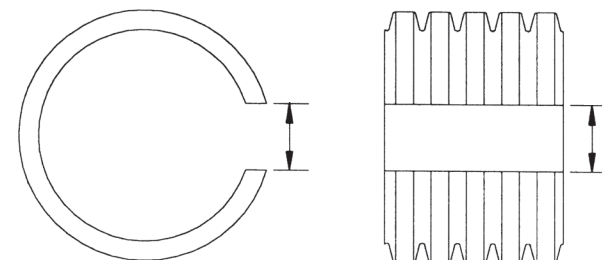
To push "home" joints, an installation stub can be used to prevent bell damage. Stubs are not required if the bell is not pushed on directly. Installation stubs can be fabricated on site:

- Cut a pipe 5 corrugations long
- Using a saw, remove a strip of pipe wall. Note: Strip width shown in table.
- To use stub, push on pipe walls to change outside diameter of stub to inside diameter of bell to be installed.

### Strip Width for Installation Stub

Pipe Diameter in (mm)	Strip Width in (mm)
4-6 (100-150)	2 (51)
8 (200)	2.5 (64)
10-12 (250-300)	4 (102)
15 (375)	5 (127)
18 (450)	6 (152)
24 (600)	7.5 (191)
30-42 (750-1050)	10 (254)
48-60 (1200-1500)	12 (305)

### Installation Stub





## Minimum Cover, Temporary Construction and Paving Traffic

- 4"-48" (100-1200 mm) single pipe runs receiving H-25 traffic requires final backfill 12" (300 mm) above initial backfill to provide at least 12" (300 mm) of total cover as measured from the top of pipe to bottom of flexible pavement or to top of rigid pavement.
- 60" (1500 mm) single pipe runs receiving H-25 traffic require final backfill 24" (600 mm) above initial backfill to provide at least 24" (600 mm) of total cover as measured from top of the pipe to the bottom of flexible pavement or to top of rigid pavement. Some construction vehicles, such as many types of paving equipment, are not as heavy as the design load.
- The corresponding table presents surface applied loads and the corresponding minimum cover that can be temporarily permitted. Areas with heavy construction equipment traffic from 30-60 tons (27,215-54,431) kg and heavy duty compaction equipment require at least 3' (0.9 m) of cover. Higher loads require cover greater than 3' (0.9 m).
- If cover is not provided, mound and compact material over pipe to provide minimum cover needed for load during construction.

**See details 111A through 111F for temporary minimum cover for additional construction vehicles.**

### Cover Requirements for Temporary Light Construction Traffic\*

Vehicle Type	Single or Tandem Axle Load lbs (kg)	Pipe Diameter in (mm)	Temporary Min. Cover in (mm)	
			Class I Compacted	Class II @ 95% SPD
Drum Roller	29,626 (13,438)	12-48 (300-1200)	9 (229)	9 (229)
		60 (1500)	9 (229)	12 (305)
Dump truck	65,000 (29,484)	12-60 (300-1500)	15 (381)	18 (457)
Concrete Mixer	65,000 (29,484)	12-60 (300-1500)	15 (381)	18 (457)

*\* These criteria should only be employed during construction. Vehicles exceeding these criteria must not be permitted to drive over the installation.*

## Fittings

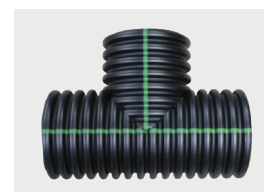
ADS offers a complete selection of fittings for gravity-flow pipe. These fittings are for plain end or field-cut pipe and are not to be used with bell and spigot connections. Fittings are available for pipe from 4"-60" (100-1500 mm) diameters and include couplers, bends, tees, wyes and reducers.



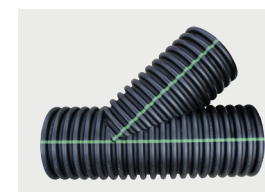
Split coupler being installed on N-12 plain end pipe.



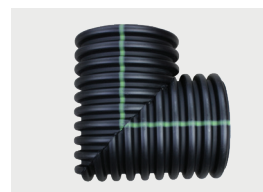
Split coupler



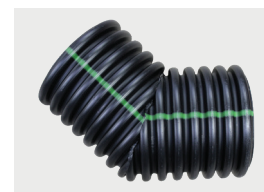
Tee



Wye



90° Bend



45° Bend



Reducer

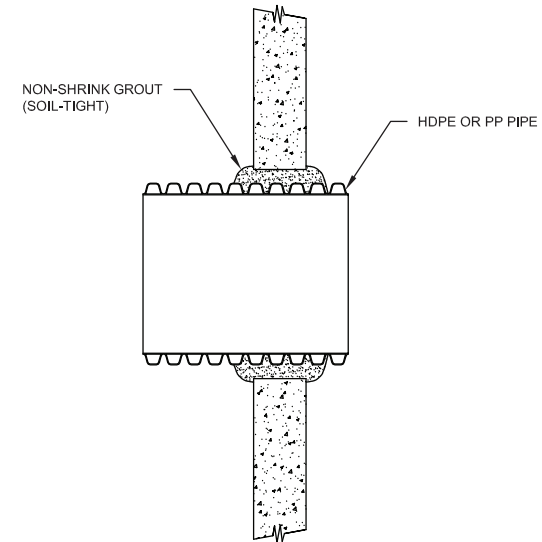
## Installing Gaskets for Fittings

When standard lengths of pipe must be cut to fit in a field application, the following instructions will ensure proper performing joints:

- For reduced spigot pipe ONLY, reducing spigot must be removed.
- Using a saw, cut in the center of the valley of the first full corrugation.
- Trim remaining plastic burrs from saw cut. Note: Failure to smoothly trim burrs may compromise joint integrity.
- Wipe clean first valley from end of pipe. This is where gasket will be placed.
- Hold gasket with both hands so printing is facing you.
- With printing on gasket face-up and toward spigot end of pipe, slide gasket into first corrugation valley, starting at bottom. Note: It is easier to pull gasket up to conform to valley.
- Slide gasket into first corrugation valley by hand.
- Ensure printing on gasket is face-up and toward spigot end of pipe.
- Vent tubes shall be appropriately scaled at joint where applicable, see Technical Note 5.10: Integral Bell Transition for HDPE.
- Using clean rag or brush, lubricate exposed gasket with pipe lubricant.
- Do not let lubricated section touch dirt or backfill, as foreign material could adhere to surface and compromise joint integrity.

## Manhole Connections

The most common method for connecting ADS pipe to a manhole is grouting into the structure. If grouting is allowed per project specifications, place and work non-shrink grout into the corrugations sealing both the inner and outer connection points around the entire circumference of the pipe at the manhole. When resilient connectors are required, refer to Technical Note 1.07.



## Flotation

For projects where a high groundwater table or water surrounding the pipe is expected, precautions should be taken to prevent flotation of thermoplastic pipe. Minimum required cover to prevent flotation is based on the assumption that the pipe is empty with the groundwater at the ground surface and a saturated soil density of 130 pcf. **For more information on flotation, refer to ADS Technical Note 5.05.**





# HP Storm Pipe

---



**///ADS**™

# HP Storm Pipe 12”–60” for Storm Applications

## Overview

HP Storm is a high-performance polypropylene (PP) pipe for gravity-flow storm drainage applications. HP Storm is the perfect choice when premium joint performance and/or greater pipe stiffness is required. HP Storm couples advanced polypropylene resin technology with a proven, dual-wall profile design for superior performance and durability.

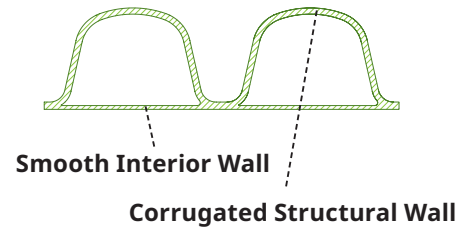
Specify HP Storm with confidence based on national standards and approvals. This innovative product meets or exceeds ASTM F2881 and AASHTO M330. From a federal perspective, polypropylene pipe is approved for use by the Army Corps of Engineers for storm drainage applications under Section 33 40 00 (Unified Facilities Guide Specifications). The Federal Aviation Authority (FAA) permits polypropylene pipe under airfield pavements per Item D-701, Pipe for Storm Drains and Culverts in AC 150/5370-10G (Standards for Specifying Construction of Airports). Additionally, the American Railway Engineering and Maintenance-of-Way Association (AREMA) approves polypropylene pipe in storm drainage applications under railroads.

## Advanced Dual Wall Profile Construction

HP Storm pipe utilizes a dual wall construction, providing increased pipe stiffness. The additional stiffness and beam strength enhances jobsite performance in stringent line and grade requirements. The pipe profile is completed with a smooth interior which provides additional strength and excellent flow characteristics.

## Superior Polypropylene Material

Made from an engineered impact modified co-polymer compound, the superior strength and material properties of polypropylene offer robust pipe stiffness, excellent handling characteristics, and long service life when compared to traditional storm sewer products. It is highly resistant to chemical attack and is unaffected by soils or effluents with PH ranges 1.5 to 14. The unique light grey resin color provides immediate jobsite recognition as well as improving the pipe's interior visibility during post-installation inspection.



Smooth Interior Wall



Polypropylene Resin



### Superior Joint Performance

HP Storm pipe has an extended bell that adds an additional factor of safety within each joint. The joint performance meets or exceeds the 10.8 psi laboratory performance standards per ASTM D3212 requirements. Third party certification of joint performance is available upon request.

In the field, each section of HP Storm may be tested by a low pressure air test, according to ASTM F1417, which is a commonly used standard and specifies that 3.5 psi air pressure be held for a specified length of time based upon pipe diameter and length of run.

Where an infiltration/exfiltration test is preferred, ASTM F2487 specifies a simplistic method of verifying proper joint performance.

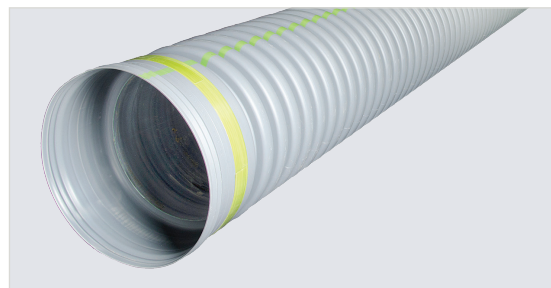
### Fittings

Both standard and custom fittings are available for the HP Storm product line. A complete line of standard Nyloplast PVC molded fittings are available in the 12"–30" (300-750 mm) mainline sizes.

Standard branch laterals are designed to accept SDR-35 or SDR-26 pipe.

### Diameter Range

HP Storm is currently manufactured in the 12"–60" (300-1500mm) size range and in 20-foot (6m) lengths. The 20-foot (6m) lengths aid in speed of installation and reduce the total number of joints.



**Extended Bell**



**Fabricated Wye Fitting**

Nominal Diameter in (mm)	Profile Type	Length ft (m)	Inside Diameter in (mm)	Outside Diameter in (mm)	Truckload Footage ft (m)
12 (300)	Dual Wall	20 (6)	12.2 (310)	14.5 (368)	2,400 (731.5)
15 (375)	Dual Wall	20 (6)	15.1 (384)	17.7 (450)	1,600 (487.7)
18 (450)	Dual Wall	20 (6)	18.2 (462)	21.4 (544)	1,120 (341.4)
24 (600)	Dual Wall	20 (6)	24.1 (612)	28.0 (711)	600 (182.9)
30 (750)	Dual Wall	20 (6)	30.2 (767)	35.5 (902)	360 (109.7)
36 (900)	Dual Wall	20 (6)	36.0 (914)	41.5 (1054)	240 (73.2)
42 (1050)	Dual Wall	20 (6)	42.0 (1067)	47.4 (1204)	160 (48.8)
48 (1200)	Dual Wall	20 (6)	47.9 (1217)	54.1 (1374)	120 (36.6)
60 (1500)	Dual Wall	20 (6)	59.9 (1521)	67.1 (1704)	80 (24.4)

## Tap Connections

A standard tapping product, such as Inserta Tee®, is compatible with HP Storm.

## Repair Couplers

Depending on local requirements, ADS offers a full range of repair coupling options. For soil-tight performance, split couplers and Mar Mac® repair bands are offered. Testable repair couplers are also available, which include stainless steel restraint bands and Nyloplast® PVC repair sleeves.

## 12"-60" Structure Connections

Storm sewer structure connection requirements vary greatly by region. For soil-tight performance, HP Storm exterior corrugations provide an effective profile for grouted connections. For watertight performance, ADS offers a selection of options utilizing some of the most widely used manhole connectors from companies such as A-Lok®, Trelleborg® and Press Seal® Gasket Corporation.

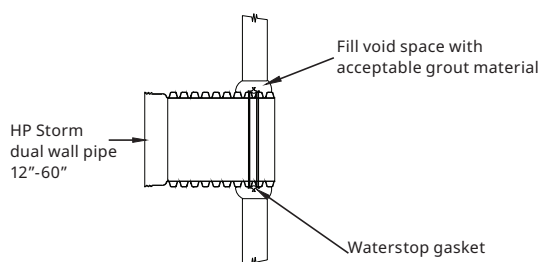


Typical Inserta Tee Tap

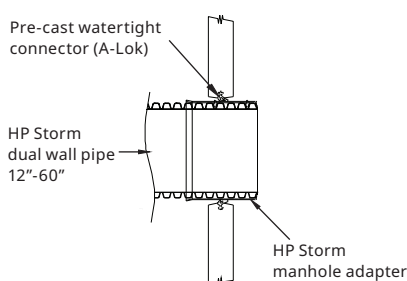


Repair Coupler

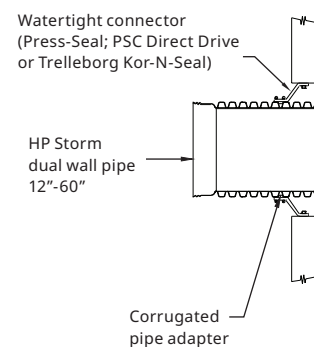
## Grouted Waterstop Manhole Connection



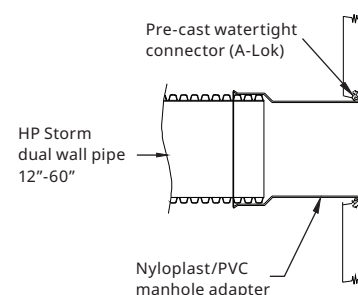
## Pre-Cast Compression Gasket Connection



## Flexible Boot Connection



## Pre-Cast Compression Gasket Connection



# HP Storm 12”–60” Pipe Specification

## Scope

This specification describes 12- through 60-inch (300 to 1500 mm) ADS HP Storm pipe for use in gravity-flow storm drainage applications.

## Pipe Requirements

ADS HP Storm pipe shall have a smooth interior and annular exterior corrugations.

- 12- through 60-inch (300 to 1500 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
- Manning’s “n” value for use in design shall be 0.012.

## Joint Performance

Pipe shall be joined using a bell and spigot joint meeting the requirements of ASTM F2881 or AASHTO M330. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during joint assembly. 12- through 60-inch (300 to 1500 mm) diameters shall have an exterior bell wrap installed by the manufacturer.

## Fittings

Fittings shall conform to ASTM F2881 or AASHTO M330. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

## Field Pipe and Joint Performance

To assure watertightness, field performance verification may be accomplished by testing in accordance with ASTM F1417 or F2487. Appropriate safety precautions must be used when field testing any pipe material. Contact the manufacturer for recommended leakage rates.

## Material Properties

Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2881, Section 5 and AASHTO M330, Section 6.1.

## Installation

Installation shall be in accordance with ASTM D2321 and ADS recommended installation guidelines, with the exception that minimum cover in traffic areas for 12- through 48-inch (300 to 1200 mm) diameters shall be one foot (0.3 m) and for 60-inch (1500 mm) diameters, the minimum cover shall be 2 feet (0.6 m) in single run applications. Backfill for minimum cover situations shall consist of Class 1, Class 2 (minimum 90% SPD) or Class 3 (minimum 95%) material. Maximum fill heights depend on embedment material and compaction level; please refer to Technical Note 2.04. Contact your local ADS representative or visit our website at [adspipe.com](http://adspipe.com) for a copy of the latest installation guidelines.

## Build America, Buy America (BABA)

ADS HP Storm pipe, manufactured in accordance with ASTM F2881 or AASHTO M330, complies with the requirements in the Build America, Buy America (BABA) Act.

## Pipe Dimensions

Nominal Diameter in (mm)	12 (300)	15 (375)	18 (450)	24 (600)	30 (750)	36 (900)	42 (1050)	48 (1200)	60 (1500)
Average Pipe I.D. in (mm)	12.2 (310)	15.1 (384)	18.2 (462)	24.1 (612)	30.2 (767)	36.0 (914)	42.0 (1067)	47.9 (1217)	59.9 (1521)
Average Pipe O.D. in (mm)	14.5 (368)	17.7 (450)	21.4 (544)	28.0 (711)	35.5 (902)	41.5 (1054)	47.4 (1204)	54.1 (1374)	67.1 (1704)
Minimum Pipe Stiffness at 5% Deflection* #/in/in (kN/m <sup>2</sup> )	75 (517)	60 (414)	56 (386)	50 (345)	46 (317)	40 (276)	35 (241)	35 (241)	30 (207)

\* Minimum pipe stiffness values listed; contact a representative for maximum values.





**adspipe.com**

800-821-6710

ADS "Terms and Conditions of Sale" are available on the ADS website, [www.adspipe.com](http://www.adspipe.com). The ADS logo and the Green Stripe are registered trademarks of Advanced Drainage Systems, Inc. Inserta Tee® is a registered trademark of Inserta Fittings, Co. A-Lok® is a registered trademark of A-Lok Products, Inc. NPC® is a registered trademark of Trelleborg. Press Seal® Gasket Corporation is a registered trademark of Press Seal Gasket Corporation. Mar Mac® is a registered trademark of Mar Mac Construction Products, Inc. Nyloplast® is a registered trademark of Nyloplast.  
© 2022 Advanced Drainage Systems, Inc. #10820 11/22 MH



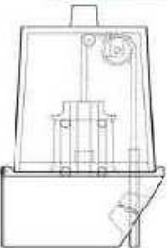


ILLUMINATOR

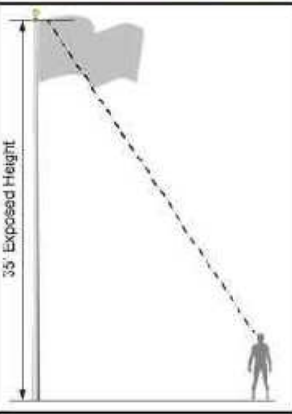
Model ILIH35

FLAGPOLE  
WAREHOUSE

Max unflagged wind speed: 200 mph  
Max flagged wind speed: 120 mph



**Truck Details**  
Revolving non-fouling internal halyard truck, cast aluminum, 26 stainless steel ball bearings and 2-1/2" diameter plated steel sheave



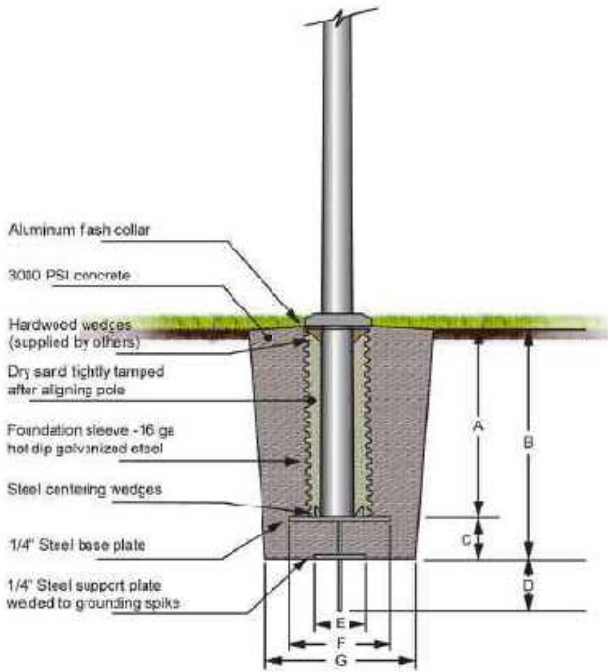
Project:	Ground set tapered aluminum flagpole: ALLOY 6063T6	Flagpole Warehouse	Date:
Location:	Exposed Height: 35' - 0"	3600 Cantrell Industrial CT.	Revision:
Architect:	Butt diameter: 7"	Acworth, GA 30101	
Contractor:	Top diameter: 3'-1/2"	www.flagpolewarehouse.com	
Customer:	Wall Thickness: .188"	Ship in: 1 Section	Job:

Model ILIH35

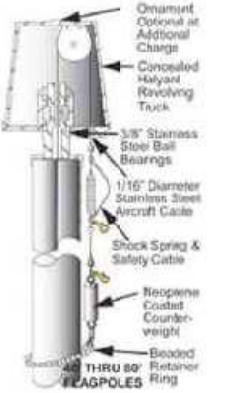
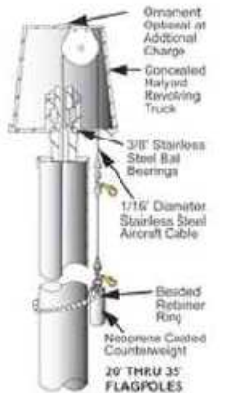
35' Pole Height

FLAGPOLE  
WAREHOUSE

Pole Height	A	B	C	D	E	F	G
20'	3' - 0"	3' - 6"	6"	12"	8"	12"	24"
25'	3' - 0"	3' - 6"	6"	12"	8"	16"	30"
30'	3' - 0"	3' - 6"	6"	12"	8"	16"	30"
35'	3' - 6"	4' - 0"	6"	12"	8"	16"	35"
40'	4' - 0"	4' - 6"	6"	12"	9"	18"	45"
45'	4' - 0"	4' - 6"	6"	12"	9"	18"	45"
60'	5' - 0"	5' - 6"	6"	12"	10"	20"	60"
60'	5' - 0"	5' - 10"	10"	14"	12"	34"	72"
70'	7' - 0"	8' - 0"	12"	12"	12"	24"	72"
80'	3' - 0"	8' - 0"	12"	12"	12"	24"	72"



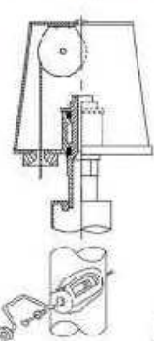
Project:	Ground set tapered aluminum flagpole: ALLOY 6063T6	Flagpole Warehouse	Date:
Location:	Exposed Height: 35' - 0"	3600 Cantrell Industrial CT.	Revision:
Architect:	Butt diameter: 7"	Acworth, GA 30101	
Contractor:	Top diameter: 3'-1/2"	www.flagpolewarehouse.com	
Customer:	Wall Thickness: .188"	Ship in: 1 Section	Job:



COMMERCIAL FLAGPOLE LIGHTING FIXTURE

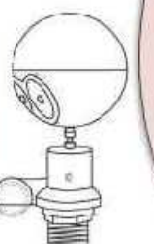
Its patented design lights the flag only and follows the flag as the wind blows it around the flagpole.

FLAGPOLE  
WAREHOUSE



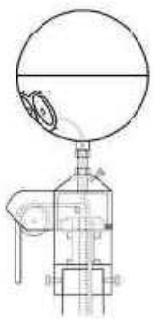
Internal Halyard Beacon Included

- Features include:
- Revolving Internal Halyard Truck, 359 degrees
  - Wire kit 10' past height of pole
  - LED Bulb
  - Utilizes a winch system to pull up and down the halyard
  - Transformer inside fixture, 120V Supply / 12V Output



External Halyard Beacon

- Features include:
- Wiring length of pole +10 feet
  - 8" Flagpole Beacon
  - Revolving 359 degrees
  - LED Bulb
  - Suitable for 3.5" top diameter poles
  - Transformer inside fixture, 120V Supply / 12V Output



Internal Halyard CAM System Beacon

- Features include:
- Wire kit 10' past height of pole
  - All Cam units require a pole top adapter
  - 8" Flagpole Beacon
  - Revolving 359 degrees
  - LED Bulb
  - Suitable for 20' to 40' poles
  - Transformer inside fixture, 120V Supply / 12V Output

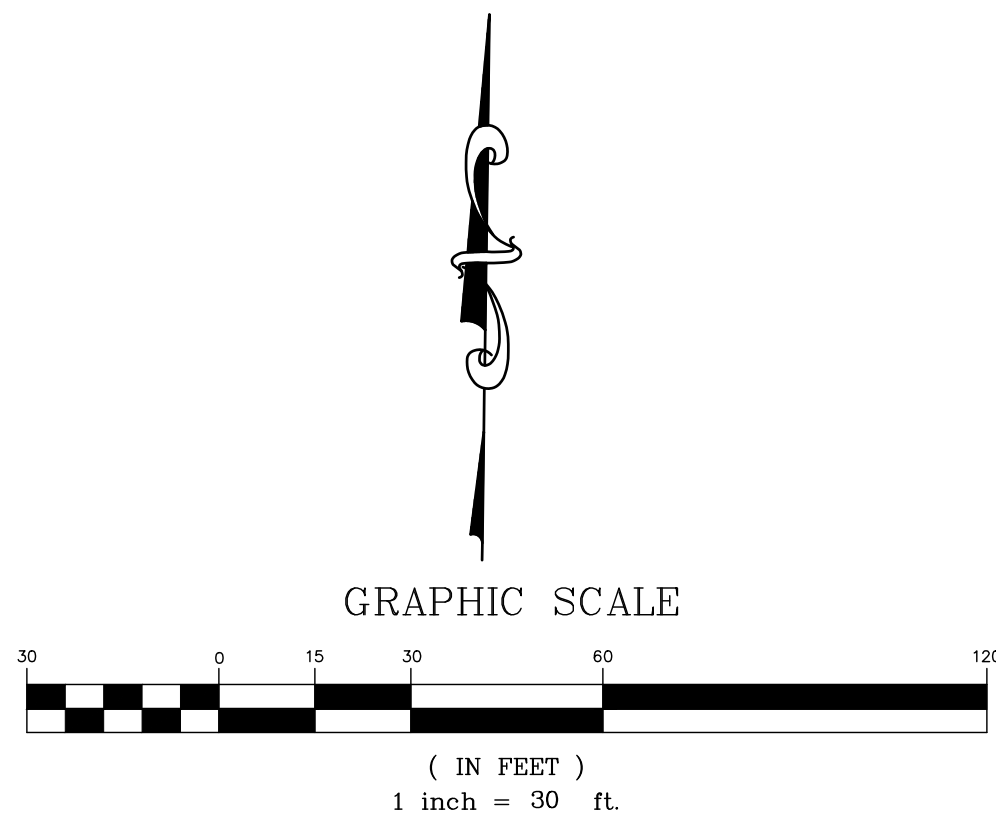


Project:		Flagpole Warehouse	Date:
Location:		3600 Cantrell Industrial CT.	Revision:
Architect:		Acworth, GA 30101	
Contractor:		www.flagpolewarehouse.com	
Customer:		1-800-962-0955	Job:

GROUND SET TAPERED ALUMINUM FLAGPOLE  
NOT TO SCALE



Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



**EROSION CONTROL NOTES:**

1. SEE SHEET G-002 FOR FOR CONSTRUCTION SEQUENCE AND GENERAL NOTES.
2. ALL SLOPES GREATER THAN 3:1 SHALL HAVE EROSION CONTROL MATTING INSTALLED.
3. ALL TOPOGRAPHY IS SHOWN AT 1 FOOT CONTOUR INTERVALS  
TOTAL LIMITS OF DISTURBANCE = 3.1 AC

LIGHT POLE TO BE RELOCATED

CONTRACTOR TO TRIM TREES AS NECESSARY

**KEY NOTES:**

- 1 EXISTING BUILDING TO REMAIN
- 2 EXISTING BUILDING TO BE REMOVED
- 3 EXISTING GRAVEL PARKING LOT
- 4 EXISTING GRAVEL WALKWAY
- 5 EXISTING CONCRETE SIDEWALK
- 6 EXISTING BRICK PAVERS TO BE REMOVED
- 7 EXISTING COVERED CONCRETE PAD TO REMAIN
- 8 EXISTING STAGE TO REMAIN
- 9 EXISTING ASPHALT PAVEMENT TO BE REMOVED
- 10 EXISTING LIGHT POLE TO REMAIN
- 11 EXISTING POWER POLE/OVERHEAD ELECTRIC TO REMAIN
- 12 EXISTING POWER POLE/OVERHEAD ELECTRIC TO BE RELOCATED
- 13 EXISTING OUTLET BOX TO REMAIN
- 14 EXISTING OUTLET BOX AND POWER POST TO BE REMOVED
- 15 EXISTING FLAG POLE TO REMAIN (TYP.)
- 16 EXISTING UTILITY INFRASTRUCTURE TO REMAIN
- 17 EXISTING WATER MAIN TO REMAIN
- 18 EXISTING SEWER FORCE MAIN TO REMAIN
- 19 EXISTING STORM DROP INLET TO REMAIN (TYP.)
- 20 EXISTING STORM PIPE TO REMAIN
- 21 EXIST. STORM DI TO BE CONVERTED TO JUNCTION MANHOLE
- 22 EXISTING STORM PIPE TO BE REMOVED
- 23 TYPE A INLET PROTECTION (TYP.)
- 24 SEDIMENT TUBE INLET PROTECTION (TYP.)
- 25 CONCRETE WASHOUT
- 26 GRAVEL CONSTRUCTION ENTRANCE
- 27 REINFORCED SILT FENCE
- 28 ORANGE TREE PROTECTION FENCING
- 29 EXISTING FLAG POLE TO BE RELOCATED
- 30 EXISTING WOOD DECK AND STEPS TO GRADE TO BE REMOVED
- 31 EXISTING ASPHALT PAVEMENT TO REMAIN
- 32 SILT FENCE ROCK OUTLET



5 LEGACY PARK ROAD  
SUITE A  
GREENVILLE, SC 29607  
(864) 990-0180

WWW.WKDICKSON.COM

WKD PROJECT NO. - 20231100.00.GV

Seal



**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS**

Project Number 23236  
Drawn By EAH  
Checked By JHE  
Date 30 APR 2025

Revisions  
A 6/3/2025 ADDENDUM 2

Drawing

DEMOLITION & ESC PLAN

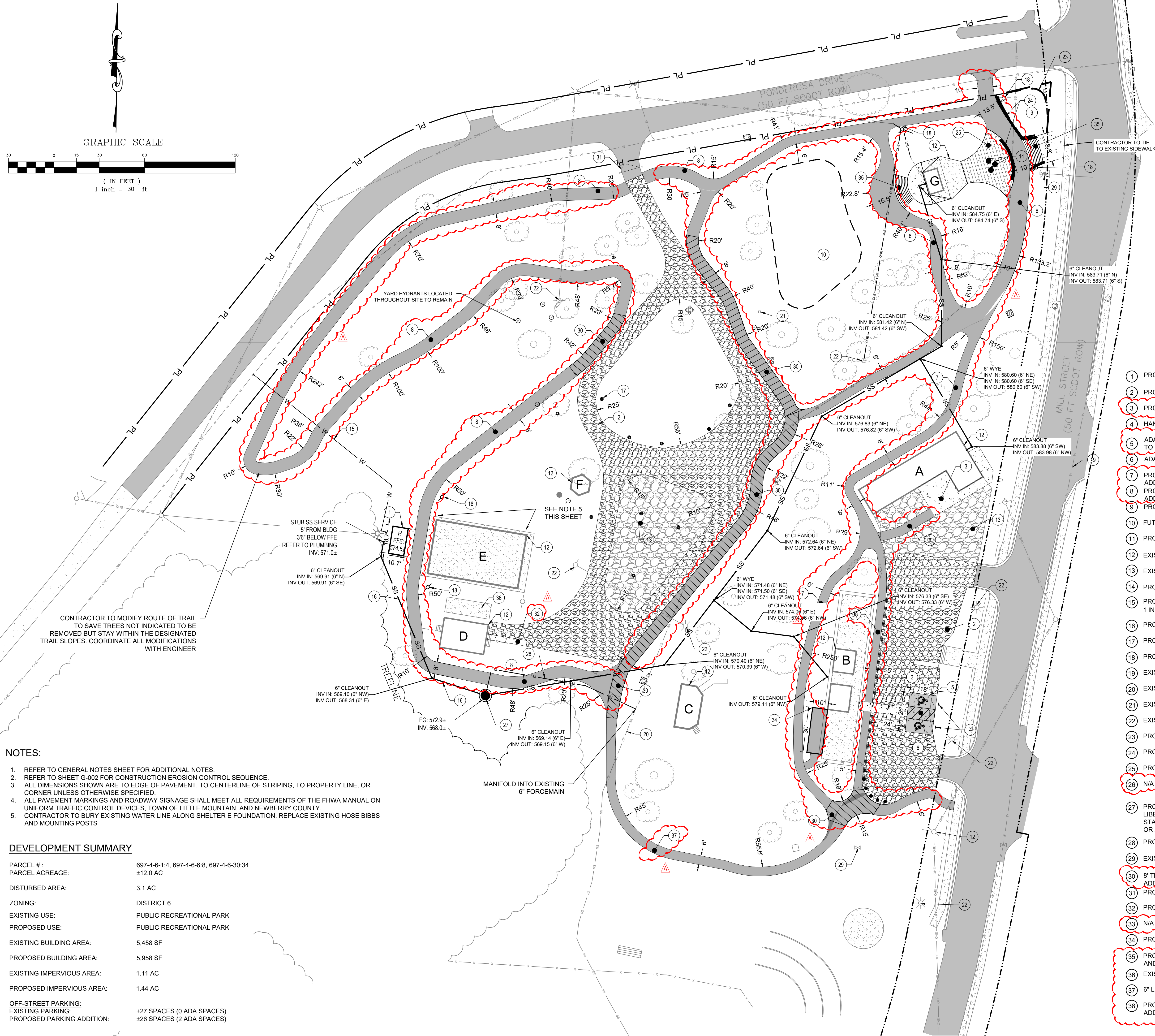
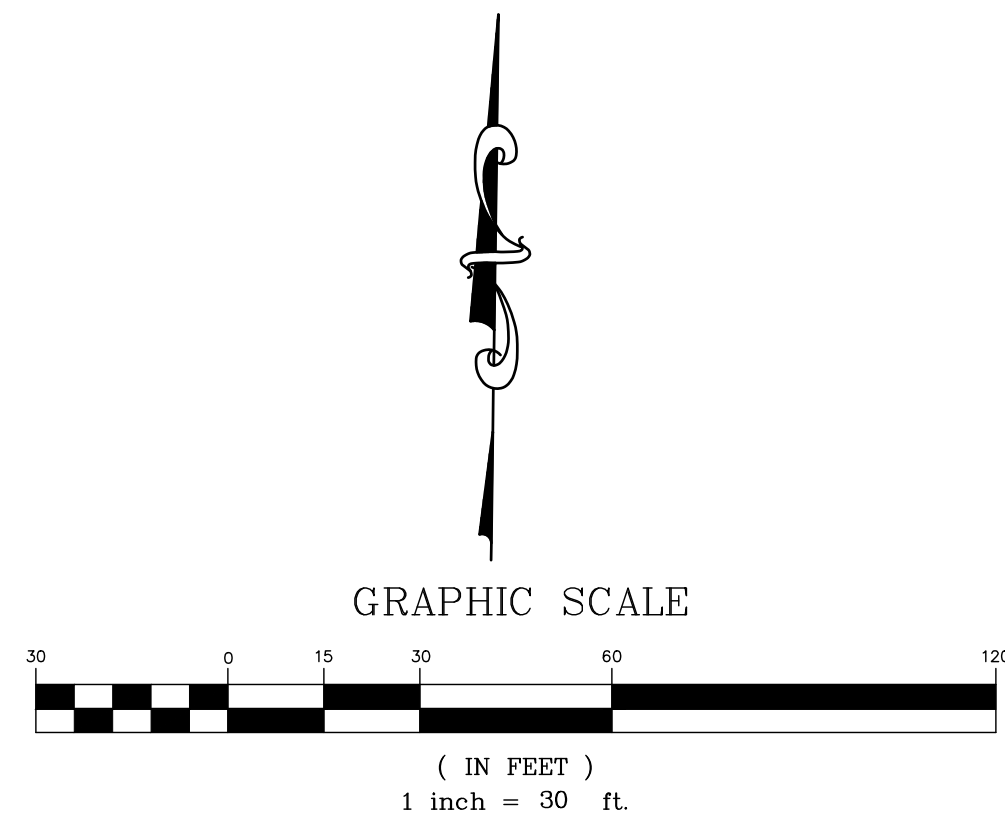
**CD-101**



**Know what's below.  
Call before you dig**



Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



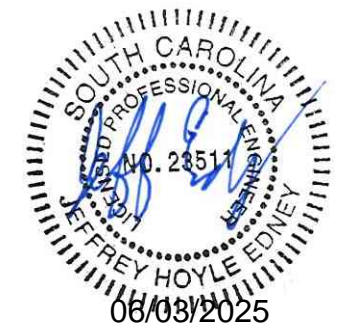
- NOTES:**
1. REFER TO GENERAL NOTES SHEET FOR ADDITIONAL NOTES.
  2. REFER TO SHEET G-002 FOR CONSTRUCTION EROSION CONTROL SEQUENCE.
  3. ALL DIMENSIONS SHOWN ARE TO EDGE OF PAVEMENT, TO CENTERLINE OF STRIPING, TO PROPERTY LINE, OR CORNER UNLESS OTHERWISE SPECIFIED.
  4. ALL PAVEMENT MARKINGS AND ROADWAY SIGNAGE SHALL MEET ALL REQUIREMENTS OF THE FHWA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, TOWN OF LITTLE MOUNTAIN, AND NEWBERRY COUNTY.
  5. CONTRACTOR TO BURY EXISTING WATER LINE ALONG SHELTER E FOUNDATION. REPLACE EXISTING HOSE BIBBS AND MOUNTING POSTS

**DEVELOPMENT SUMMARY**

PARCEL #:	697-4-6-1-4, 697-4-6-6-8, 697-4-6-30-34
PARCEL ACREAGE:	±12.0 AC
DISTURBED AREA:	3.1 AC
ZONING:	DISTRICT 6
EXISTING USE:	PUBLIC RECREATIONAL PARK
PROPOSED USE:	PUBLIC RECREATIONAL PARK
EXISTING BUILDING AREA:	5,458 SF
PROPOSED BUILDING AREA:	5,958 SF
EXISTING IMPERVIOUS AREA:	1.11 AC
PROPOSED IMPERVIOUS AREA:	1.44 AC
OFF-STREET PARKING:	
EXISTING PARKING:	±27 SPACES (0 ADA SPACES)
PROPOSED PARKING ADDITION:	±26 SPACES (2 ADA SPACES)

- KEY NOTES:**
- 1 PROPOSED BUILDING
  - 2 PROPOSED GRAVEL ADDITION (SEE DETAIL SHEET C-502)
  - 3 PROPOSED CONCRETE SIDEWALK
  - 4 HANDICAP PARKING SIGN, SEE DETAIL ON SHEET C-502
  - 5 ADA PARKING BAY, FOR PAVEMENT MARKING, REFER TO DETAIL ON SHEET C-502 - MEDIUM DUTY CONCRETE
  - 6 ADA LOADING/UNLOADING ZONE
  - 7 PROPOSED MIN. 6' LIGHT DUTY ASPHALT WALKWAY. ADD ALTERNATIVE CONCRETE SIDEWALK.
  - 8 PROPOSED MIN. 8' PEDESTRIAN LIGHT DUTY ASPHALT SIDEWALK (C-502). ADD ALTERNATE CONCRETE SIDEWALK.
  - 9 PROPOSED LANDSCAPE AREA (SEE LANDSCAPE PLANS)
  - 10 FUTURE PLAYGROUND AREA (BY OTHERS)
  - 11 PROPOSED BOLLARDS (SEE DETAIL SHEET C-502)
  - 12 EXISTING STRUCTURE TO REMAIN
  - 13 EXISTING GRAVEL AREA
  - 14 PROPOSED FLAG POLE RELOCATION
  - 15 PROPOSED 1 INCH SCH 40 PVC WATER SERVICE WITH 1 INCH METER AND 3/4" TAP
  - 16 PROPOSED 6 INCH SCH 40 PVC GRAVITY SEWER SERVICE
  - 17 PROPOSED RV POWER POST (TYP. OF 10)
  - 18 PROPOSED LIGHT/UTILITY POLE RELOCATION
  - 19 EXISTING 6-INCH PVC WATER MAIN (APPROX. LOCATION)
  - 20 EXISTING SANITARY SEWER FORCE MAIN
  - 21 EXISTING POWER POST
  - 22 EXISTING LIGHT/UTILITY POLE TO REMAIN
  - 23 PROPOSED BRICK MONUMENT SIGN
  - 24 PROPOSED SEATWALL
  - 25 PROPOSED PAVERS OR COLORED CONCRETE
  - 26 N/A
  - 27 PROPOSED SANITARY PUMP STATION  
LIBERTY DUPLEX D3672LSG ENGINEERED PUMP STATION WITH LSG202M GRINDER PUMPS OR APPROVED EQUAL
  - 28 PROPOSED 2 INCH SCH 40 PVC FORCE MAIN
  - 29 EXISTING 3/4"x3/4" WATER METER
  - 30 8' TRAFFIC RATED PAVEMENT SECTION - HEAVY DUTY ASPHALT. ADD ALTERNATIVE MEDIUM DUTY CONCRETE PAVEMENT.
  - 31 PROPOSED SWING GATE
  - 32 PROPOSED 24' CONCRETE RAMP
  - 33 N/A
  - 34 PROPOSED ACCESSIBLE VIEWING AREA
  - 35 PROPOSED CONCRETE STEPS AND HANDRAILS ON BOTH SIDES AND MIDDLE. SEE ARCHITECTURAL DRAWINGS AND DETAIL
  - 36 EXISTING CONCRETE PAD IN FRONT OF STAGE TO REMAIN
  - 37 6' LIGHT DUTY ASPHALT
  - 38 PROPOSED MIN. 5' LIGHT DUTY ASPHALT WALKWAY. ADD ALTERNATIVE CONCRETE SIDEWALK.

Seal



**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS**

Project Number 23236  
Drawn By EAH  
Checked By JHE  
Date 30 APR 2025

Revisions  
A 6/3/2025 ADDENDUM 2

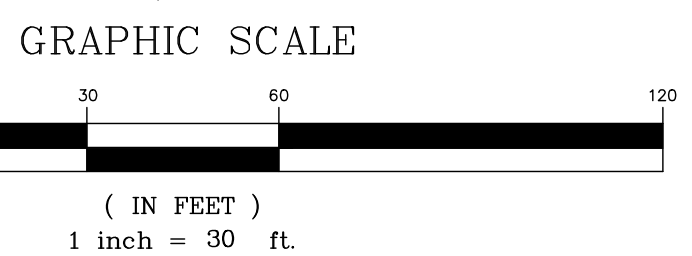
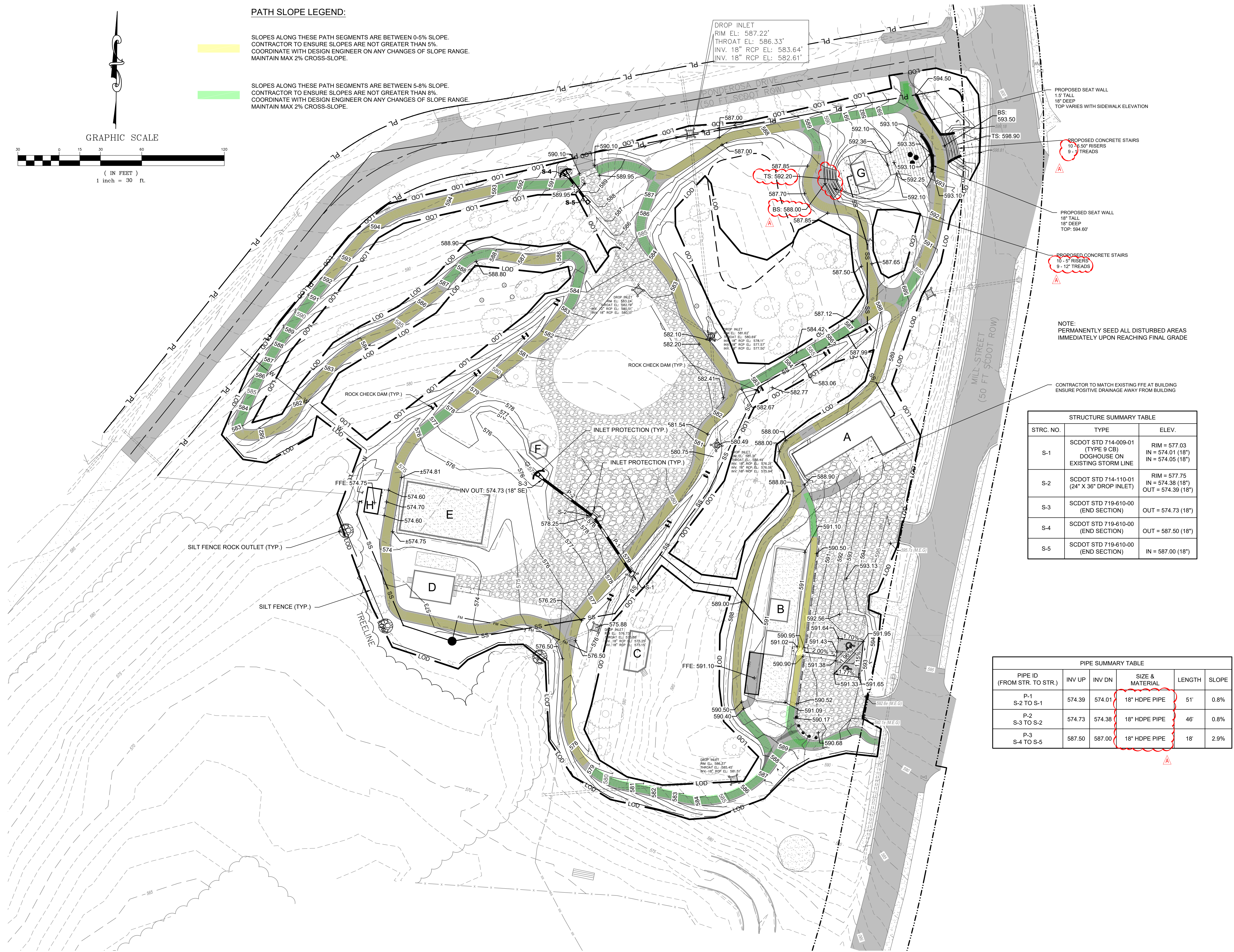
Drawing

**SITE LAYOUT & UTILITY  
PLAN**

**C-102**



Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



**PATH SLOPE LEGEND:**

SLOPES ALONG THESE PATH SEGMENTS ARE BETWEEN 0-5% SLOPE.  
CONTRACTOR TO ENSURE SLOPES ARE NOT GREATER THAN 5%.  
COORDINATE WITH DESIGN ENGINEER ON ANY CHANGES OF SLOPE RANGE.  
MAINTAIN MAX 2% CROSS-SLOPE.

SLOPES ALONG THESE PATH SEGMENTS ARE BETWEEN 5-8% SLOPE.  
CONTRACTOR TO ENSURE SLOPES ARE NOT GREATER THAN 8%.  
COORDINATE WITH DESIGN ENGINEER ON ANY CHANGES OF SLOPE RANGE.  
MAINTAIN MAX 2% CROSS-SLOPE.

PROPOSED SEAT WALL  
1.5' TALL  
18" DEEP  
TOP VARIES WITH SIDEWALK ELEVATION

PROPOSED CONCRETE STAIRS  
10 - 6.50" RISERS  
9 - 12" TREADS

PROPOSED SEAT WALL  
18" TALL  
18" DEEP  
TOP: 594.60'

PROPOSED CONCRETE STAIRS  
10 - 5" RISERS  
9 - 12" TREADS

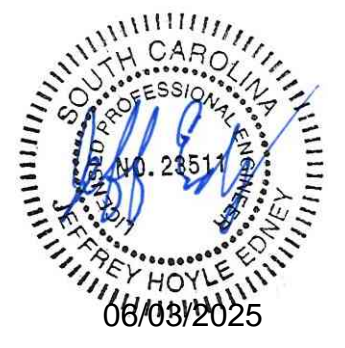
NOTE:  
PERMANENTLY SEED ALL DISTURBED AREAS  
IMMEDIATELY UPON REACHING FINAL GRADE

CONTRACTOR TO MATCH EXISTING FFE AT BUILDING  
ENSURE POSITIVE DRAINAGE AWAY FROM BUILDING

STRUCTURE SUMMARY TABLE		
STRC. NO.	TYPE	ELEV.
S-1	SCDOT STD 714-009-01 (TYPE 9 CB) DOGHOUSE ON EXISTING STORM LINE	RIM = 577.03 IN = 574.01 (18") IN = 574.05 (18")
S-2	SCDOT STD 714-110-01 (24" X 36" DROP INLET)	RIM = 577.75 IN = 574.38 (18") OUT = 574.39 (18")
S-3	SCDOT STD 719-610-00 (END SECTION)	OUT = 574.73 (18")
S-4	SCDOT STD 719-610-00 (END SECTION)	OUT = 587.50 (18")
S-5	SCDOT STD 719-610-00 (END SECTION)	IN = 587.00 (18")

PIPE SUMMARY TABLE					
PIPE ID (FROM STR. TO STR.)	INV UP	INV DN	SIZE & MATERIAL	LENGTH	SLOPE
P-1 S-2 TO S-1	574.39	574.01	18" HDPE PIPE	51'	0.8%
P-2 S-3 TO S-2	574.73	574.38	18" HDPE PIPE	46'	0.8%
P-3 S-4 TO S-5	587.50	587.00	18" HDPE PIPE	18'	2.9%

Seal



**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS**

Project Number 23236  
Drawn By EAH  
Checked By JHE  
Date 30 APR 2025

Revisions  
A 6/3/2025 ADDENDUM 2

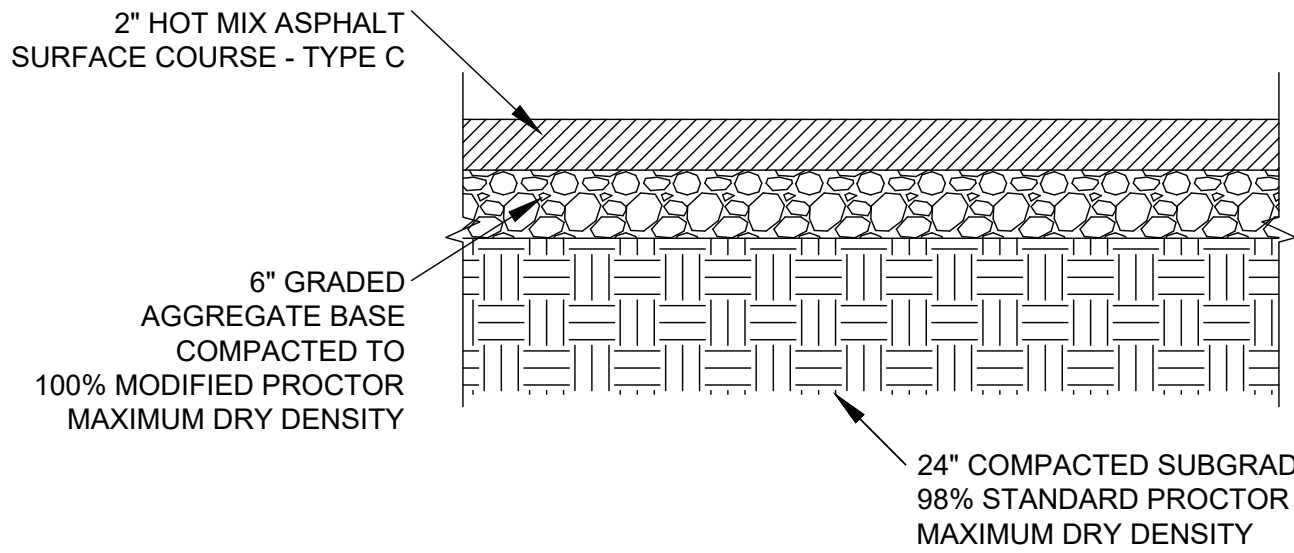
Drawing

**GRADING & DRAINAGE  
PLAN**

**C-103**

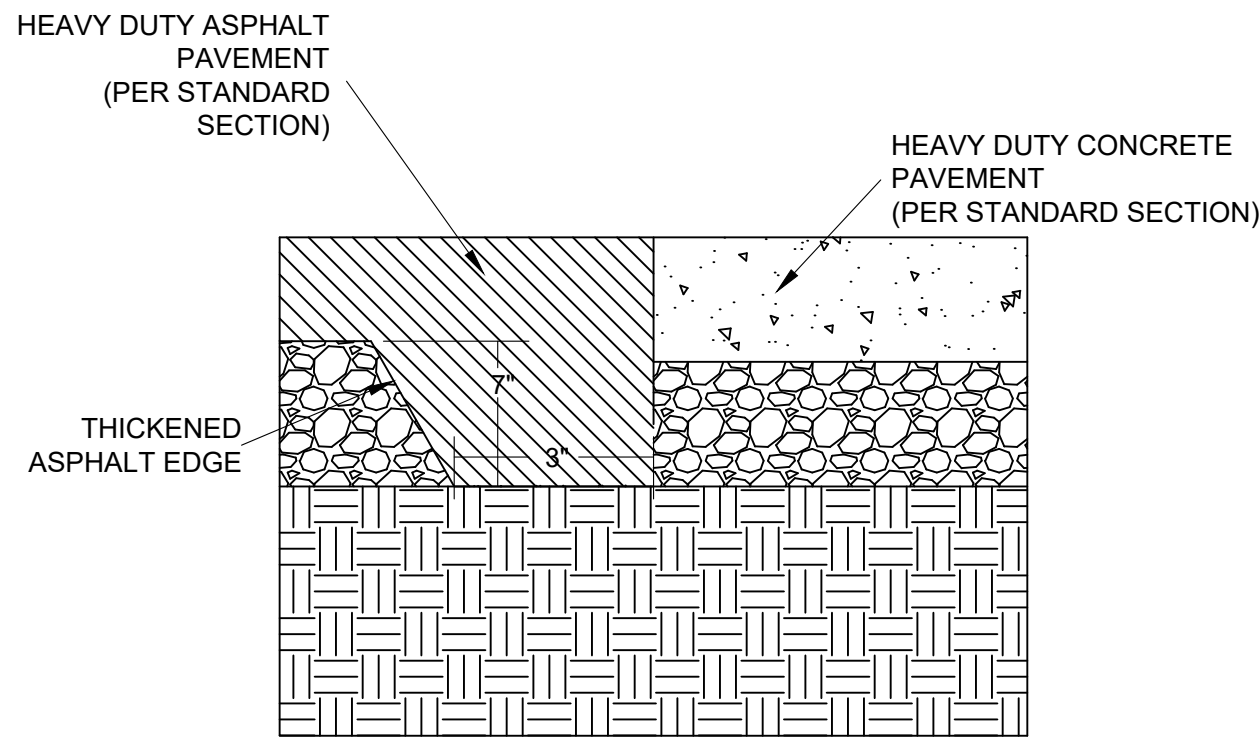


Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.

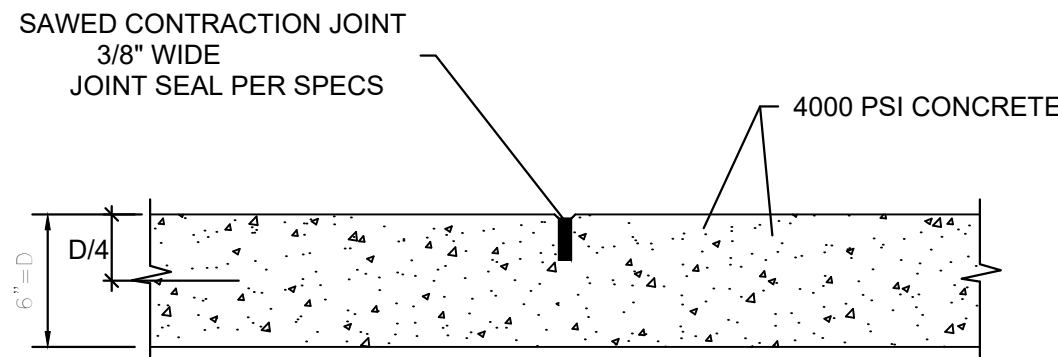


- NOTES:
1. ASPHALT THICKNESS NOTED SHALL BE THE FINAL COMPACTED MATERIAL THICKNESS.
  2. PAVEMENT DESIGN PROVIDED FOR BID PURPOSES ONLY. ACTUAL PAVEMENT DESIGN TO BE PROVIDED BY GEOTECHNICAL INVESTIGATION AND RECOMMENDATION BY OTHERS.
  3. CONCRETE AND BASE COURSE PREPARED AND INSTALLED ACCORDING TO SCDOT STANDARD SPECIFICATIONS, LATEST EDITION.

**LIGHT DUTY ASPHALT PAVEMENT SECTION**  
**(ADD ALTERNATE)**  
NOT TO SCALE



**THICKENED EDGE ASPHALT PAVEMENT SECTION**  
NOT TO SCALE



SEE PLAN VIEW FOR CONTRACTION JOINT LOCATION - IF NOT SHOWN, PROVIDE CONTRACTION JOINTS AT 12' ON CENTER MAX.

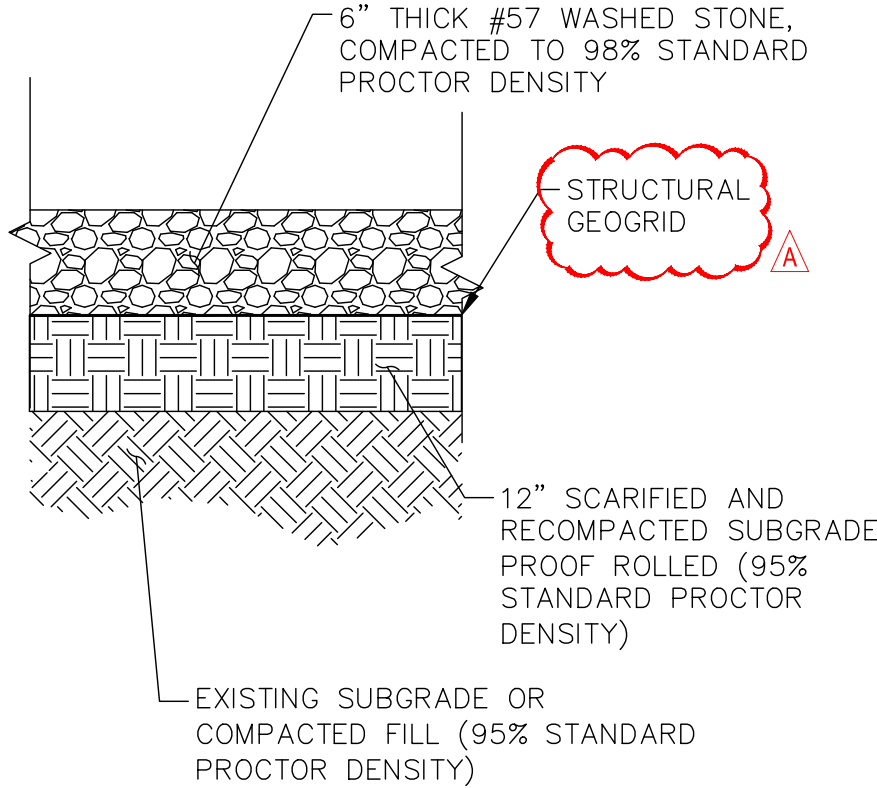
CONTRACTOR TO SAW CONTRACTION JOINTS 4 TO 8 HOURS AFTER CONCRETE PLACEMENT

**CONCRETE CONTRACTION JOINT**  
**6" PAVEMENT (S.J.) TRANSVERSE OR LONGITUDINAL**



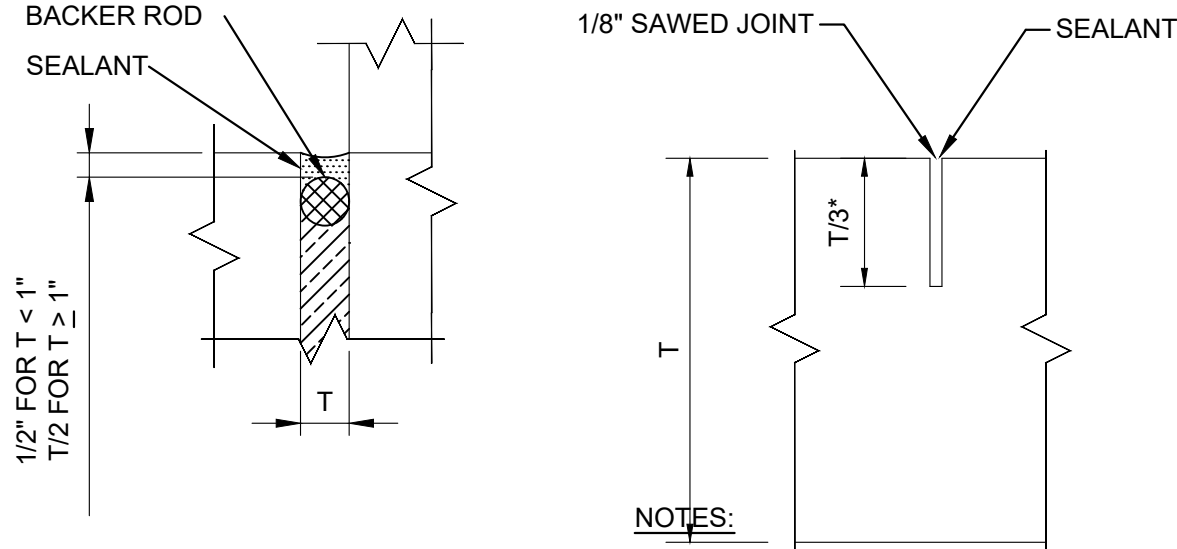
STOP BAR EDGE CLOSEST TO ROADWAY TO BE 6' FROM EDGE OF PAVEMENT

**STOP BAR**  
NOT TO SCALE



- NOTES:
1. SUBGRADE AND SUBBASE SHALL BE CONSTRUCTED IN ACCORDANCE WITH GEOTECHNICAL REPORT.

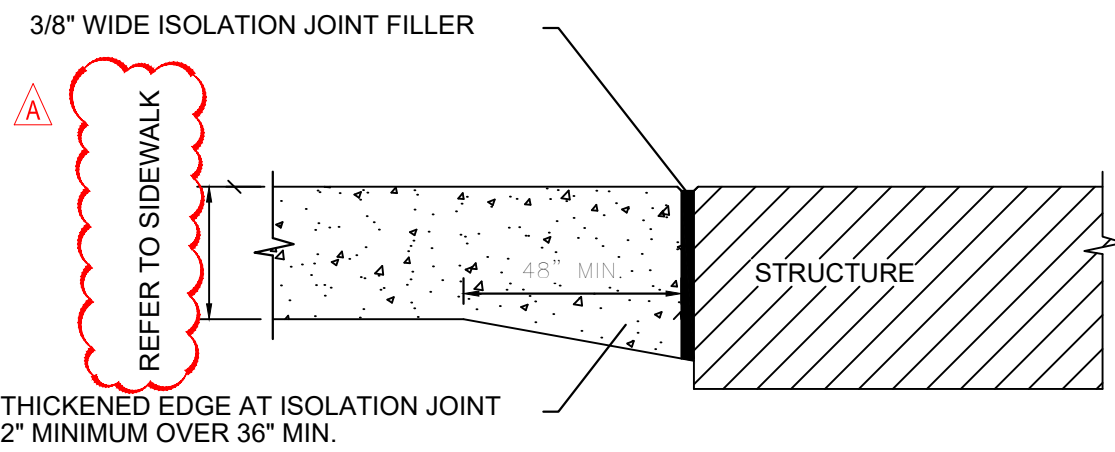
**GRAVEL SURFACING**  
N.T.S.



- NOTES:
1. USE T=1" FOR NEW CONCRETE ADJACENT TO BUILDINGS OR EXISTING SAW-CUT PAVEMENT/CONCRETE.
  2. PROVIDE 1/2" EXPANSION JOINT WHERE CONCRETE PAVING AND SIDEWALK ABUTS ADJACENT STRUCTURES AND DISSIMILAR SURFACES.
- NOTES:
1. JOINTS SHALL BE LOCATED AS SHOWN ON THE PLANS OR 15'-0" OC EW (MAX).
  2. JOINT DEPTH = 2 1/2" (MAX)

**EXPANSION JOINT**  
NOT TO SCALE

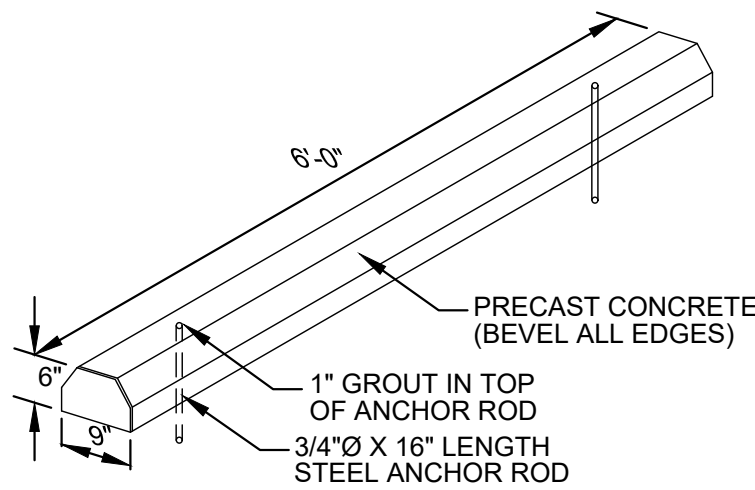
**CONTROL JOINT**  
NOT TO SCALE



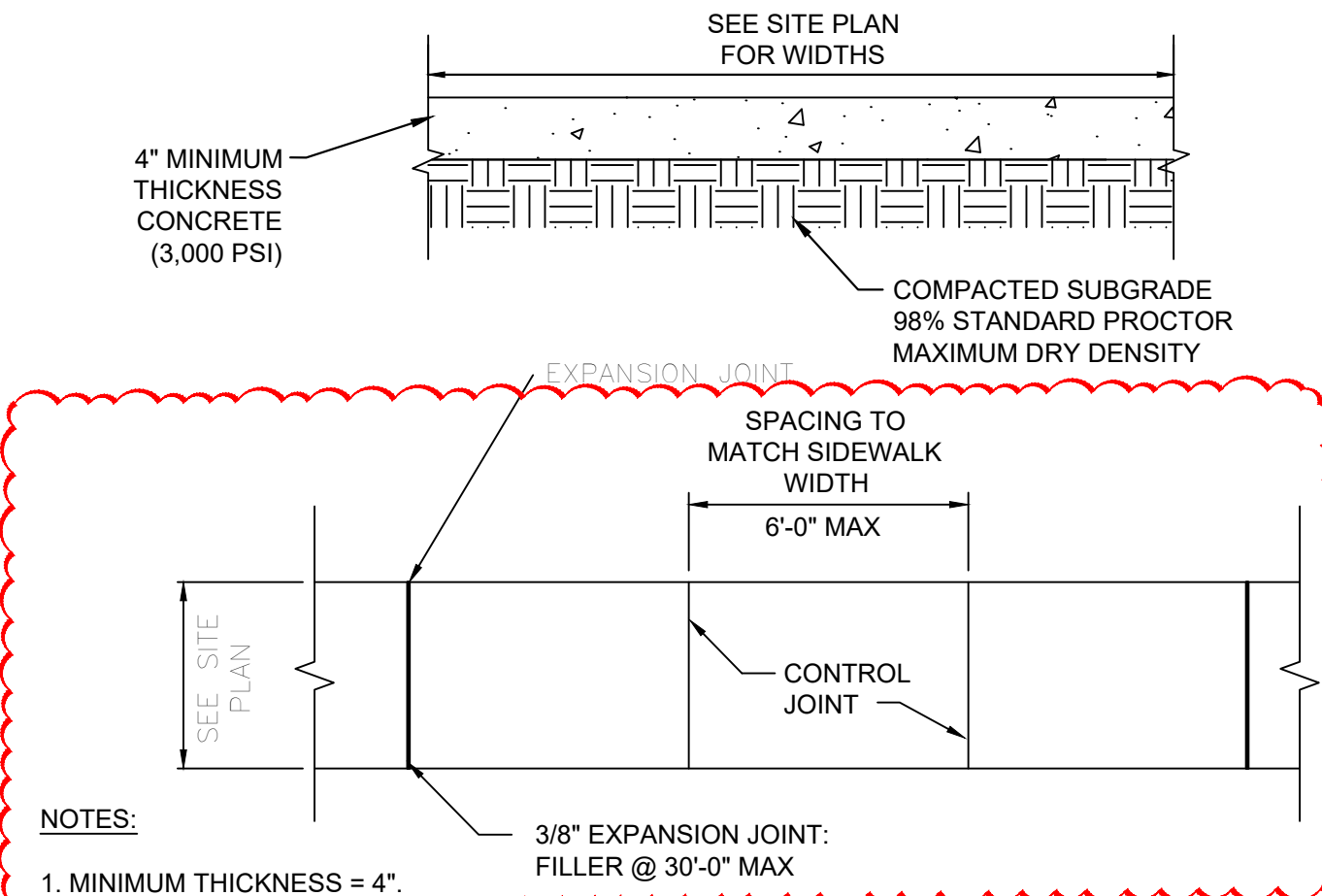
PROVIDE ISOLATION JOINTS WHEN CONCRETE ABUTS ANY STRUCTURE, ALTERNATE PAVEMENT AREA, OR ALTERNATIVE OBJECT

PROVIDE THICKENED EDGE AS SHOWN ABOVE WHEN CONCRETE ABUTS EXISTING PAVEMENTS AND AT INTERSECTIONS AS NOTED. THICKENED EDGES ARE NOT REQUIRED AT DRAINAGE INLETS OR ADJACENT TO CURBING.

**CONCRETE PAVEMENT ISOLATION JOINT (E.J.)**

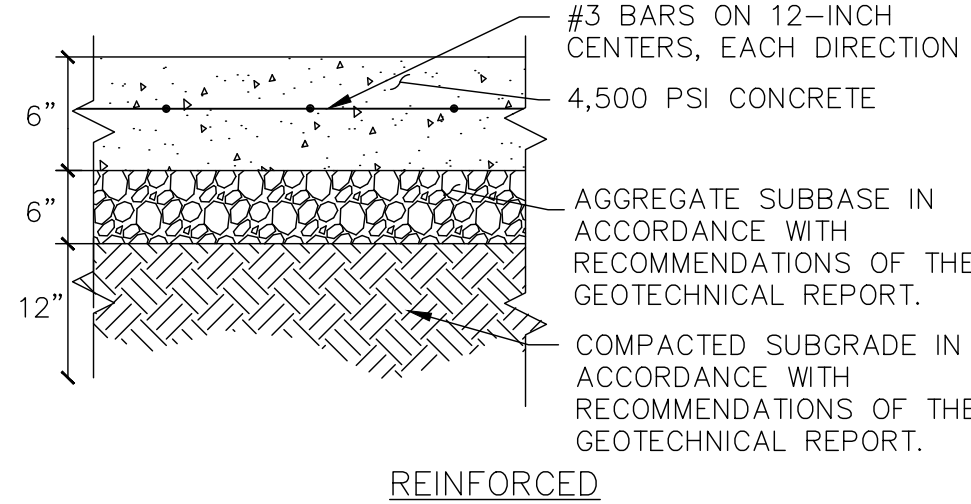


**PRECAST CONCRETE WHEELSTOP**  
NOT TO SCALE

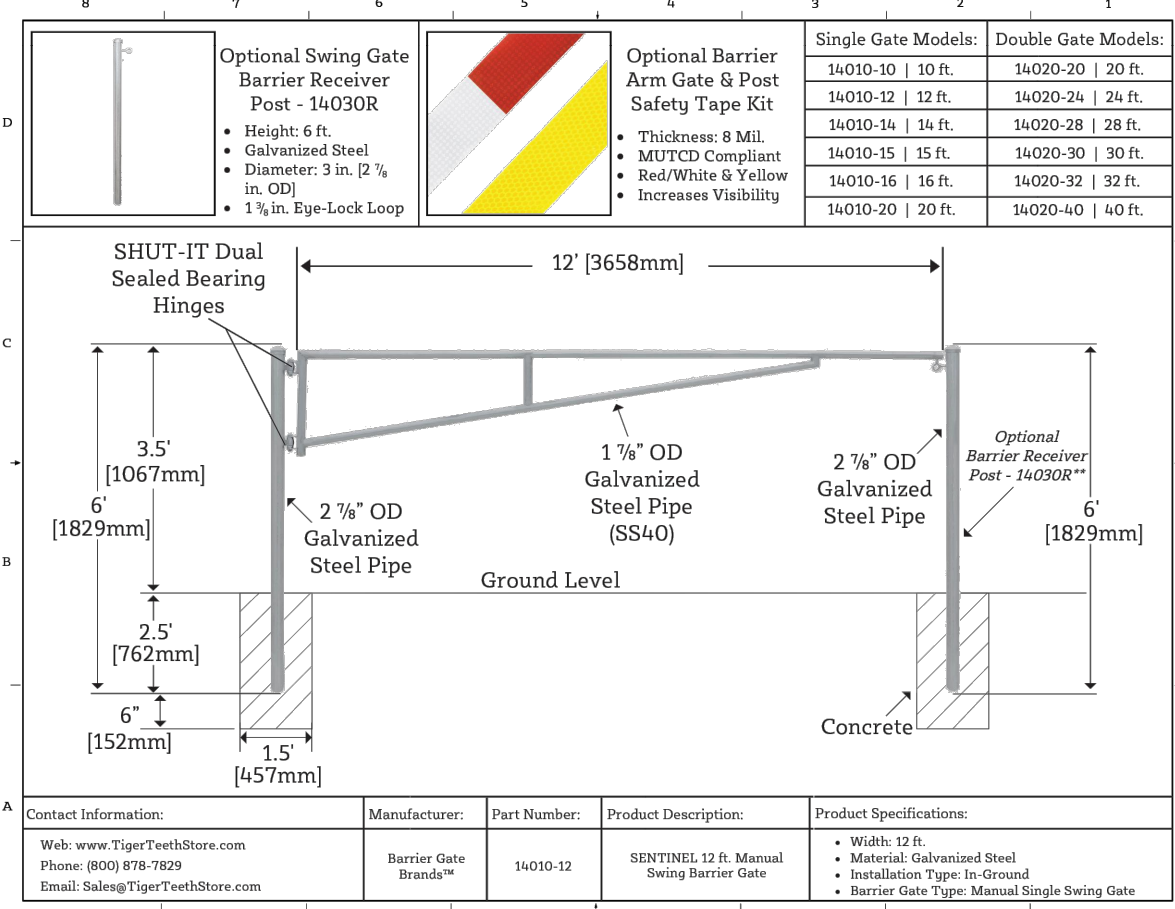


- NOTES:
1. MINIMUM THICKNESS = 4".
  2. PROVIDE EXPANSION JOINTS @ INTERSECTIONS OF WALKS AND WHERE WALK ABUTTS OTHER STRUCTURES.
  3. 3000 PSI MINIMUM CONCRETE FOR 28 DAY STRENGTH.
  4. SIDEWALKS TO HAVE BROOM FINISH.
  5. ALL JOINTS AND EDGES TO BE TOOLED.
  6. CONTROL JOINTS TO BE TOOLED TO A MINIMUM DEPTH OF 1".
  7. SMOOTH TROWEL 3" "PICTURE FRAME" EDGE, TYP.

**CONCRETE SIDEWALK**  
NOT TO SCALE



**MEDIUM DUTY CONCRETE PAVING**  
N.T.S.



**SWING GATE (OR APPROVED EQUIVALENT) DETAIL**

N.T.S.

Seal



Project



**NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS**

Project Number 23236  
Drawn By EAH  
Checked By JHE  
Date 30 APR 2025

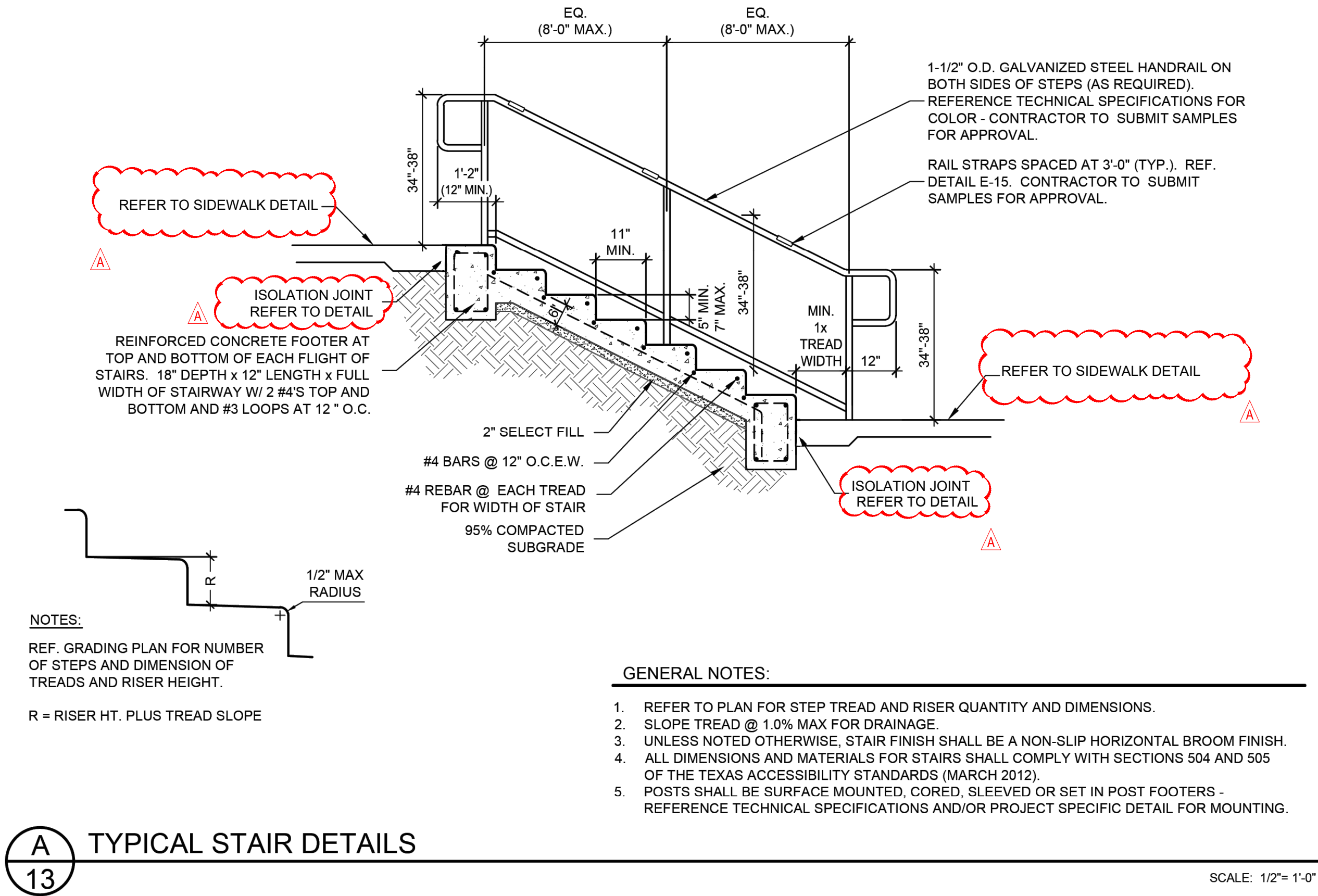
Revisions  
A 6/3/2025 ADDENDUM 2

Drawing

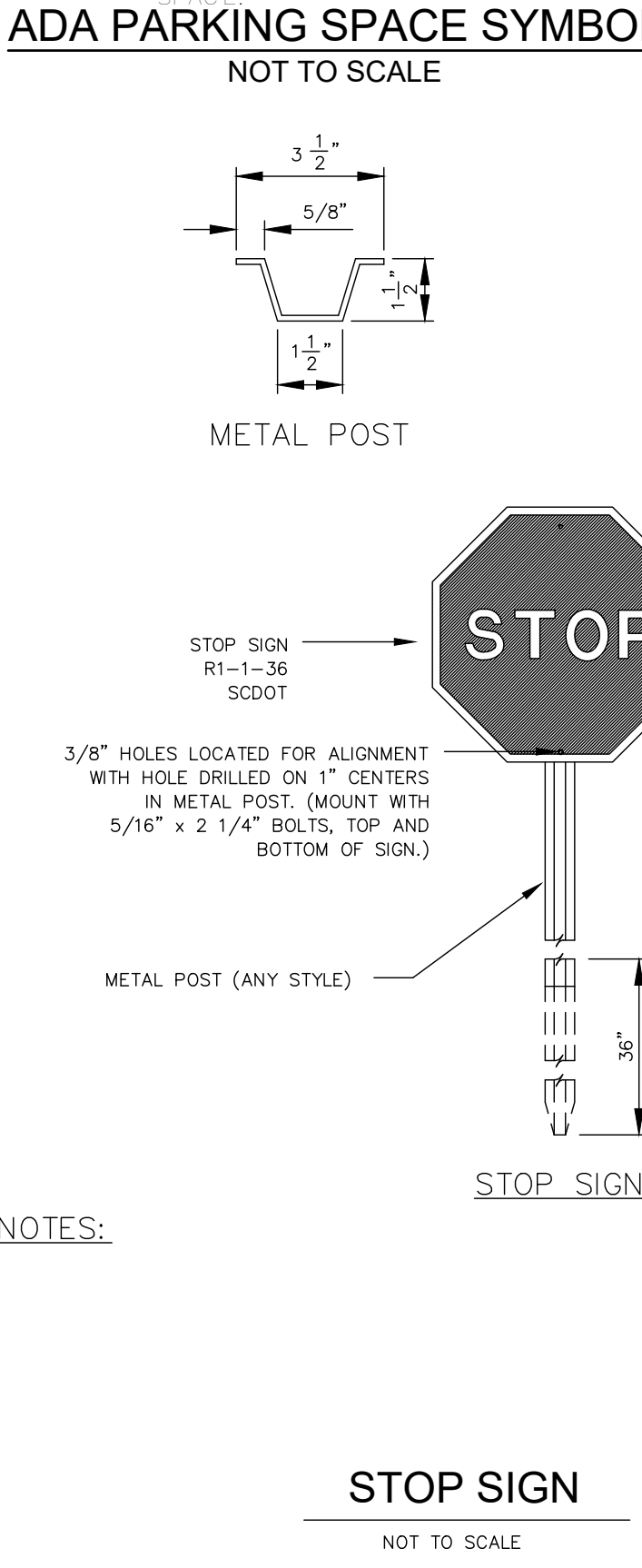
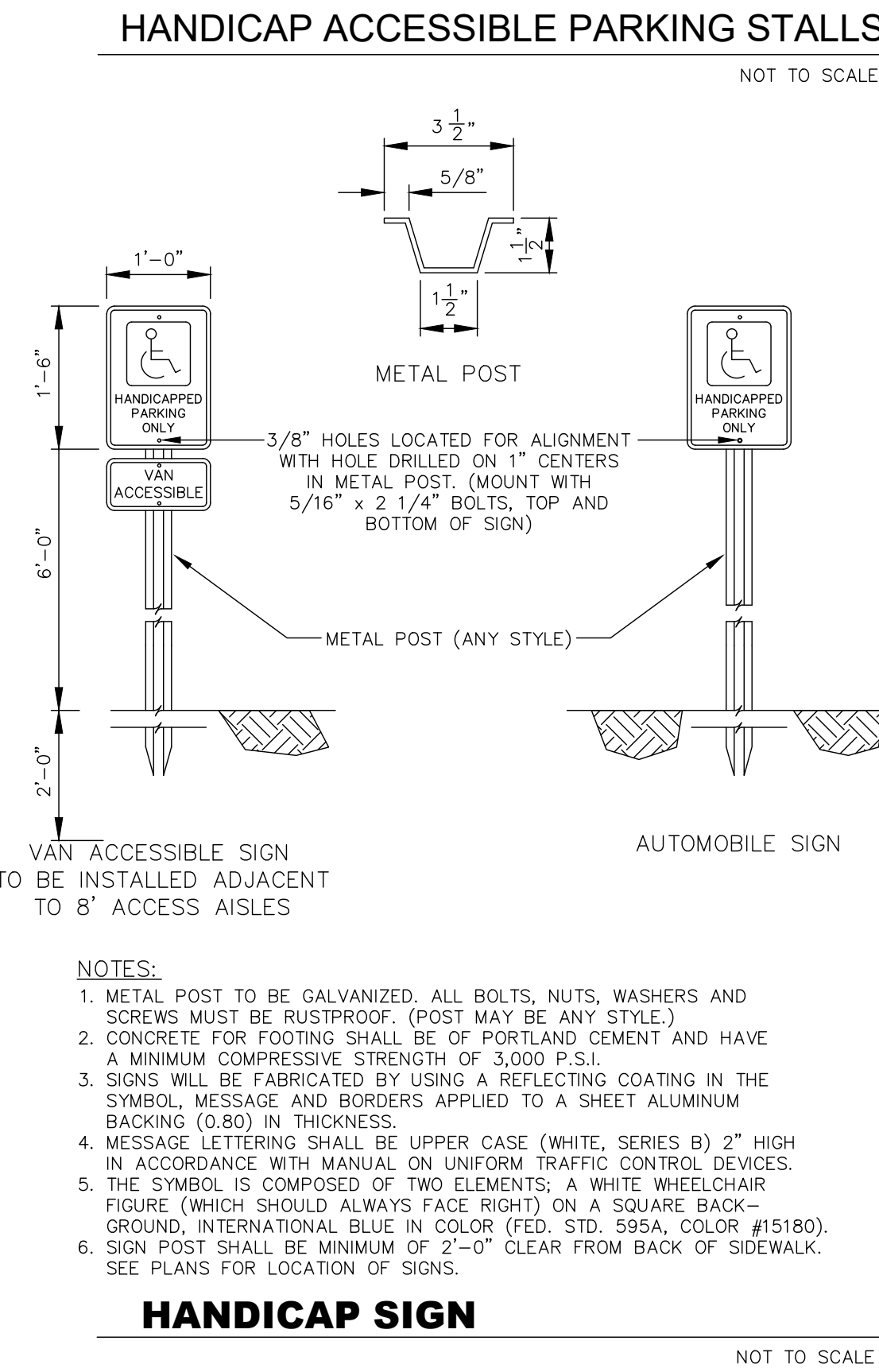
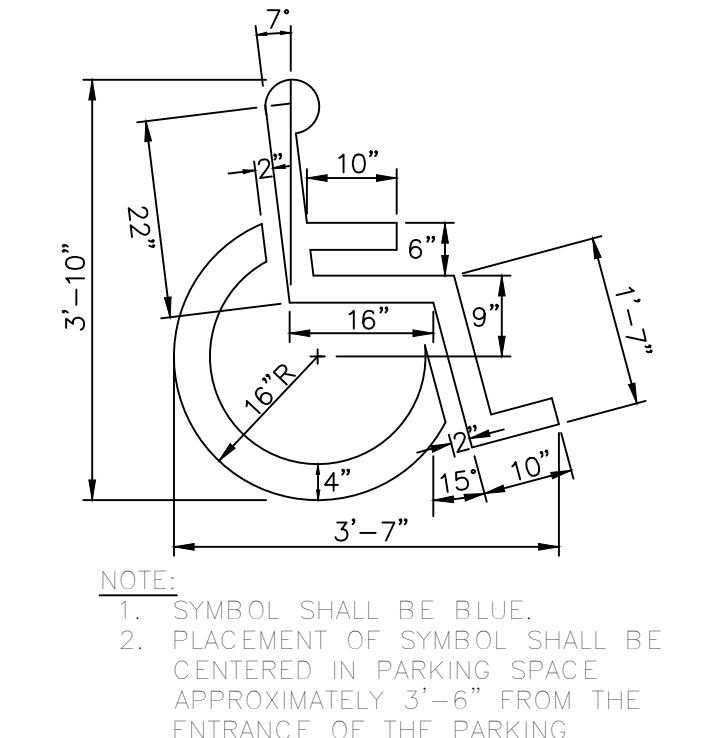
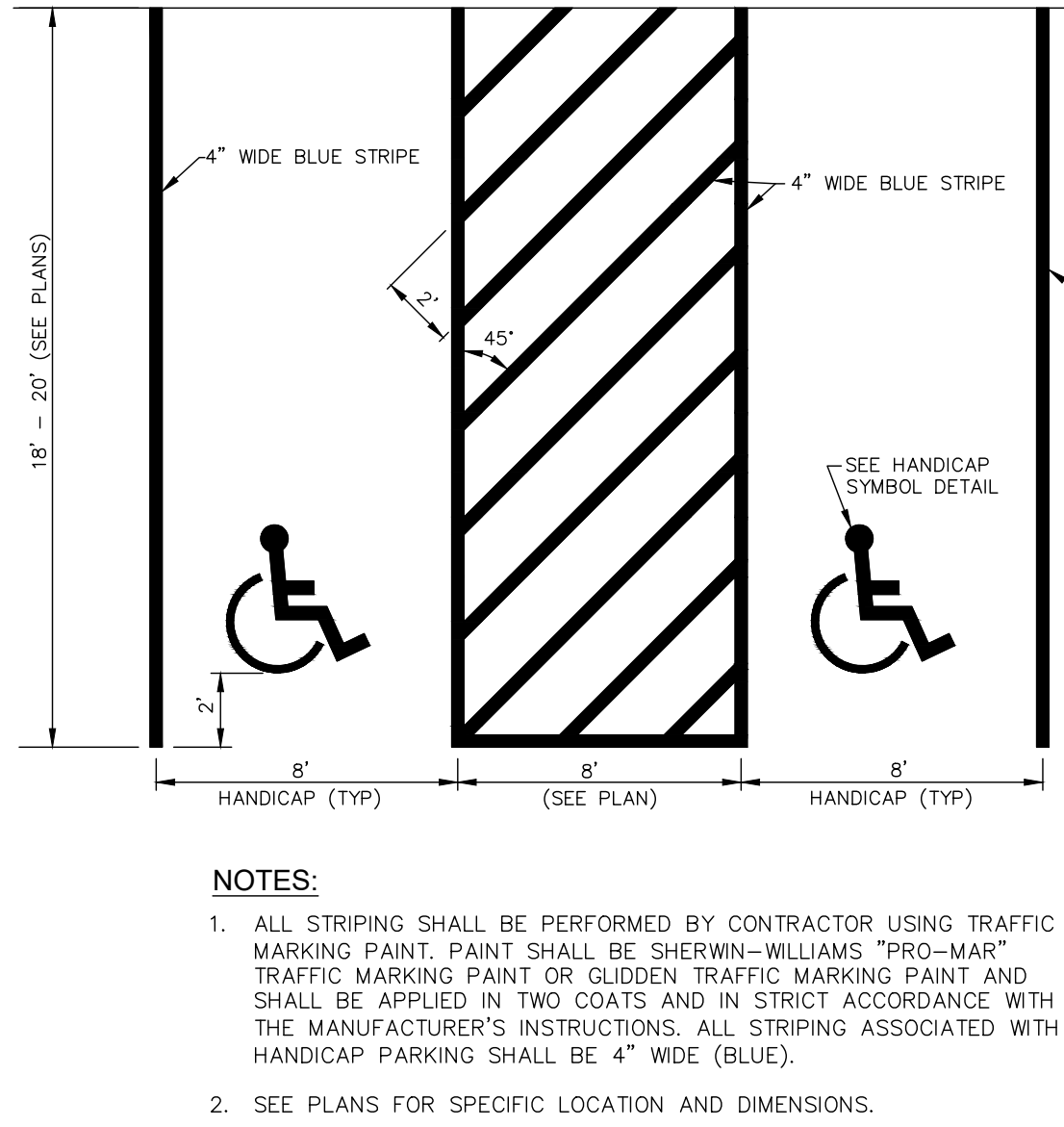
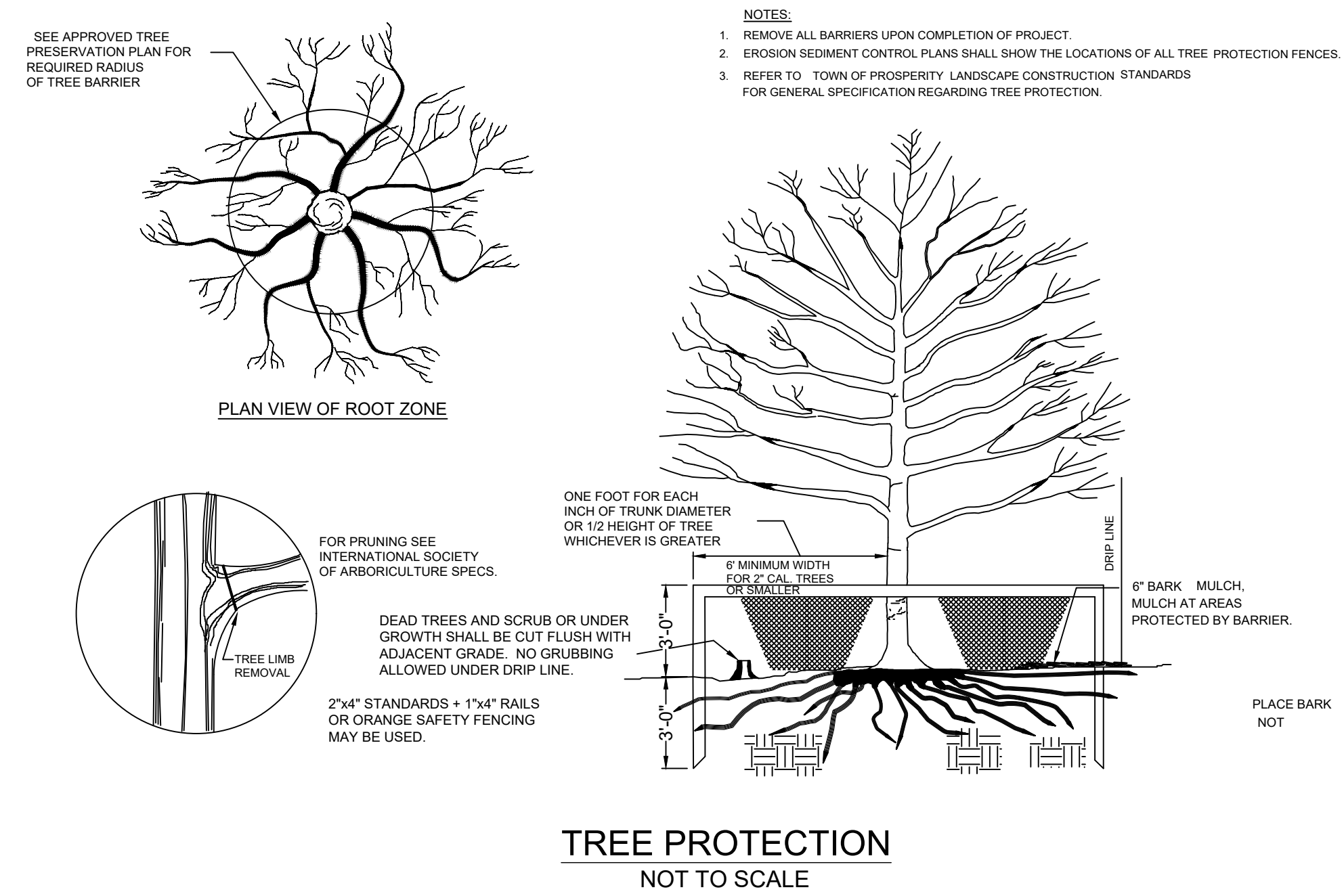
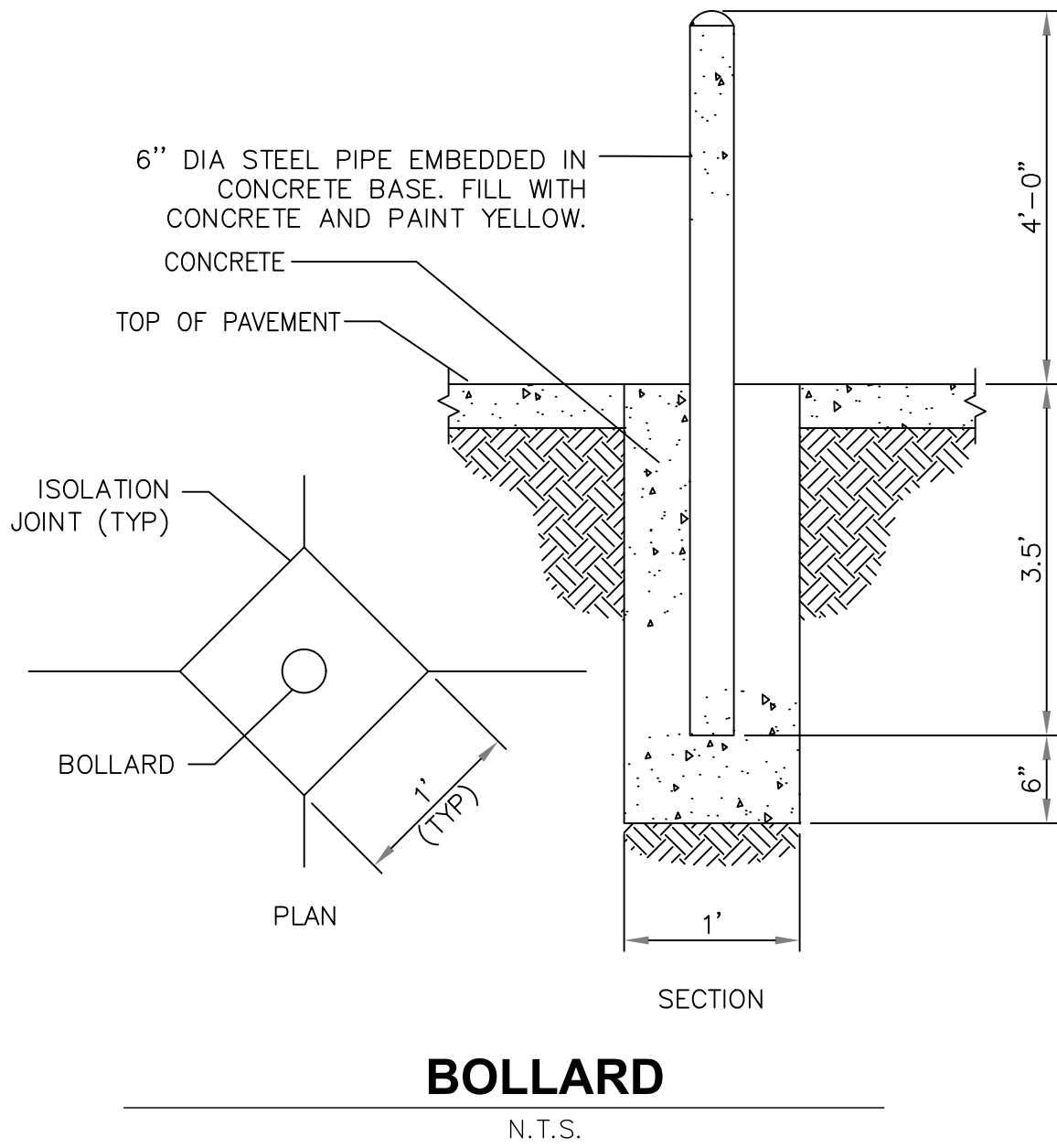
SITE DETAILS



Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



COORDINATE WITH ARCHITECT FOR FINAL DESIGN



**WK DICKSON**  
community infrastructure consultants

5 LEGACY PARK ROAD  
SUITE A  
GREENVILLE, SC 29607  
(1)864-990-0180  
WWW.WKDICKSON.COM

WKD PROJECT NO. - 20231100.00.GV

Seal

**SOUTH CAROLINA**  
W.K. DICKSON & CO., LLC  
No. 000177  
REGISTERED PROFESSIONAL ENGINEER  
06/09/2025

**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project

**historic Little Mountain**

**NEWBERRY COUNTY REUNION PARK IMPROVEMENTS**

Project Number 23236  
Drawn By EAH  
Checked By JHE  
Date 30 APR 2025

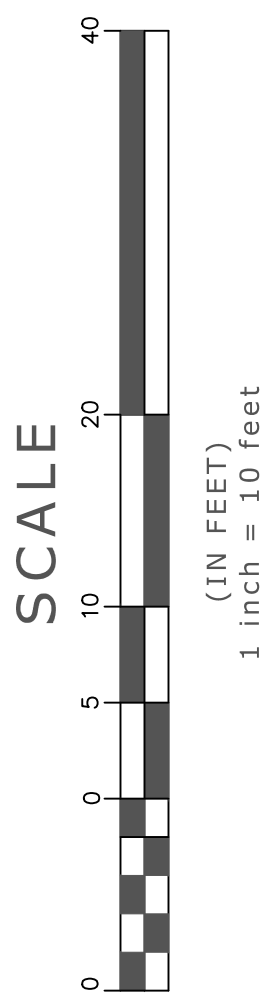
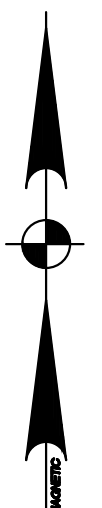
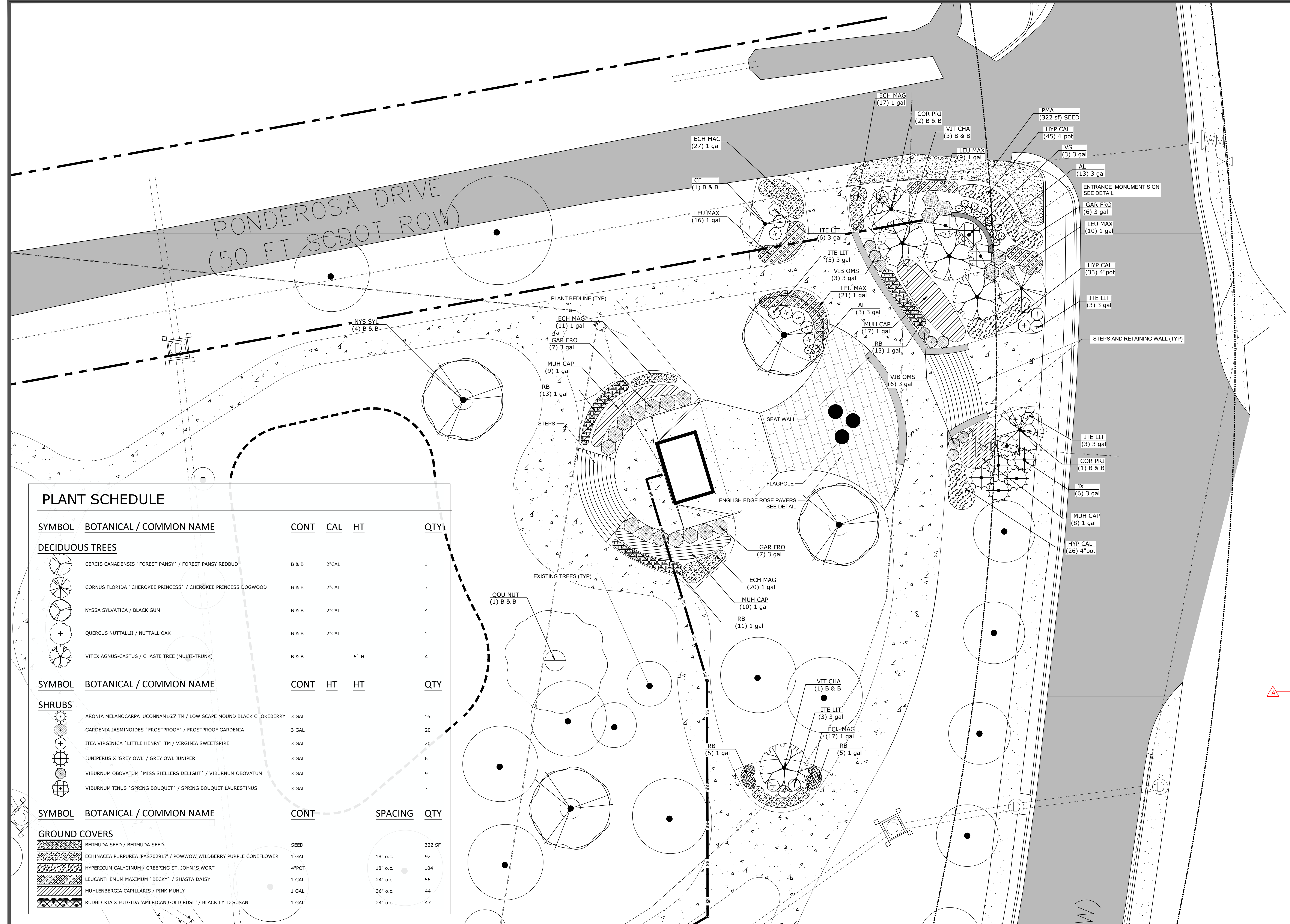
Revisions  
A 6/3/2025 ADDENDUM 2

Drawing

SITE DETAILS (2 OF 2)

**C-503**





THE DESIGNS AND IDEAS REPRESENTED IN THESE DRAWINGS ARE THE PROPERTY OF EARTH DESIGN INC. NO REPRODUCTION OR USE OF THESE PLANS OR THE INFORMATION IS STRICTLY PROHIBITED WITHOUT THE WRITTEN CONSENT OF EARTH DESIGN INC.

\*ANY INFRINGEMENT MAY BE SUBJECT TO LEGAL ACTION\*



**EarthDesign**  
Landscape Architecture and Environmental Design

1309 Grove Road  
Greenville, SC 29603  
Phone: 864-603-1231  
Fax: 864-603-1323  
www.earthdesignsc.com



NEWBERRY COUNTY

REUNION PARK IMPROVEMENTS

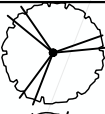


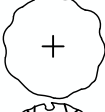
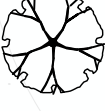







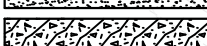
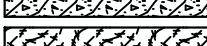

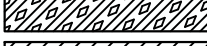

PROJECT NUMBER: 23531  
DESIGNER: HBO  
DRAWN BY: HBO, MB  
DATE DRAWN: 05/29/25

Addendum A: 06/04/25

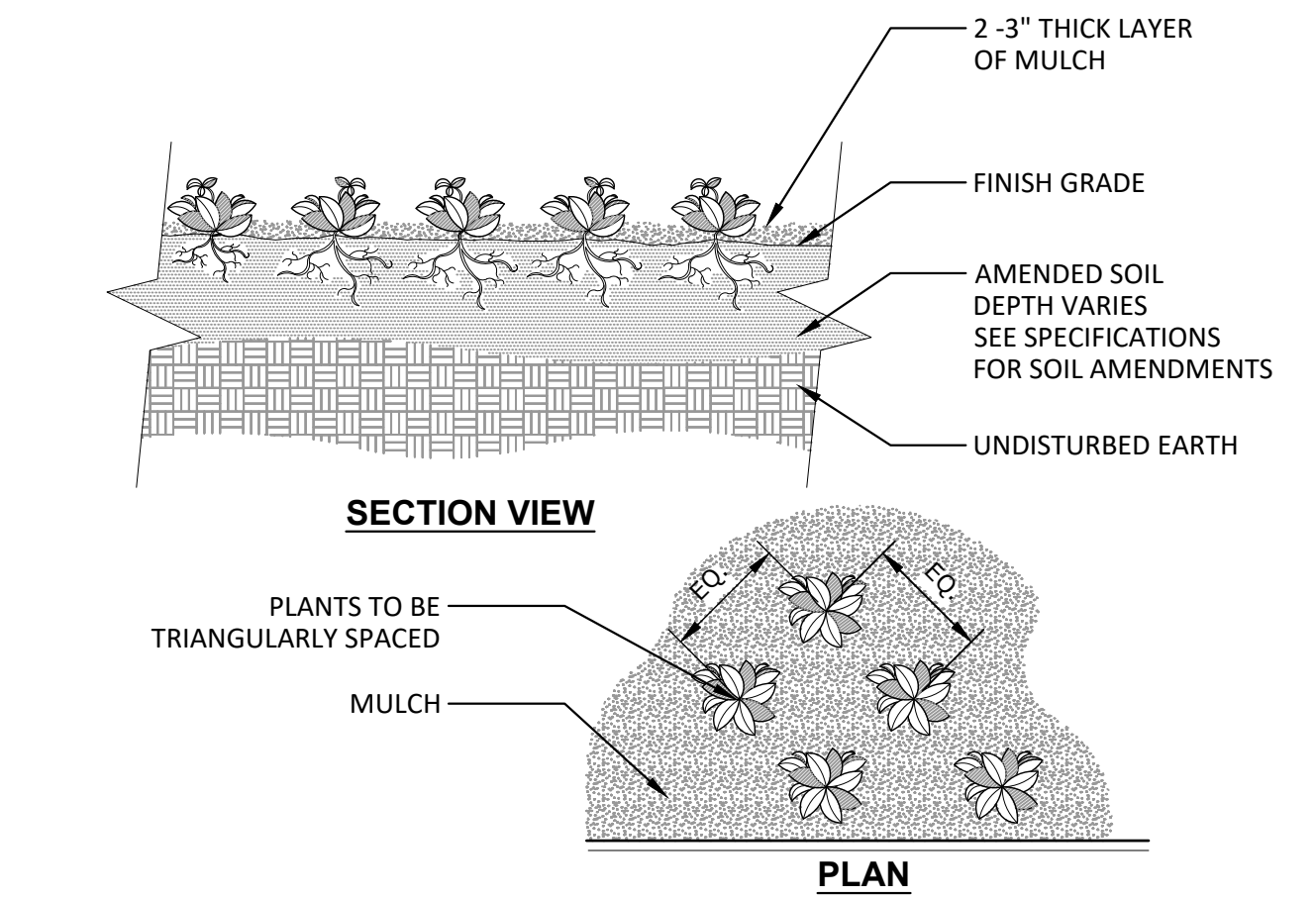
Drawing:

PLANTING PLAN  
L-101

PLANT SCHEDULE

SYMBOL	BOTANICAL / COMMON NAME	CONT	CAL	HT	QTY
DECIDUOUS TREES					
	CERCIS CANADENSIS 'FOREST PANSY' / FOREST PANSY REDBUD	B & B	2" CAL		1
	CORNUS FLORIDA 'CHEROKEE PRINCESS' / CHEROKEE PRINCESS DOGWOOD	B & B	2" CAL		3
	NYSSA SYLVATICA / BLACK GUM	B & B	2" CAL		4
	QUERCUS NUTTALLII / NUTTALL OAK	B & B	2" CAL		1
	VITEX AGNUS-CASTUS / CHASTE TREE (MULTI-TRUNK)	B & B		6' H	4
SYMBOL	BOTANICAL / COMMON NAME	CONT	HT	HT	QTY
SHRUBS					
	ARONIA MELANOCARPA 'UCONNAM165' TM / LOW SCAPE MOUND BLACK CHOKEBERRY	3 GAL			16
	GARDENIA JASMINOIDES 'FROSTPROOF' / FROSTPROOF GARDENIA	3 GAL			20
	ITEA VIRGINICA 'LITTLE HENRY' TM / VIRGINIA SWEETSPICE	3 GAL			20
	JUNIPERUS X 'GREY OWL' / GREY OWL JUNIPER	3 GAL			6
	VIBURNUM OBOVATUM 'MISS SHILLERS DELIGHT' / VIBURNUM OBOVATUM	3 GAL			9
	VIBURNUM TINUS 'SPRING BOUQUET' / SPRING BOUQUET LAURESTINUS	3 GAL			3
SYMBOL	BOTANICAL / COMMON NAME	CONT	SPACING		QTY
GROUND COVERS					
	BERMUDA SEED / BERMUDA SEED	SEED			322 SF
	ECHINACEA PURPUREA 'PAS702917' / POWWOW WILDBERRY PURPLE CONEFLOWER	1 GAL	18" o.c.		92
	HYPERICUM CALYGINUM / CREEPING ST. JOHN'S WORT	4" POT	18" o.c.		104
	LEUCANTHEMUM MAXIMUM 'BECKY' / SHASTA DAISY	1 GAL	24" o.c.		56
	MUHLENBERGIA CAPILLARIS / PINK MUHLY	1 GAL	36" o.c.		44
	RUDBECKIA X FULGIDA 'AMERICAN GOLD RUSH' / BLACK EYED SUSAN	1 GAL	24" o.c.		47





Notes:

- 1- See planting legend for groundcover species, size, and spacing dimension.
- 2- Small roots ( $\frac{1}{2}$ " or less) that grow around, up, or down the root ball periphery are considered a normal condition in container production and are acceptable however they should be eliminated at the time of planting. Roots on the periphery can be removed at the time of planting.
- 3- Settle soil around root ball of each groundcover prior to mulching.

#### 1 GROUNDCOVER DETAIL

3/4" = 1'-0"

P-ED-24

#### 2 SHRUB PLANTING DETAIL

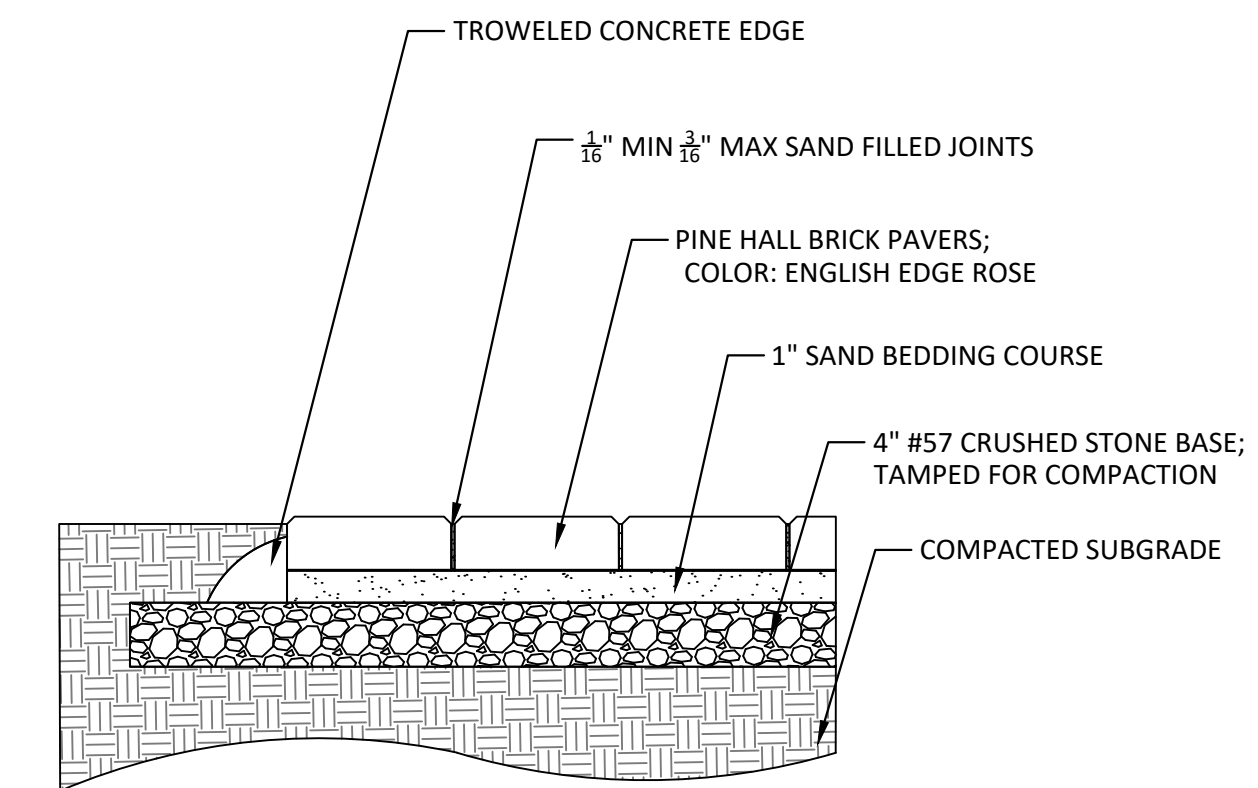
3/16" = 1'-0"

P-ED-23

#### 3 TREE PLANTING DETAIL - SINGLE TRUNK

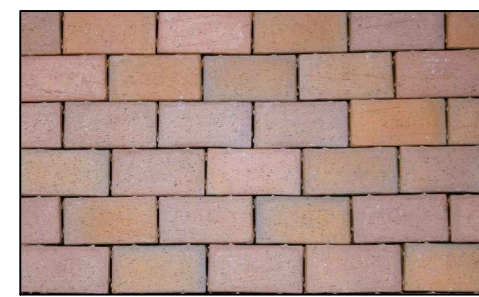
3/16" = 1'-0"

P-ED-CIT-07



SUPPLIER: PINE HALL BRICK  
TELEPHONE: (800)-952-7425  
WEBSITE: WWW.PINEHALLBRICK.COM

PRODUCT: ENGLISH EDGE ROSE  
DIMENSIONS: 4" X 8" X 2.25" THICK

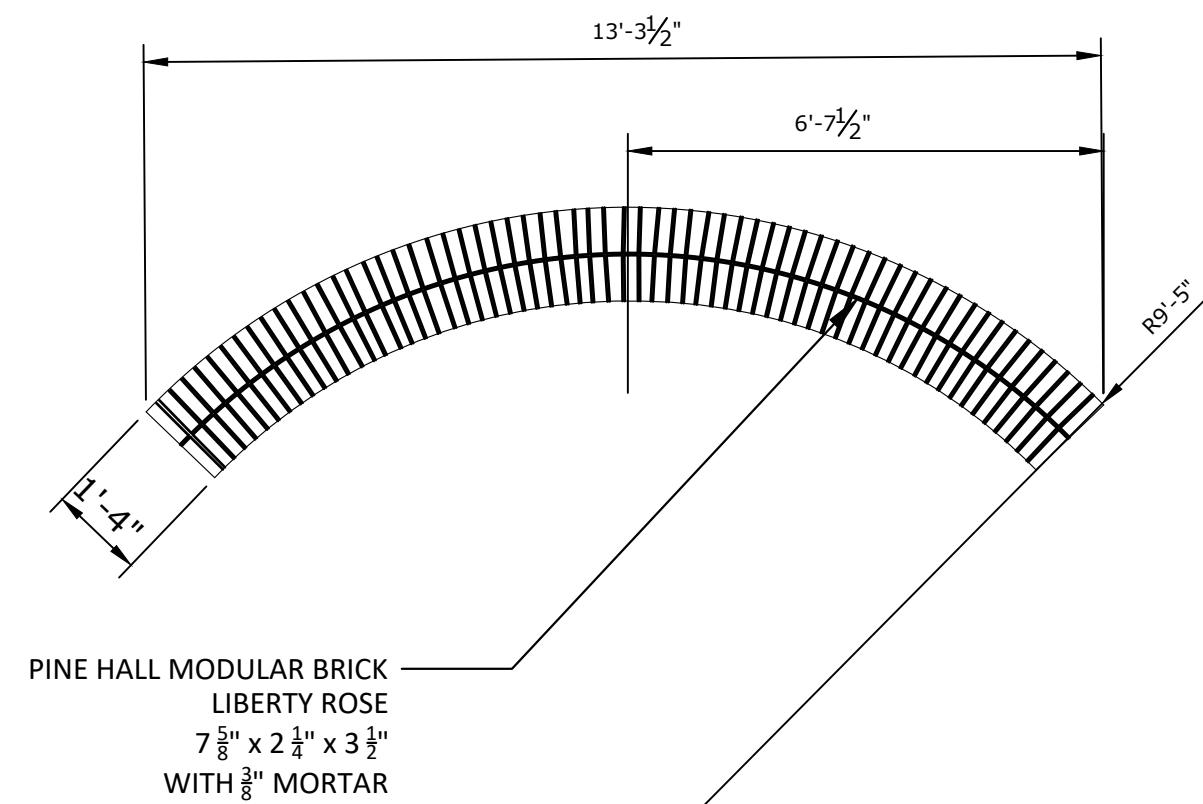


#### 4 PAVER PATH WITH TROWELED CONCRETE EDGE

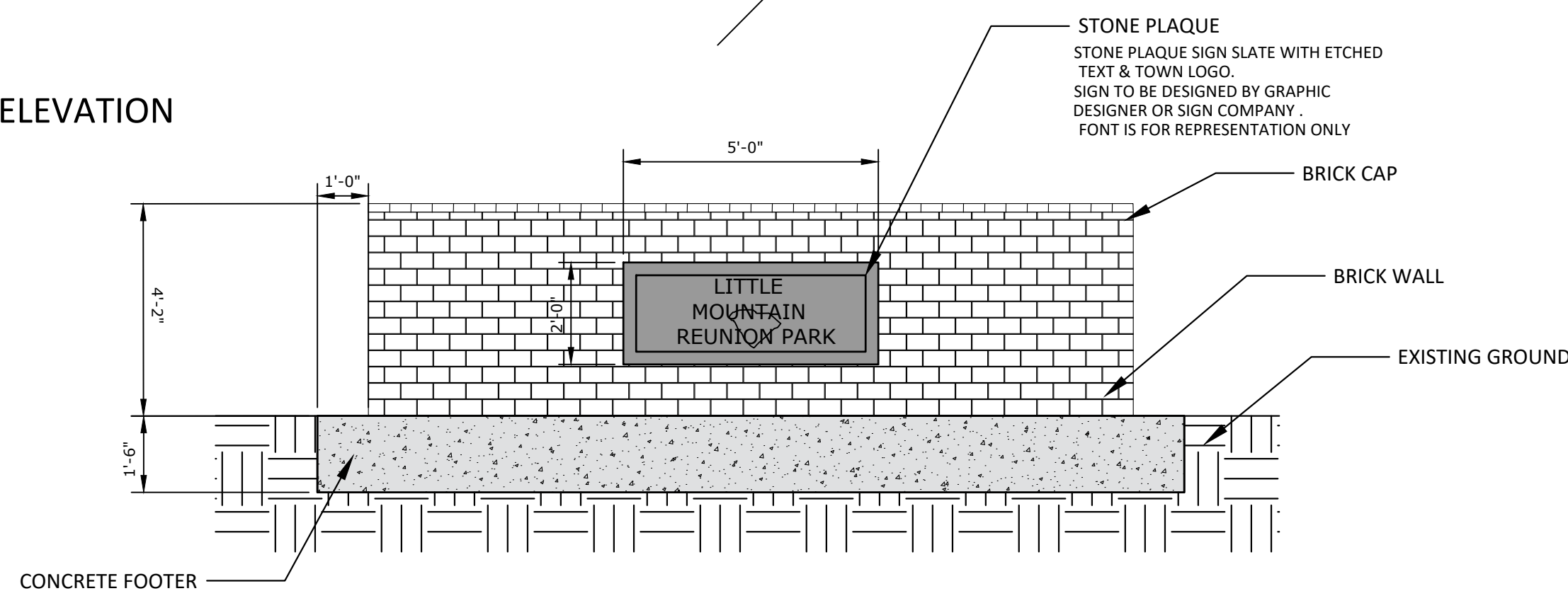
1" = 1'-0"

P-ED-PAT1-22

#### PLAN VIEW



#### ELEVATION

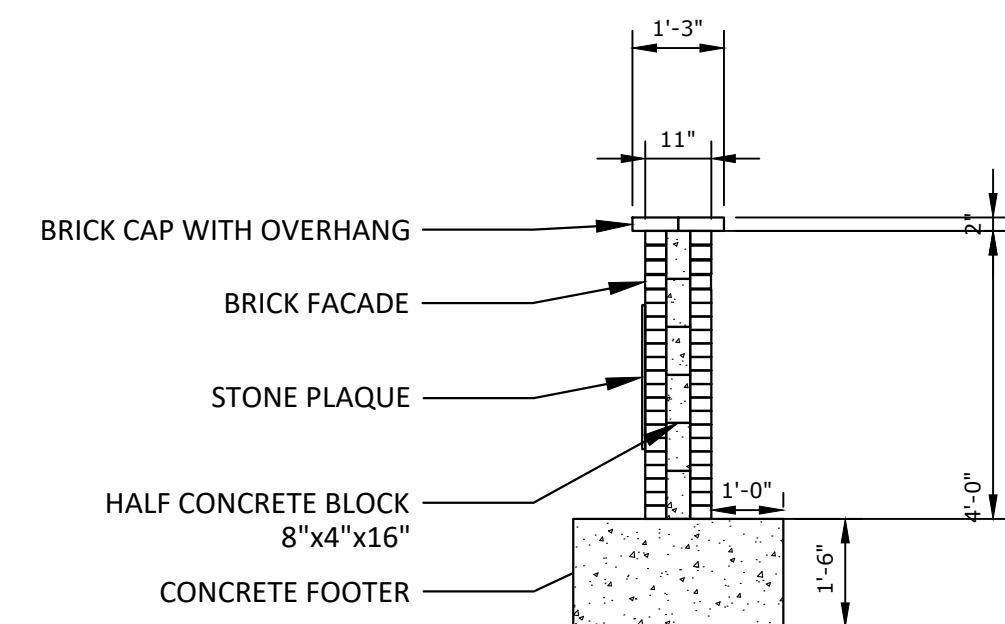


#### 5 BRICK ENTRY SIGN

3/8" = 1'-0"

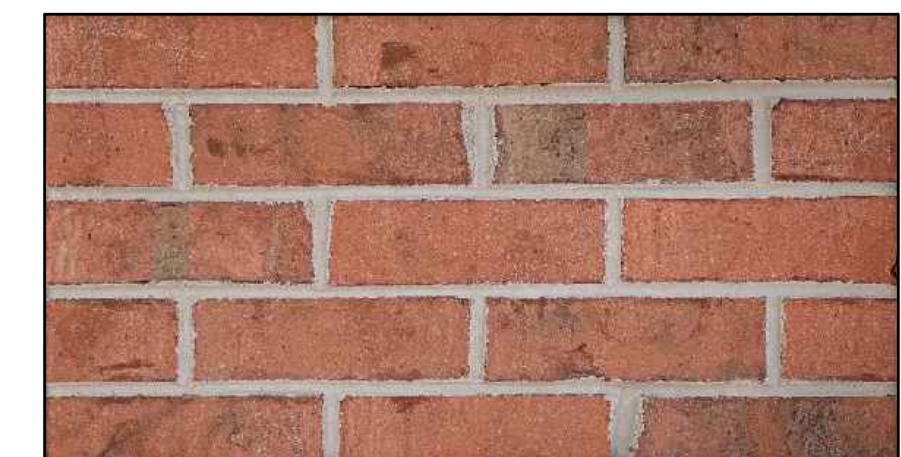
P-ED-WAL-18

#### SIDE PROFILE



BRICK SUPPLIER: PINE HALL BRICK  
TELEPHONE: (800)-952-7425  
WEBSITE: WWW.PINEHALLBRICK.COM

PRODUCT: MODULAR LIBERTY ROSE  
DIMENSIONS: 2.25" X 7.625" X 3.5" THICK



THE DESIGNS AND IDEAS REPRESENTED IN THESE DRAWINGS ARE THE PROPERTY OF EARTH DESIGN INC. NO REPRODUCTION OR USE OF THESE PLANS OR THE INFORMATION IS STRICTLY PROHIBITED WITHOUT THE WRITTEN CONSENT OF EARTH DESIGN INC.

\*ANY INFRINGEMENT MAY BE SUBJECT TO LEGAL ACTION\*



1309 Grove Road  
Greenville, SC 29603  
Phone: 864-603-1231  
Fax: 864-603-1323  
www.earthdesignsc.com

#### NEWBERRY COUNTY

#### REUNION PARK IMPROVEMENTS

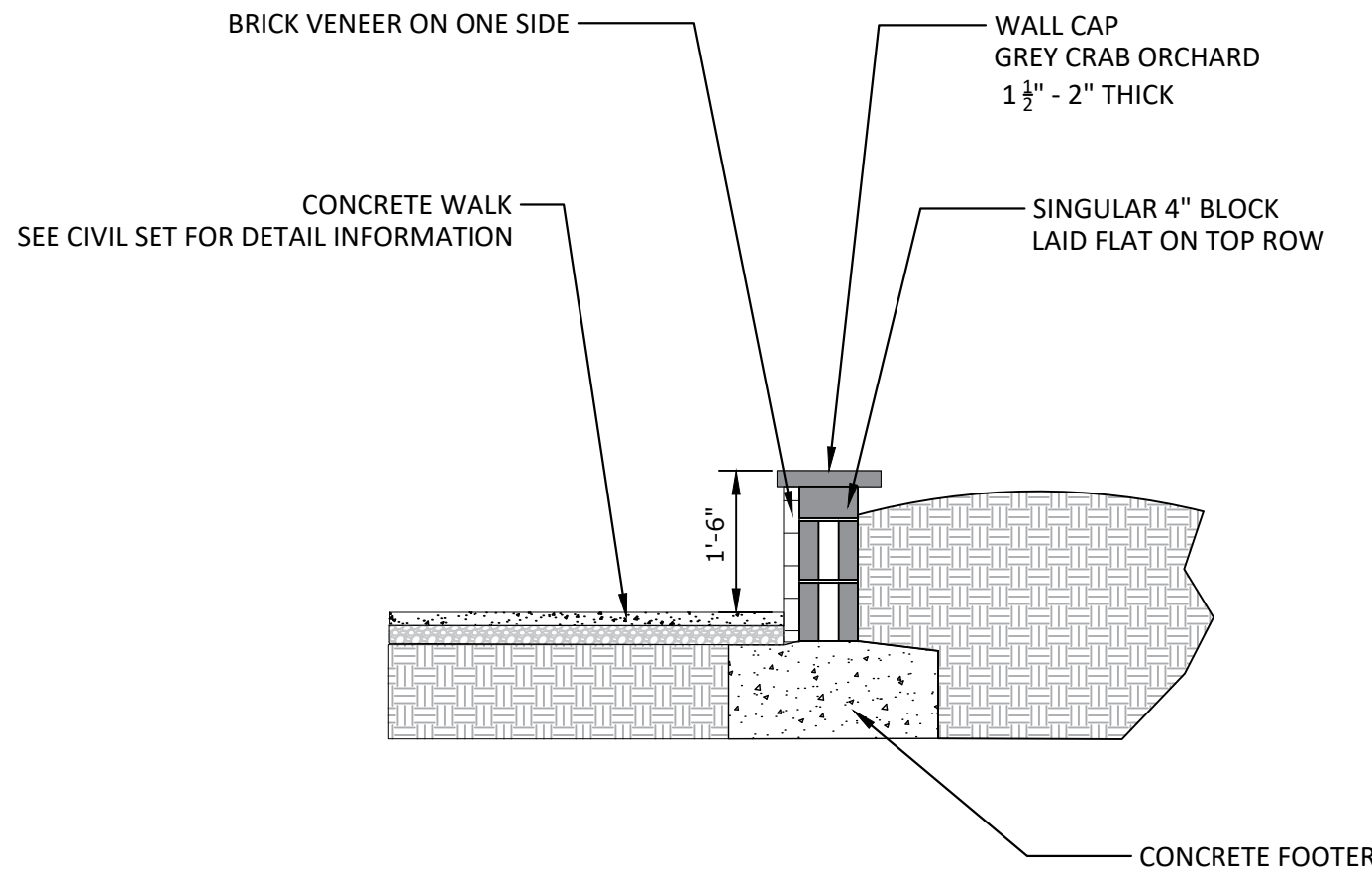
PROJECT NUMBER: 23531  
DESIGNER: HBO  
DRAWN BY: HBO, MB  
DATE DRAWN: 05/29/25

Addendum A: 06/04/25

Drawing:

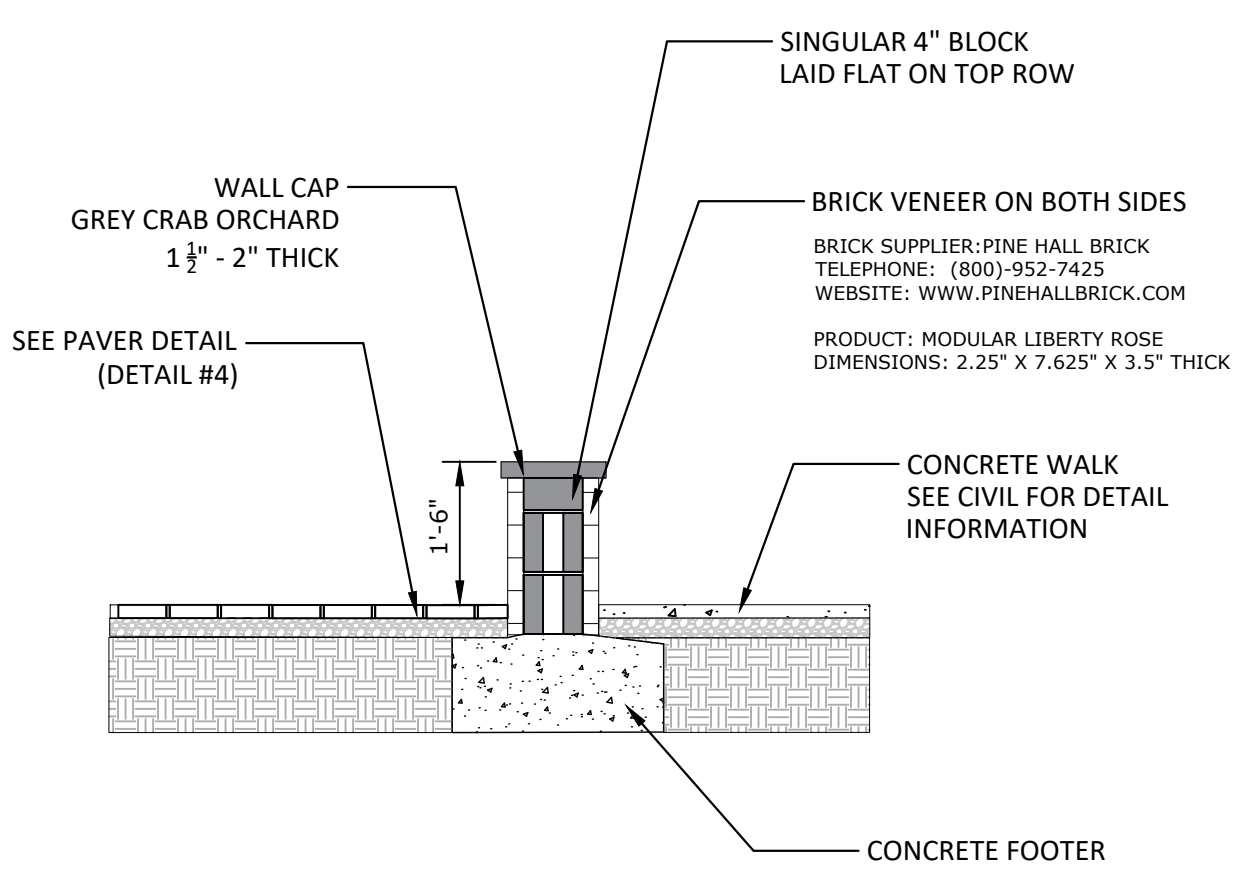
#### LANDSCAPE DETAILS L-201





6 BRICK RETAINING WALL  
1/2" = 1'-0"

P-ED-WAL-16



7 FREE STANDING BRICK WALL  
1/2" = 1'-0"

P-ED-WAL-19

## GENERAL NOTES:

1. GRADING All final grading shall be the responsibility of the landscape contractor.
2. BACKFILL/TOPSOIL Landscape contractor shall provide all planting areas with an organic, screened topsoil. Two inches (2)" of organic, screened topsoil should be added to and incorporated into all plant beds.
3. ORGANIC AMENDMENTS Organic amendments, comprised of 50% composted leaf mulch, 50% mushroom compost, should be added to all single planting holes and back fill for all plant beds and be thoroughly cultivated 6 inches deep to a fine texture (no clods over 1/2") with a mechanical tiller. Organic matter should comprise approximately 10 to 20 percent of this total soil volume. **PLANTINGS NOT DONE IN THIS MANNER SHALL BE REMOVED AND PROPERLY REPLANTED.** In addition, during planting, all plants shall receive a mycorrhizal based fertilizer amendment per item 7.
4. PLANT QUALITY All plants shall be nursery grown, have a full habit of growth as is characteristic of that species, and shall be free of disease or insects. General plant quality shall be as specified in the "USA Standard for Nursery Stock" (published by the American Association of Nurserymen) and meet ANSI Z60.1 standards. All 3 gallon deciduous material shall be a minimum of 2' in height. All 3 gallon evergreen material shall be a minimum of 18" height with the exception of the dwarf gardenia which should be a minimum of 12". All 5 gallon material shall be a minimum of 3' in height. All 7 gallon material shall be a minimum of 4' in height. **The owner and Landscape Architect reserve the right to modify plant selection during contract negotiations. If a particular species or cultivar is unavailable, the owner or Landscape Architect must approve a substitution.**
5. PLANTING HOLES Trees and shrubs: Remove rock and construction debris from planting area. Dig holes two to three times as wide as the rootball and almost as deep as the height of the root ball. Soil at the bottom of the hole is left undisturbed. The rootball of trees should sit 2"- 3" above the surrounding soil. See planting detail additional information.
6. SETTING OF PLANTS The root ball of container grown plants shall be scarified in several places prior to planting. Plant shrubs and trees so that the top of the root ball will be slightly above the adjacent soil line. SINGLE PLANTING HOLE - backfill bottom half of space around the rootball with loosened original soil (use amended soil only when necessary for good soil tilth. (See ORGANIC AMENDMENTS). Tamp lightly. Finish filling the hole with loose soil and then tamp again. SHRUB BEDS - Backfill bottom half of bed surrounding shrubs with amended backfill (see ORGANIC AMENDMENTS). Tamp lightly and water to settle soil. Finish filling hole with loose amended backfill and gently tamp again. Water shrub bed to settle soil. Mulch plant beds with 3" double ground hard wood mulch - KEEP MULCH OFF OF TREE TRUNKS AND PLANT STEMS.
7. FERTILIZING During planting, all plants shall receive a mycorrhizal based fertilizer amendment, such as Bio-Plex 5-in-1 Complete Planting granules, or equal (if approved by landscape architect), according to manufacturer's instructions. **This product must be incorporated into the soil used for backfill and cannot be installed on the surface after planting.**
8. STAKING OF TREES All trees over 5' height should be staked when planted. The Landscape Contractor is responsible for all wind damage to trees. (provided winds are less than 60 mph) during the guarantee period, and may stake other trees (for his own protection) at his option. Landscape Contractor will be responsible for removal of all staking material one year after installation. Any trees leaning more than 15 degrees from upright at the end of the the year guarantee must be replaced by the landscape contractor.
9. IRRIGATION All shrub beds and trees should be irrigated with drip - Rainbird, Toro or equal. Include rain sensor and ground moisture probes. System mush shut off after 1/4 in rain event Lawn areas to receive spray heads. Provide shop drawing of final layout. Turf lawn areas shall receive spray irrigation.
10. MULCH All plant beds are to receive 3" of double ground hardwood mulch (not dyed) evenly distributed. Ensure mulch is NOT in contact with trunk of trees or stems of plants (no volcano mulching).
11. UTILITY LOCATION: The Landscape Contractor is responsible for contacting the utility locator service and is responsible for any damage done to utilities.
12. QUANTITIES Plant quantities are shown for the contractor's convenience only. PLANTS SHALL BE INSTALLED AS SHOWN. Contractor is responsible for confirming all quantities prior to bidding and installation.
13. BIDS In order to keep all bids standard, all bids are to have unit prices listed. The Owner has the option to delete any portion of the contract prior to signing the contractor beginning work. This will be a unit price contract.
14. CLEAN UP Final clean up of any disturbances occurring as a result of landscape operations shall be the responsibility of the landscape contractor.
15. INSPECTION It shall be the contractor's responsibility to provide for inspection of the plant material by the Landscape Architect prior to installation. All plant material will be inspected. Plants not conforming precisely to the plant list will not be accepted and shall be replaced at the contractor's own expense.
16. LICENSES The contractor will be responsible for obtaining all licenses necessary to complete the work.
17. INSURANCE With the submittal of bid documents, the landscape contractor shall also submit a certificate of insurance for workman's compensation and a contractor's general liability. Contractors not providing evidence of such insurance will be ineligible to receive the contract for the job.
18. GUARANTEE All plant material and workmanship to be guaranteed for one year from the date of acceptance by the Owner. Plant replacement to occur only once. The contractor will not be responsible for defects resulting from neglect by the Owner, abuse or damage by others, or unusual phenomena or incidents beyond the landscape contractors control which result from natural causes such as floods, lightning, storms freezing rain, or winds over 60 miles per hour, fire, vandalism or theft.

THE DESIGNS AND IDEAS REPRESENTED IN THESE DRAWINGS ARE THE PROPERTY OF EARTH DESIGN INC. NO REPRODUCTION, COPY OR USE OF THESE PLANS OR THE INFORMATION IS STRICTLY PROHIBITED WITHOUT THE WRITTEN CONSENT OF EARTH DESIGN INC.

\*ANY INFRINGEMENT MAY BE SUBJECT TO LEGAL ACTION\*



1309 Grove Road  
Greenville, SC 29603  
Phone: 864-603-1231  
Fax: 864-603-1323  
www.earthdesignsc.com

NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS

PROJECT NUMBER: 23531  
DESIGNER: HBO  
DRAWN BY: HBO, MB  
DATE DRAWN: 05/29/25

Addendum A: 06/04/25

Drawing:

LANDSCAPE  
DETAILS  
L-202



Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



# NEWBERRY COUNTY REUNION PARK IMPROVEMENTS

749 MILL STREET  
LITTLE MOUNTAIN, SC 29075

## GENERAL NOTES

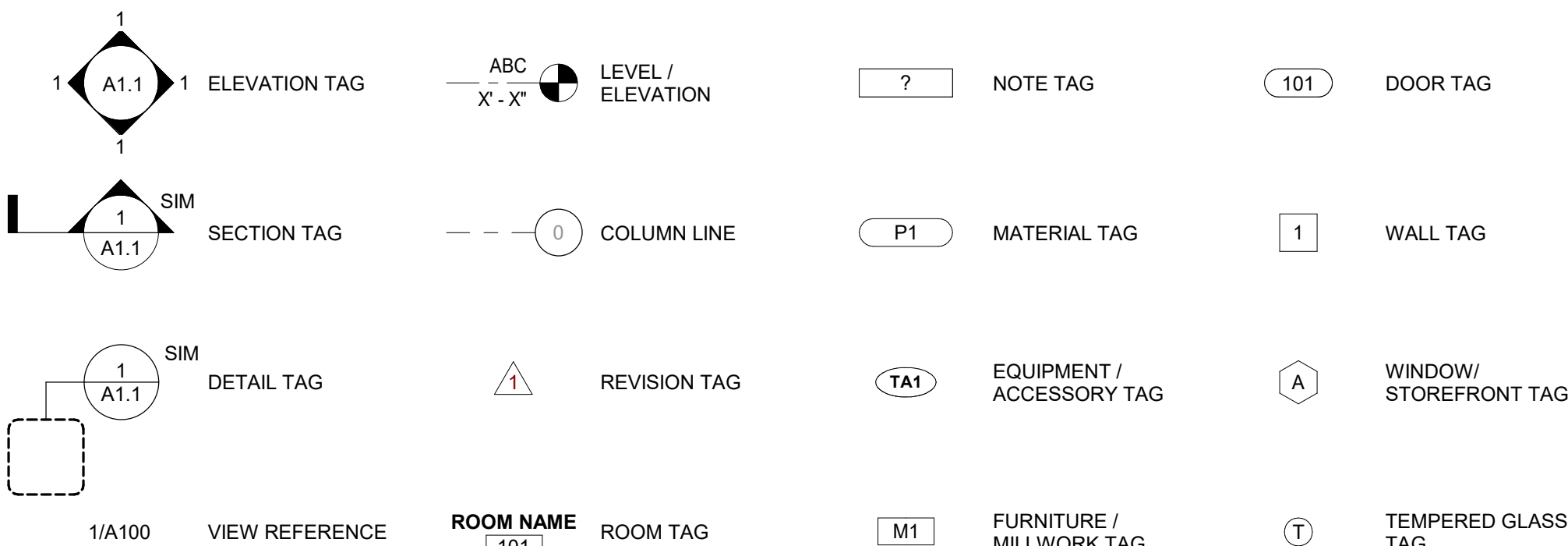
- A. THE TERM "WORK" AS USED IN THESE NOTES SHALL INCLUDE ALL PROVISIONS AS DRAWN OR SPECIFIED IN THESE DOCUMENTS AS WELL AS ALL OTHER PROVISIONS SPECIFICALLY INCLUDED BY THE OWNER IN THE FORM OF DRAWINGS, SPECIFICATIONS, AND WRITTEN INSTRUCTIONS AND APPROVED BY THE ARCHITECT.
- B. THE TERM "CONTRACTOR" AS USED IN THESE NOTES SHALL REFER TO THE GENERAL CONTRACTOR OR TO THE SUB-CONTRACTORS. THE OWNER MAY ELECT TO CONTRACT DIRECTLY WITH A SUB-CONTRACTOR FOR ANY PART OF THE WORK.
- C. SCOPE OF WORK: THE CONTRACTOR SHALL INCLUDE AND PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, TRANSPORTATION, AND PAY ALL EXPENSES INCURRED IN THE PROPER COMPLETION OF WORK UNLESS SPECIFICALLY NOTED TO BE THE WORK OF OTHERS. CONTRACTOR SHALL PERFORM ALL WORK NECESSARY FOR PRODUCING A COMPLETE, HABITABLE PROJECT, INCLUDING BUT NOT LIMITED TO SITE WORK, ARCHITECTURAL, STRUCTURAL, FIRE PROTECTION, PLUMBING, HVAC, AND ELECTRICAL.
- D. BEFORE CONSTRUCTION BEGINS, THE CONTRACTOR SHALL VISIT THE SITE TO VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS AND SHALL NOTIFY THE ARCHITECT, IN WRITING, OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK AND SHALL BE RESPONSIBLE FOR SAME.
- E. IF THE CONTRACT DOCUMENTS ARE FOUND TO BE UNCLEAR, AMBIGUOUS OR CONTRADICTORY, THE CONTRACTOR MUST REQUEST CLARIFICATION FROM THE ARCHITECT IN WRITING BEFORE PROCEEDING WITH THAT PART OF THE WORK.
- F. IF A CONDITION EXISTS THAT REQUIRES OBSERVATION OR ACTION BY THE ARCHITECT, OR OTHER DESIGN PROFESSIONAL, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT.
- G. CONTRACTOR SHALL BE FAMILIAR WITH PROVISIONS OF ALL APPLICABLE CODES AND SHALL ENSURE THE COMPLIANCE OF THE WORK WITH ALL LOCAL, STATE AND FEDERAL CODES, TRADE STANDARDS AND MANUFACTURER'S RECOMMENDATIONS. IN THE EVENT OF CONFLICT BETWEEN LOCAL, STATE AND NATIONAL CODES, THE MORE STRINGENT SHALL GOVERN. BEFORE COMMENCING WORK NOT SHOWN IN DOCUMENTS, BUT REQUIRED TO ACHIEVE FULL COMPLIANCE WITH CODES, CONTRACTOR SHALL NOTIFY ARCHITECT.
- H. THESE DOCUMENTS DO NOT INCLUDE THE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY. SAFETY, COMPLIANCE WITH STATE AND FEDERAL REGULATIONS REGARDING SAFETY AND COMPLIANCE WITH REQUIREMENTS SPECIFIED IN THE OWNER/CONTRACTOR CONTRACT IS, AND SHALL BE, THE CONTRACTOR'S RESPONSIBILITY.
- I. CONTRACTOR SHALL PAY ALL TAXES, SECURE ALL PERMITS AND PAY ALL FEES INCURRED IN THE COMPLETION OF THE PROJECT.
- J. THE CONTRACTOR SHALL UNCONDITIONALLY WARRANTY ALL MATERIALS, AND WORKMANSHIP FURNISHED OR INSTALLED BY HIM OR HIS SUBCONTRACTORS FOR A PERIOD OF ONE (1) YEAR FROM DATE OF ACCEPTANCE AND SHALL REPLACE ANY DEFECTIVE WORK WITHIN THAT PERIOD WITHOUT EXPENSE TO THE OWNER AND PAY FOR ALL DAMAGES TO OTHER PARTS OF THE BUILDING RESULTING FROM DEFECTIVE WORK OR ITS REPAIR. THE CONTRACTOR SHALL REPLACE DEFECTIVE WORK WITHIN A REASONABLE, AGREED UPON TIME FRAME, AFTER IT IS BROUGHT TO HIS ATTENTION.
- K. THE CONTRACTOR SHALL AT ALL TIMES KEEP THE PREMISES FREE FROM ACCUMULATION OF WASTE MATERIALS AND RUBBISH AND AT THE COMPLETION OF THE WORK THE CONTRACTOR SHALL REMOVE ALL RUBBISH, IMPLEMENTS, AND SURPLUS MATERIALS AND LEAVE THE BUILDING IN NEW AND CLEAN CONDITION.
- L. CONTRACTOR IS TO PROVIDE TO THE OWNER A LIST OF ALL SUBCONTRACTORS USED, COMPLETE WITH ADDRESSES, PHONE NUMBERS AND COPIES OF ALL WARRANTIES AND OPERATIONS AND MAINTENANCE MANUALS.

## COORDINATION OF WORK

ALL NOTES APPLY TO ALL DRAWINGS AND ALL TRADES. IT IS THE RESPONSIBILITY OF ALL CONTRACTORS AND SUB-CONTRACTORS TO COORDINATE THE INSTALLATION OF THEIR WORK WITH THE INSTALLATION OF WORK BY ALL OTHER CONTRACTORS. THE REQUIREMENTS OF THE DRAWINGS, GENERAL REQUIREMENTS, AND ALL ITEMS OF THE CONTRACT DOCUMENTS ARE EQUALLY BINDING ON ALL CONTRACTORS AND SUB-CONTRACTORS. EACH CONTRACTOR IS REQUIRED TO MAINTAIN FULL SETS OF THE CONTRACT DOCUMENTS FOR HIS EMPLOYEE'S USE ON THE PROJECT AND ASSURE THAT ALL WORK IS PROPERLY COORDINATED AND INSTALLED WITH THE WORK OF OTHER CONTRACTORS AND SUB-CONTRACTORS.

CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK AND SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES AND SAFETY PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK.

## DRAWING SYMBOL LEGEND



## PROJECT CONTACTS

### OWNER

NEWBERRY COUNTY  
1309 COLLEGE STREET  
P.O. BOX 156  
NEWBERRY, SC 29108

CONTACT:  
CRYSTAL WALDROP  
T: 803.321.2100  
CWALDROP@NEWBERRYCOUNTY.GOV

### CONSTRUCTION MANAGER

CLAYTON CONSTRUCTION  
121 VENTURE BLVD # A  
SPARTANBURG, SC 29306

CONTACT:  
ADAM FAILLA  
T: 864.576.1901  
ADAM@CLAYTONCONSTRUCTION.NET

### CIVIL ENGINEER

WK DICKSON & CO., INC.  
15 LEGACY PARK ROAD  
SUITE A  
GREENVILLE, SC 29607

CONTACT:  
JEFF EDENEY, PE  
T: 864.990.0180  
JEDNEY@WKDICKSON.COM

### ARCHITECT

DP3 ARCHITECTS, LTD.  
15 SOUTH MAIN STREET  
SUITE 400  
GREENVILLE, SC 29601

CONTACT:  
LAUREL GETTY  
T: 864.232.6642  
LGETTY@DP3ARCHITECTS.COM

### STRUCTURAL ENGINEER

BRITT, PETERS & ASSOCIATES, INC.  
101 FALLS PARK DRIVE  
SUITE 601  
GREENVILLE, SC 29601

CONTACT:  
ROB GERSON, PE  
T: 864.271.8899  
RGERSON@BRITTPETERS.COM

### PLUMBING ENGINEER

DEVITA & ASSOCIATES, INC.  
33 VILLA ROAD  
SUITE 300  
GREENVILLE, SC 29615

CONTACT:  
SHANNON EPPS, PE  
T: 864.232.6642  
SEPPS@DEVITAINC.COM

### MECHANICAL ENGINEER

DEVITA & ASSOCIATES, INC.  
33 VILLA ROAD  
SUITE 300  
GREENVILLE, SC 29615

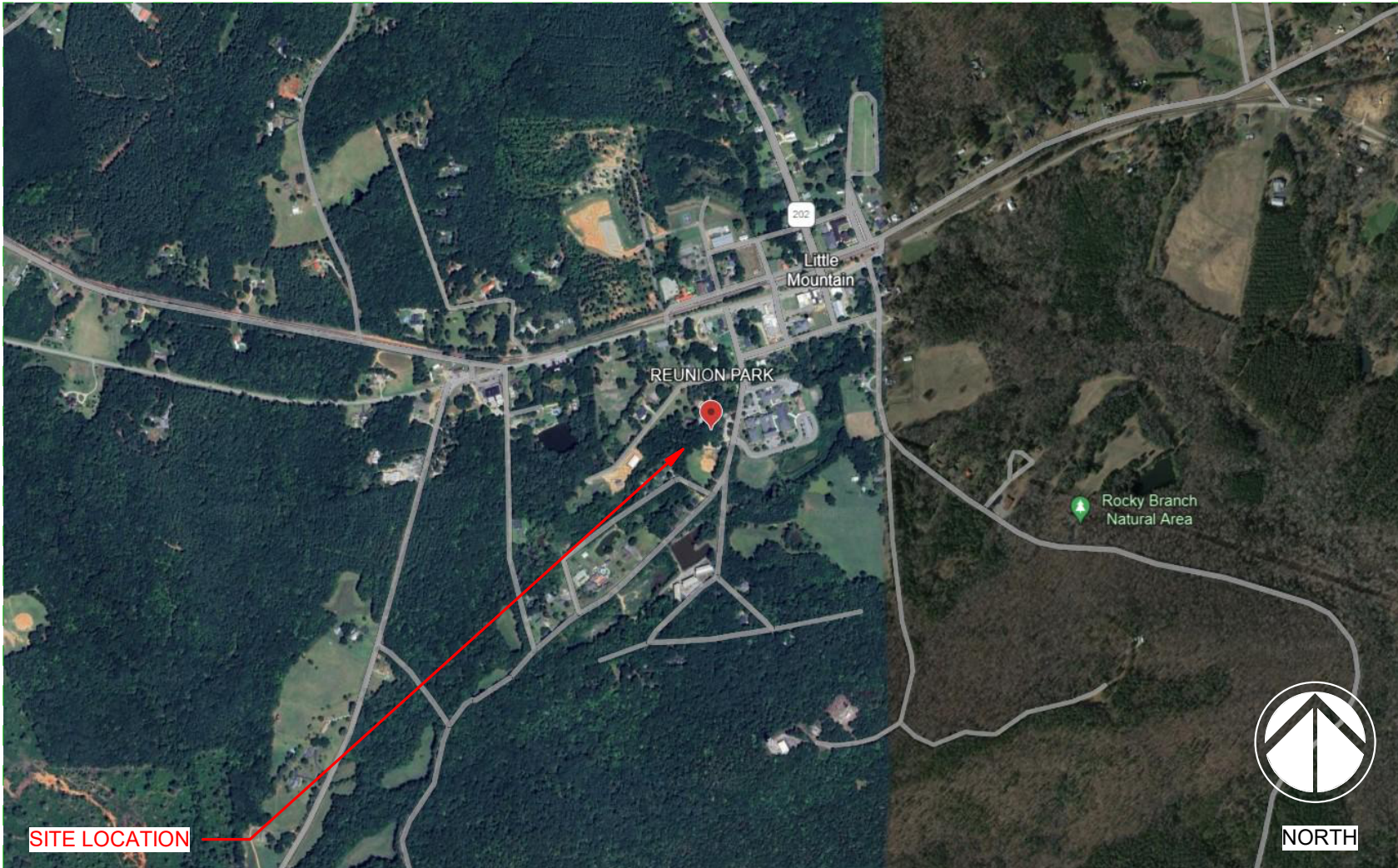
CONTACT:  
SHANNON EPPS, PE  
T: 864.232.6642  
SEPPS@DEVITAINC.COM

### ELECTRICAL ENGINEER

DEVITA & ASSOCIATES, INC.  
33 VILLA ROAD  
SUITE 300  
GREENVILLE, SC 29615

CONTACT:  
SHANNON EPPS, PE  
T: 864.232.6642  
SEPPS@DEVITAINC.COM

## VICINITY MAP



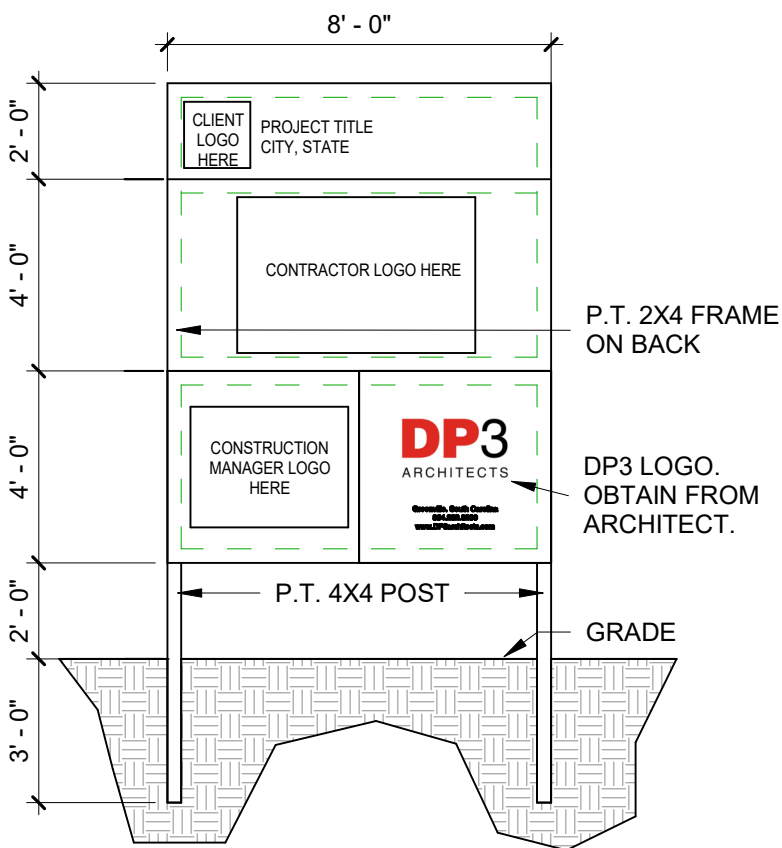
## PROJECT SCOPE

THE PROJECT SCOPE OUTLINED IN THIS SET OF DOCUMENTS INCLUDES IMPROVEMENTS TO THE TOWN OF LITTLE MOUNTAIN REUNION PARK, INCLUDING UPGRADED PARK ENTRANCE, UPGRADED WALKING TRAIL, RENOVATIONS TO EXISTING STRUCTURES, UPGRADES TO EXISTING RESTROOMS FOR ACCESSIBILITY COMPLIANCE, UPGRADED ELECTRICAL AND MECHANICAL AT EXISTING STRUCTURES AND NEW ACCESSIBLE RESTROOM BUILDING.

## ALTERNATES

- A. ALTERNATE NO. 1: CONCRETE SIDEWALKS IN LIEU OF ASPHALT PAVING
- BASE BID ITEM: ALL PAVING TO BE ASPHALT AND HEAVY-DUTY ASPHALT. REFER TO CIVIL DRAWINGS FOR LOCATION.
  - ALTERNATIVE ITEM: IN LIEU OF ALL PAVING BEING ASPHALT, ALL PAVING TO BE CONCRETE AND HEAVY-DUTY CONCRETE. REFER TO CIVIL DRAWINGS FOR LOCATION.
- B. ALTERNATE NO. 2: NEW FLAGPOLES IN LIEU OF RELOCATION OF EXISTING FLAGPOLES
- BASE BID ITEM: RELOCATE EXISTING FLAGPOLES.
  - ALTERNATIVE ITEM: IN LIEU OF RELOCATING EXISTING FLAGPOLES, DEMOLISH EXISTING FLAGPOLES AND INSTALL NEW FLAGPOLES. BASIS OF DESIGN: FLAGPOLE WAREHOUSE ILLUMINATOR MODEL ILH35.

## PROJECT SIGN



### NOTES:

- GC TO PROVIDE AND INSTALL ONE PROJECT SIGN. LOCATIONS TO BE DETERMINED IN FIELD. VERIFY LOCATION WITH OWNER.
- PROJECT SIGN TO REMAIN PROMINENTLY DISPLAYED DURING ENTIRE CONSTRUCTION PERIOD. REMOVE FROM PROJECT SITE WHEN BUILDING OCCUPIED AND OPEN FOR BUSINESS. SIGN PAINTED ON 3/4" EXTERIOR PLYWOOD. LETTER STYLE AND PLACEMENT SHOULD BE SIMILAR TO THAT SHOWN.
- PROVIDE KICK BACK TREATED WOOD POSTS AS NEEDED. PAINTED WHITE.

## DRAWING INDEX

NUMBER	SHEET NAME	CURRENT REVISION	CURRENT REVISION DATE
TITLE			
T1.01	TITLE SHEET	A	6/3/25
LIFE SAFETY			
LS1.01	CODE REVIEW		
CIVIL			
G-001	COVER SHEET		
G-002	GENERAL NOTES AND LEGEND		
CIVIL			
CD-101	DEMOLITION & ESC PLAN	A	6/3/25
CIVIL			
C-101	EXISTING CONDITIONS PLAN		
C-102	SITE LAYOUT & UTILITY PLAN	A	6/3/25
C-103	GRADING & DRAINAGE PLAN	A	6/3/25
C-501	ESC DETAILS		
C-502	SITE DETAILS	A	6/3/25
C-503	SITE DETAILS (2 OF 2)	A	6/3/25
C-504	UTILITY DETAILS		
C-505	DRAINAGE DETAILS		
L-101	PLANTING PLAN	A	6/3/25
L-201	LANDSCAPE DETAILS	A	6/3/25
L-202	LANDSCAPE DETAILS	A	6/3/25

ARCHITECTURE			
A0.01	ARCHITECTURAL SITE PLAN		
A1.01	BUILDING A - PLANS AND DETAILS		
A1.02	BUILDING B - PLANS AND DETAILS	A	6/3/25
A1.03	BUILDING C - PLANS AND DETAILS		
A1.04	BUILDING D - PLANS AND DETAILS		
A1.05	BUILDINGS E AND F - PLANS AND DETAILS	A	6/3/25
A1.06	BUILDING G - PLANS AND DETAILS	A	6/3/25
A1.07	BUILDING H - PLANS AND BUILDING SECTIONS	A	6/3/25
A3.01	ENLARGED RESTROOM PLANS AND ACCESSORY SCHEDULE		
A4.01	BUILDING A - EXTERIOR ELEVATIONS AND DETAILS		
A4.02	BUILDING H - EXTERIOR ELEVATIONS		
A7.01	BUILDING H - WALL SECTIONS		
A8.01	BUILDING H - DETAILS		
A9.01	BUILDING C & D - VERTICAL CIRCULATION PLANS & DETAILS	A	6/3/25
A10.01	DOOR, HARDWARE, AND FINISH LEGENDS & SCHEDULES		

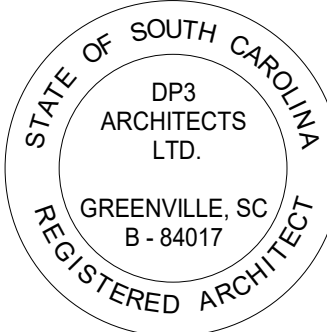
STRUCTURAL			
S0.00	GENERAL NOTES		
S0.01	GENERAL NOTES		
S0.02	SPECIAL INSPECTIONS		
S0.10	OVERALL KEY PLAN		
S1.01	PLANS - BUILDING A		
S1.02	PLANS - BUILDING B & BUILDING C		
S1.04	PLANS - BUILDING D & BUILDING H		
S3.01	TYPICAL CONCRETE DETAILS		
S3.02	TYPICAL MASONRY DETAILS		
S3.03	TYPICAL MASONRY DETAILS		
S4.01	FOUNDATION SECTIONS		
S5.01	ROOF SECTIONS		

PLUMBING			
P0.01	PLUMBING LEGEND, SCHEDULES, AND DETAILS		
P1.01	PLUMBING FLOOR PLANS - BUILDING A		
P1.02	PLUMBING FLOOR PLANS - BUILDING B		
P1.07	PLUMBING FLOOR PLANS - BUILDING G		
P1.08	PLUMBING FLOOR PLANS - BUILDING H		

MECHANICAL			
M0.01	MECHANICAL LEGENDS, SCHEDULES, AND DETAILS		
M1.02	MECHANICAL FLOOR PLAN - BUILDING B		
M1.07	MECHANICAL FLOOR PLAN - BUILDING G		
M1.08	MECHANICAL FLOOR PLAN - BUILDING H		

ELECTRICAL			
E0.01	ELECTRICAL LEGEND AND LIGHTING FIXTURE SCHEDULE		
E0.50	ELECTRICAL SITE PLAN - DEMOLITION		
E0.51	ELECTRICAL SITE PLAN - PROPOSED		
E1.01	ELECTRICAL PLANS - BUILDING A		
E1.02	ELECTRICAL PLANS - BUILDING B		
E1.03	ELECTRICAL PLANS - BUILDING C		
E1.04	ELECTRICAL PLANS - BUILDING D		
E1.05	ELECTRICAL PLANS - BUILDING E		
E1.07	ELECTRICAL PLANS - BUILDING G		
E1.08	ELECTRICAL PLANS - BUILDING H		
E2.01	ELECTRICAL PANEL SCHEDULES & RISER DIAGRAMS - BUILDINGS A, B, & C		
E2.02	ELECTRICAL PANEL SCHEDULES & RISER DIAGRAMS - BUILDINGS D, E, G, & H		
E2.03	ELECTRICAL PANEL SCHEDULES & RISER DIAGRAMS - FOOD TRUCK PEDESTALS		
E8.01	ELECTRICAL DETAILS		

Seal



27 JUNE 2023

**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS

Project Number 23236  
Drawn By LTG  
Checked By RHW  
Date 30 APR 2025

Revisions

A 6/3/25 Addendum 2

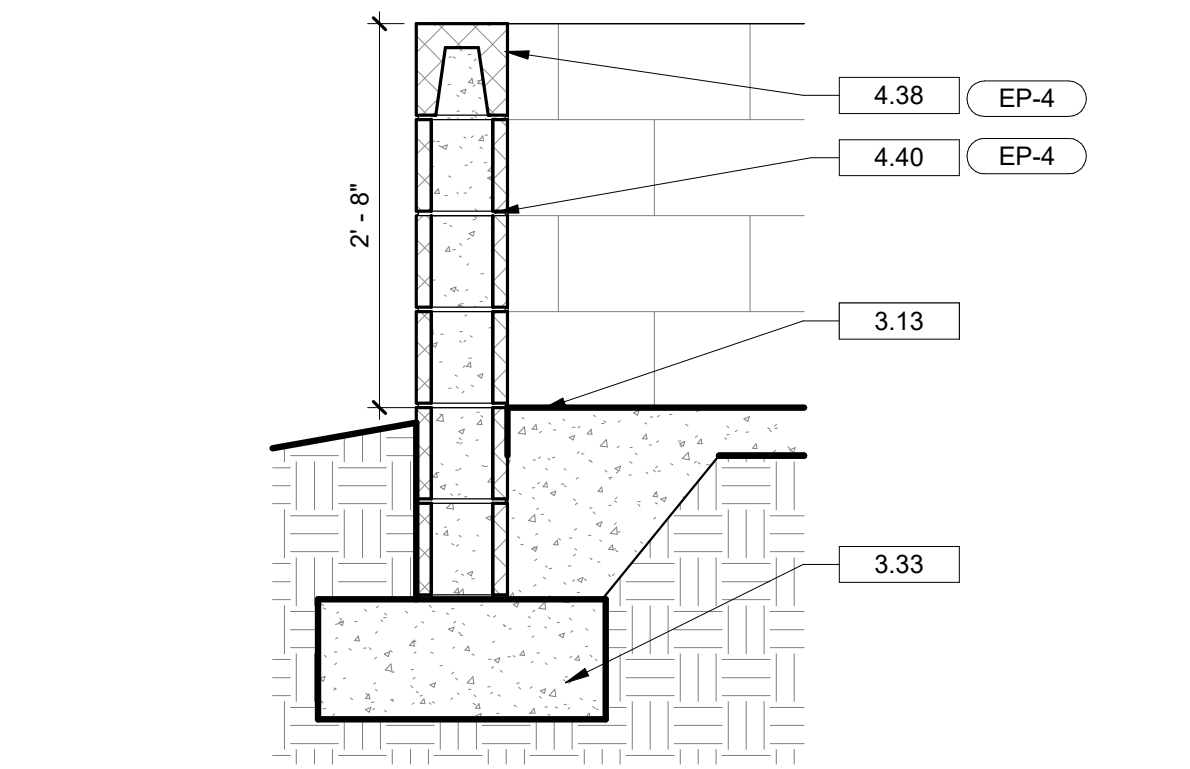
Drawing

TITLE SHEET

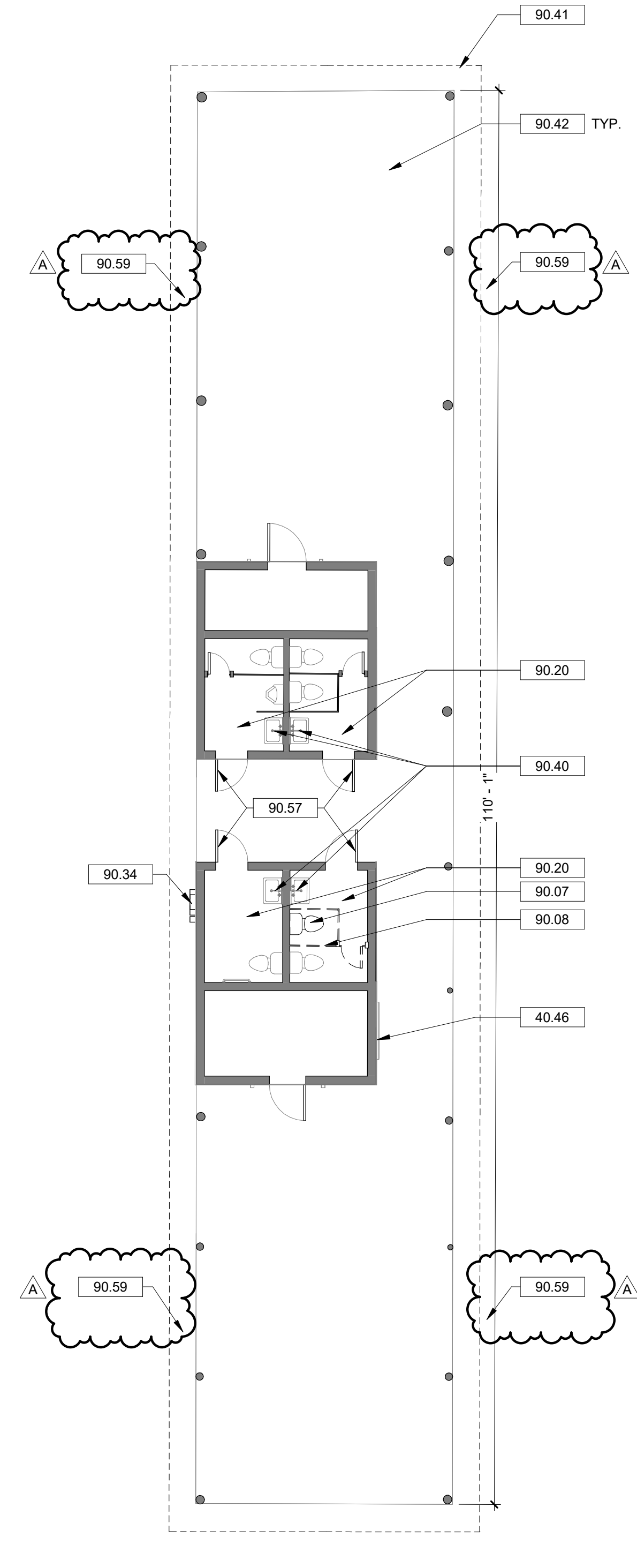
T1.01



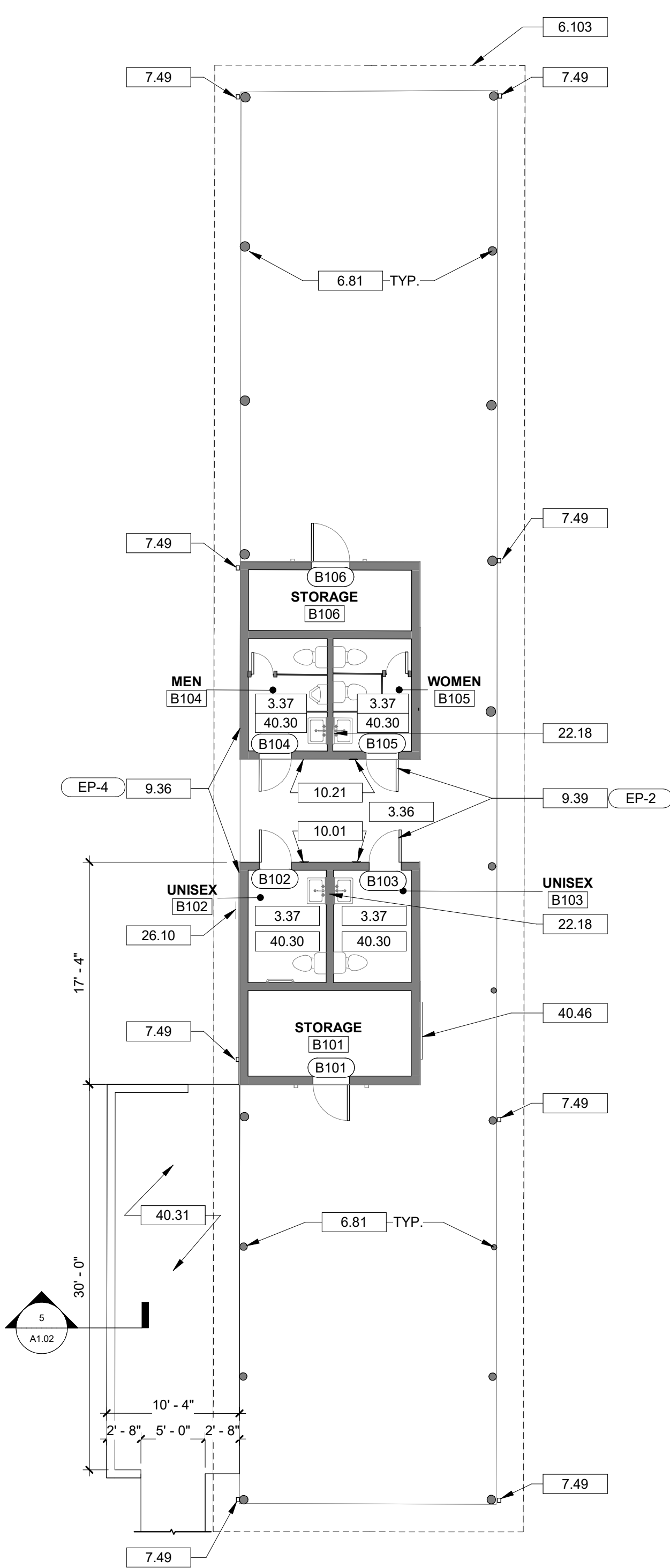
Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



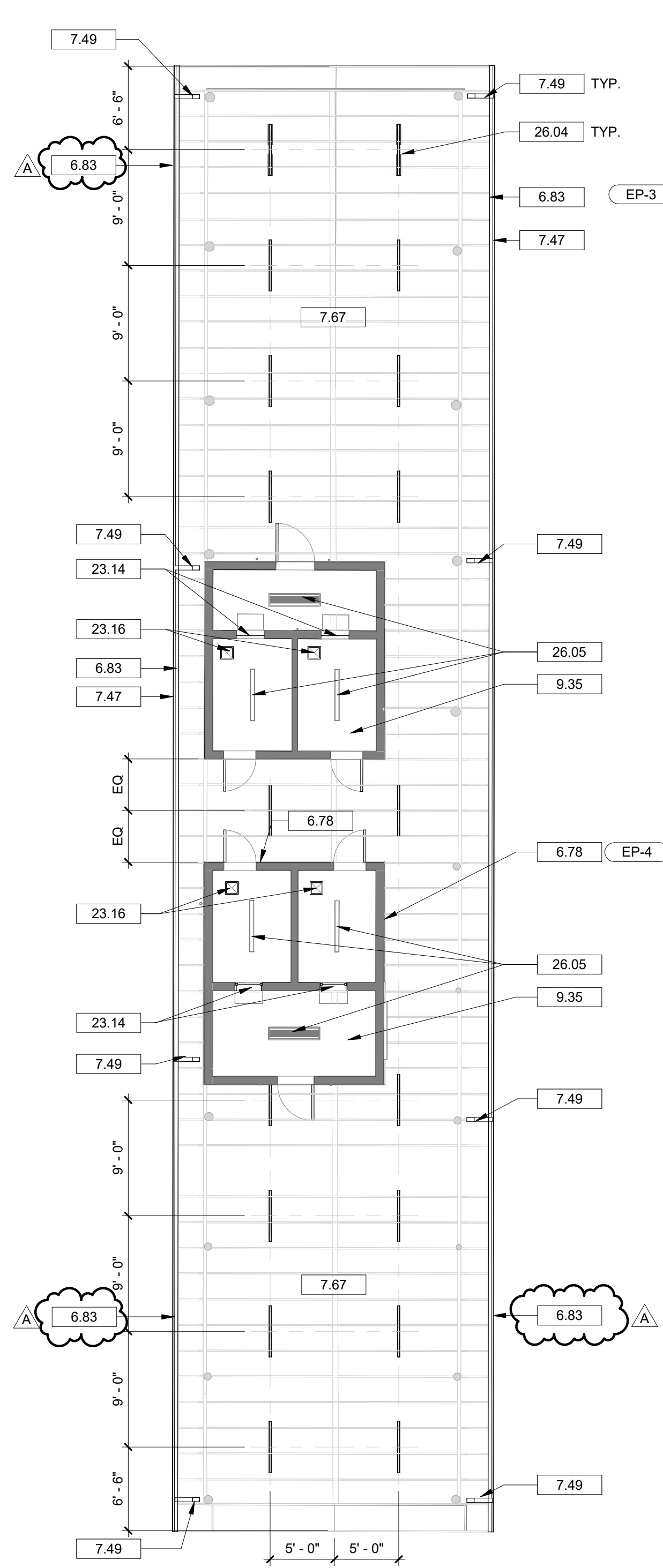
5 ACCESSIBLE PLATFORM SECTION  
A1.02 3/4" = 1'-0"



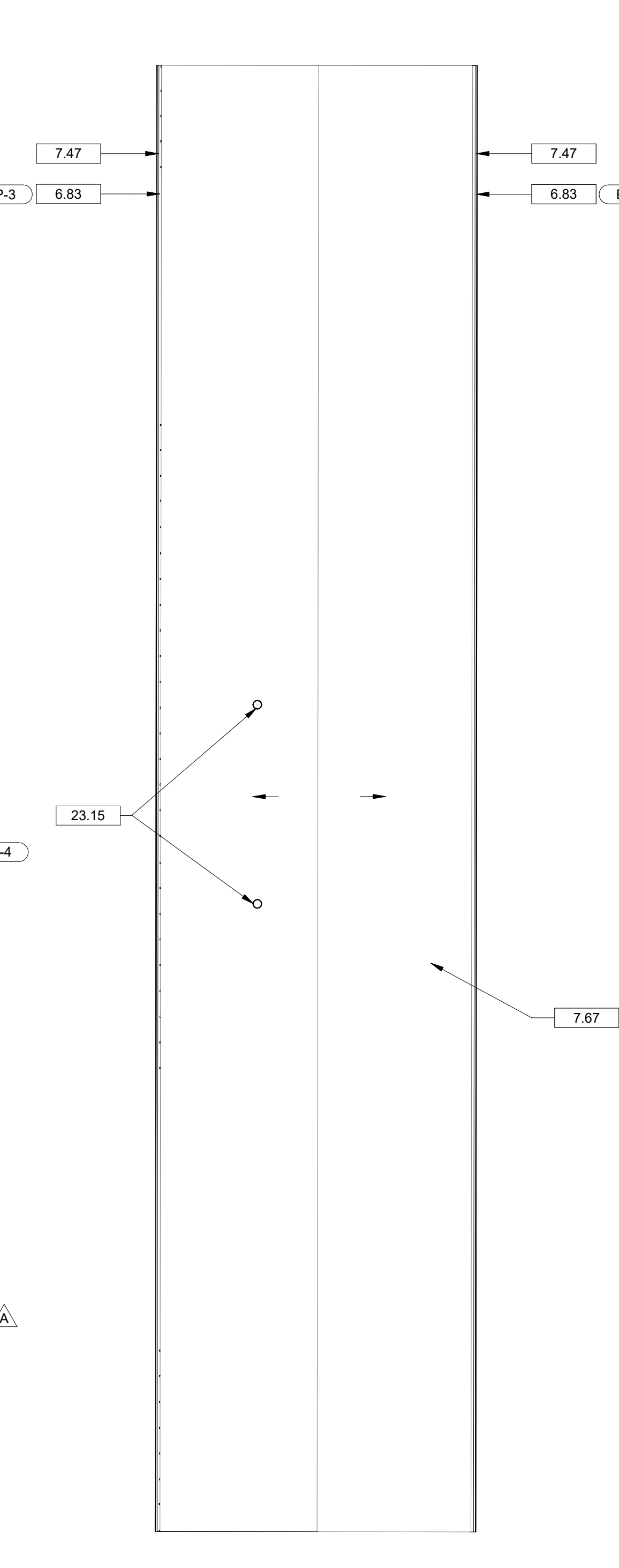
1 BUILDING B - DEMOLITION FLOOR PLAN  
A1.02 1/8" = 1'-0"



2 BUILDING B - FLOOR PLAN  
A1.02 1/8" = 1'-0"



3 BUILDING B - REFLECTED CEILING PLAN  
A1.02 1/8" = 1'-0"



4 BUILDING B - ROOF PLAN  
A1.02 1/8" = 1'-0"

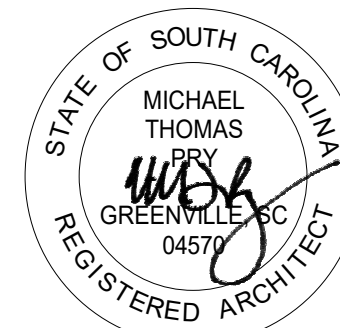
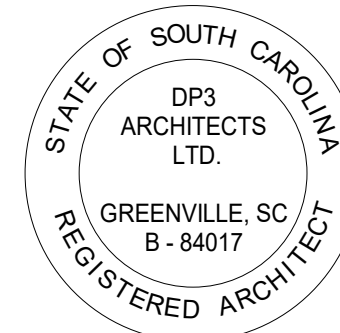
## GENERAL CONSTRUCTION NOTES

- GENERAL CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND REPORT DISCREPANCIES IMMEDIATELY TO THE ARCHITECT.
- THE CONTRACTOR SHALL COORDINATE ALL UNDERGROUND PIPING, MECHANICAL AND ELECTRICAL WORK.
- DO NOT SCALE DRAWINGS. USE WRITTEN DIMENSIONS FOR ALL MEASUREMENTS.
- LUMBER AND BLOCKING IN CONTACT WITH MASONRY AND CONCRETE SHALL BE PRESSURE TREATED.
- USE MOISTURE RESISTANT (TYPE "X" AS REQUIRED) GWB BEHIND ALL SINKS AND WET AREAS.
- REMOVE AND REPLACE ANY DAMAGED OR MISSING WOOD BOARDS.
- SEE MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR FULL SCOPE.

## DRAWING NOTES

- 3.13 REINFORCED CONCRETE SLAB ON GRADE. REFER TO STRUCTURAL DRAWINGS.
- 3.33 CONCRETE FOOTING. REFER TO CIVIL DRAWINGS FOR SIZE, TYPE OF REINFORCEMENT AND DEPTH.
- 3.36 REPAIR CRACKS IN EXTERIOR CONCRETE SLAB AS FOLLOWS. USE A GRINDER TO OPEN UP THE CRACK, REMOVE ANY LOOSE PIECES ASSOCIATED WITH THE CRACK, FILL WITH CEMENTITIOUS CRACK FILLER AND FINISH SMOOTH.
- 3.37 REPAIR CRACKS IN INTERIOR CONCRETE SLAB TO RECEIVE NEW FINISH AS FOLLOWS. REMOVE ANY LOOSE PIECES ASSOCIATED WITH THE CRACK, FILL CRACKS WITH CEMENTITIOUS CRACK FILLER AND FINISH SMOOTH. APPLY NEW EPOXY FINISH AS SCHEDULED.
- 4.38 INVERTED BOND BEAM OF SOLID CONCRETE MASONRY UNIT FOR TOP COURSE.
- 4.40 EXTERIOR 8 INCH X 8 INCH X 16 INCH CONCRETE MASONRY UNIT. REFER TO CIVIL DRAWINGS FOR REINFORCEMENT. REFER TO WALL TYPE SCHEDULE.
- 6.78 NEW 1X TRIM TO MATCH ADJACENT TRIM AT TOP OF CMU WALL. PAINT.
- 6.81 EXISTING HEAVY TIMBER POLE COLUMN TO REMAIN. CLEAN EXPOSED SURFACES.
- 6.83 NEW 1X PRESSURE TREATED WOOD FASCIA BOARD AT MODIFIED RAFTER ENDS FOR ATTACHMENT AND SUPPORT OF NEW GUTTER. ENSURE FASCIA BOARD COVERS RAFTER ENDS. PROVIDE NEW PREFINISHED DRIP EDGE FLASHING METAL INTO NEW GUTTER. PAINT.
- 6.103 NEW 1X PRESSURE TREATED WOOD FASCIA BOARD AT REMOVAL OF DAMAGED WOOD. REATTACH EXISTING SHEATHING.
- 7.47 NEW PREFINISHED METAL GUTTER.
- 7.49 NEW PREFINISHED METAL DOWNSPOUT. PROVIDE CONCRETE BRUSH BLOCK AT TERMINATION.
- 7.67 EXISTING ROOF TRUSSES, SHEATHING, AND SHINGLE ROOFING TO REMAIN. PROTECT DURING REMOVAL OF ROTTEN WOOD AT EAVE CONDITION.
- 9.35 EXISTING CEILING TO REMAIN. RESECURE PERIMETER EDGES OF CEILING SUBSTRATE. PAINT. TYPICAL IN RESTROOM AND STORAGE ROOMS.
- 9.36 ALL EXTERIOR WALLS OF RESTROOM AND STORAGE ROOMS TO RECEIVE PAINT FINISH.
- 9.39 ALL EXISTING HOLLOW METAL DOORS AND FRAMES TO RECEIVE NEW PAINT FINISH. CLEAN AND PREPARE FOR NEW FINISH.
- 10.01 RESTROOM SIGN.
- 10.21 MEN AND WOMEN RESTROOM SIGNAGE.
- 22.18 NEW INSTANTANEOUS WATER HEATER. INSTALLED UNDER LAVATORY TO FEED LAVATORIES ON BOTH SIDES OF WALL. REFER TO PLUMBING DRAWINGS.
- 23.14 EXISTING VENTILATION SCREEN TO REMAIN. PAINT.
- 23.15 EXHAUST VENT THRU ROOF. FLASH PENETRATION IN ACCORDANCE WITH SHINGLE ROOFING INDUSTRY STANDARD DETAILS.
- 23.16 EXHAUST FAN. REFER TO MECHANICAL DRAWINGS.
- 26.04 NEW LIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.
- 26.05 EXISTING LIGHT FIXTURE TO REMAIN. RECONDITION. REFER TO ELECTRICAL DRAWINGS.
- 26.10 NEW ELECTRICAL PANEL. REFER TO ELECTRICAL DRAWINGS.
- 40.30 NEW EPOXY OVER EXISTING SLAB, NEW WALL PAINT, AND NEW SILOXANE SEALER ON CMU WALLS. REFER TO FINISH SCHEDULE.
- 40.31 NEW WHEELCHAIR ACCESSIBLE PLATFORM. NEW SLAB TO ALIGN WITH EXISTING SLAB. REFER TO STRUCTURAL DRAWINGS.
- 40.46 EXISTING DISPLAY CABINET TO REMAIN. PROTECT DURING CONSTRUCTION.
- 90.07 REMOVE TOILET. CAP AND ABANDONED UTILITIES. REFER TO PLUMBING DRAWINGS.
- 90.08 REMOVE TOILET PARTITIONS. PATCH AND REPAIR WALL AS NEEDED.
- 90.20 REMOVE EXISTING FLOOR COATINGS. PREPARE EXISTING SLAB FOR NEW FINISH.
- 90.34 REMOVE EXISTING ELECTRICAL PANEL. REFER TO ELECTRICAL DRAWINGS.
- 90.40 REMOVE EXISTING FAUCET. PREPARE FOR NEW FAUCET. REFER TO PLUMBING DRAWINGS.
- 90.41 REMOVE ROTTED FASCIA BOARD BACK TO SOUND MATERIAL.
- 90.42 REMOVE EXISTING LIGHT FIXTURES AT COVERED PICNIC SHELTER AREAS. LIGHT FIXTURES IN RESTROOMS AND STORAGE ROOMS TO REMAIN.
- 90.57 DEMOLISH EXISTING RESTROOM SIGNAGE. PREPARE DOOR FOR NEW PAINT FINISH.
- 90.59 CUT BACK ENDS OF TRUSS EXTENSIONS AND SHEATHING TO APPROXIMATELY 8 INCHES TO STABLE MATERIALS. COORDINATE LENGTH WITH LENGTH OF EXISTING SHINGLE TO REMAIN.

Seal



27 JUNE 2023

**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY**  
**REUNION PARK**  
**IMPROVEMENTS**

Project Number 23236  
Drawn By LMG  
Checked By RHW  
Date 30 APR 2025

Revisions  
A 6/3/25 Addendum 2

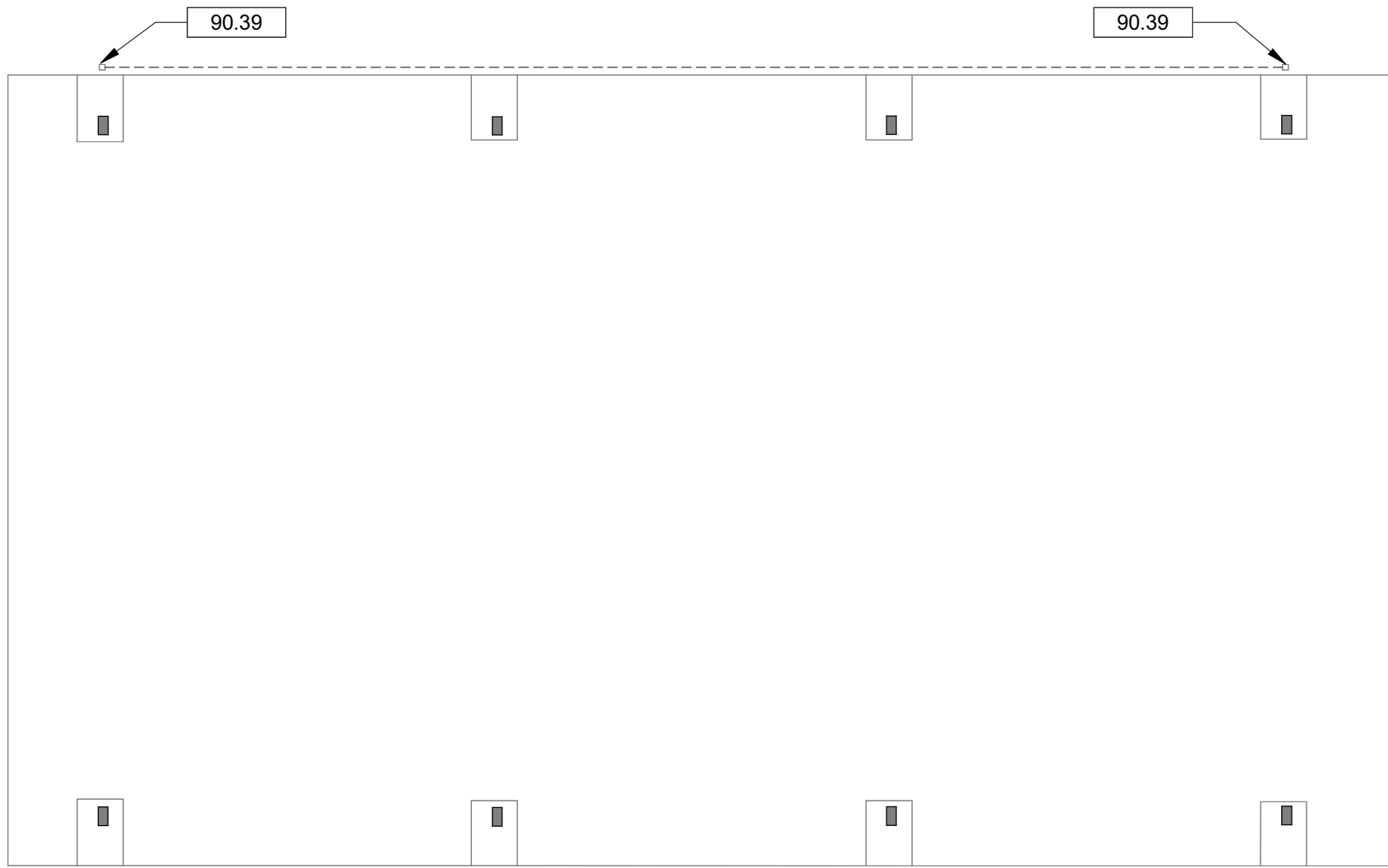
Drawing

**BUILDING B - PLANS**  
**AND DETAILS**

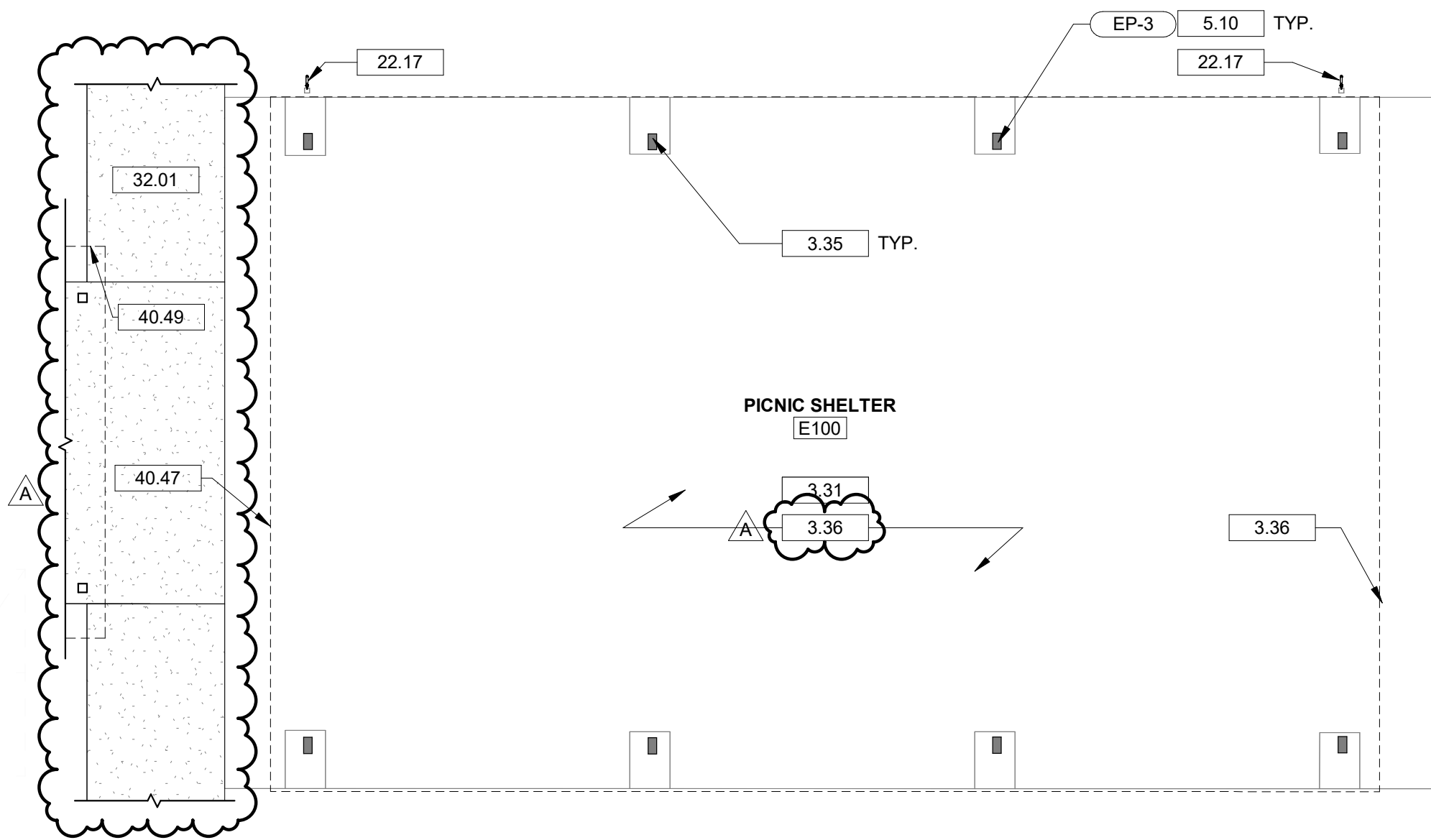
**A1.02**



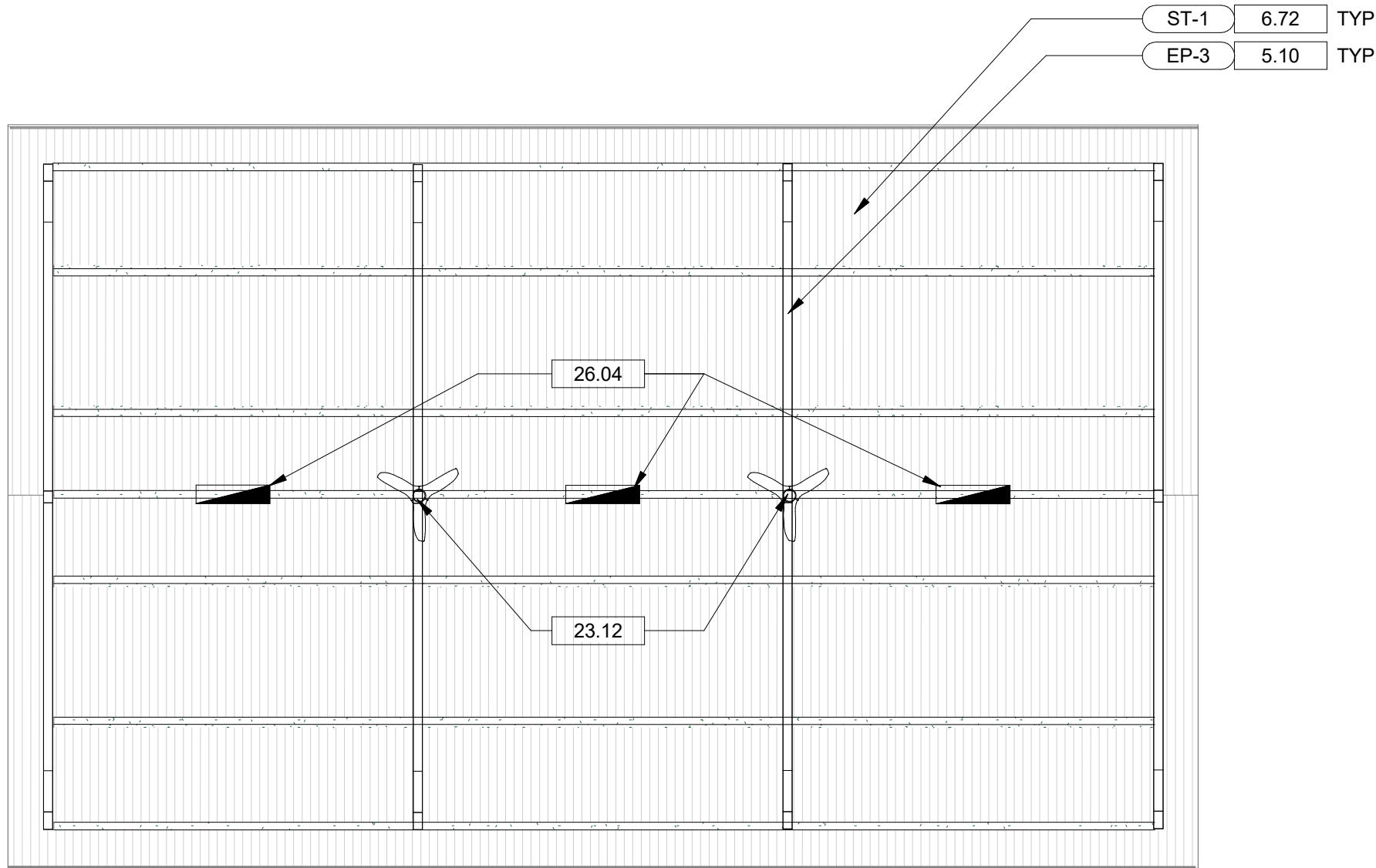
Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



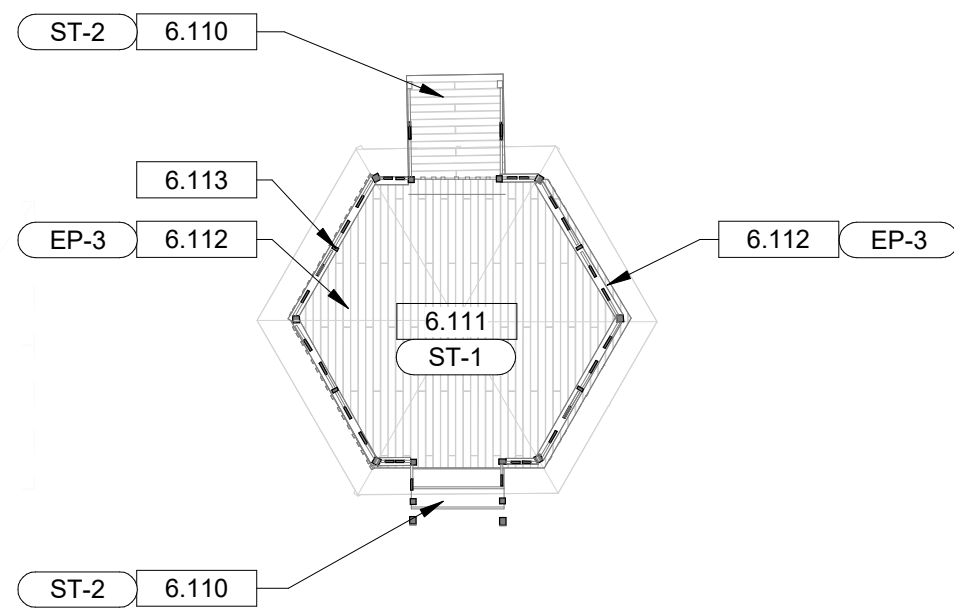
1 BUILDING E - DEMOLITION FLOOR PLAN  
A1.05 1/8" = 1'-0"



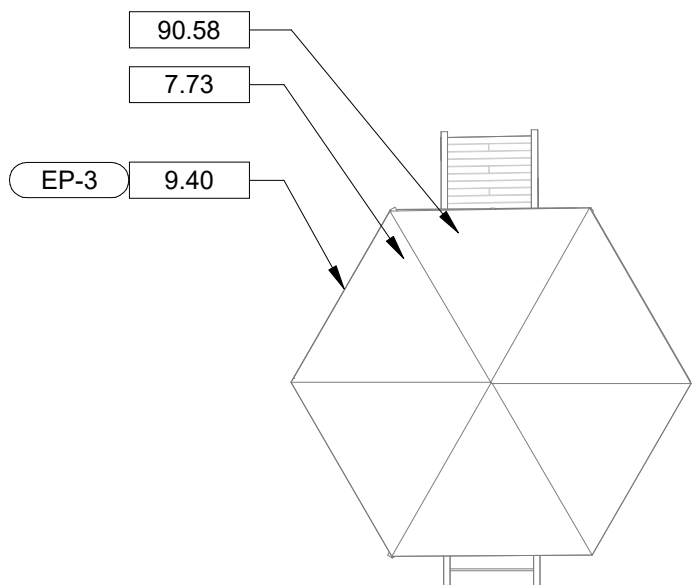
3 BUILDING E - FLOOR PLAN  
A1.05 1/8" = 1'-0"



2 BUILDING E - REFLECTED CEILING PLAN  
A1.05 1/8" = 1'-0"



4 BUILDING F - FLOOR PLAN  
A1.05 1/8" = 1'-0"



5 BUILDING F - ROOF PLAN  
A1.05 1/8" = 1'-0"

## GENERAL CONSTRUCTION NOTES

- GENERAL CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND REPORT DISCREPANCIES IMMEDIATELY TO THE ARCHITECT.
- THE CONTRACTOR SHALL COORDINATE ALL UNDERGROUND PIPING, MECHANICAL AND ELECTRICAL WORK.
- DO NOT SCALE DRAWINGS. USE WRITTEN DIMENSIONS FOR ALL MEASUREMENTS.
- LUMBER AND BLOCKING IN CONTACT WITH MASONRY AND CONCRETE SHALL BE PRESSURE TREATED.
- USE MOISTURE RESISTANT (TYPE "X" AS REQUIRED) GWB BEHIND ALL SINKS AND WET AREAS.
- REMOVE AND REPLACE ANY DAMAGED OR MISSING WOOD BOARDS.
- SEE MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR FULL SCOPE.

## DRAWING NOTES

- PRESSURE WASH EXISTING CONCRETE FLOOR.
- FILL SETTLED ISOLATION POCKET WITH NON SHRINK GROUT AND FINISH LEVEL WITH EXISTING ADJACENT SLAB. TYPICAL AT EACH COLUMN BASE.
- REPAIR CRACKS IN EXTERIOR CONCRETE SLAB AS FOLLOWS. USE GRINDER TO OPEN UP THE CRACK, REMOVE ANY LOOSE PIECES ASSOCIATED WITH THE CRACK, FILL WITH CEMENTITIOUS CRACK FILLER AND FINISH SMOOTH.
- EXISTING METAL ROOF FRAME STRUCTURE TO REMAIN. SAND AND PREPARE METAL FOR NEW PAINT FINISH.
- EXISTING TONGUE AND GROOVE WOOD ROOF DECK. SAND AND PREPARE TO RECEIVE NEW STAIN FINISH.
- REMOVE AND REPLACE EXISTING PRESSURE TREATED BOARDS AT STAIR TREADS AND RAMP. STAIN SEALER.
- EXISTING WOOD FLOOR TO REMAIN. PRESSURE WASH AND PREPARE FOR NEW STAIN FINISH.
- EXISTING DECORATIVE VERTICAL BOARD SCREENING BELOW FLOOR PERIMETER TO REMAIN. CLEAN AND PREPARE EXPOSED SURFACES TO RECEIVE NEW PAINT FINISH. TYPICAL AT GAZEBO PERIMETER.
- EXISTING GAZEBO COLUMNS, RAILING, DECORATIVE HEADER DETAIL, ROOF FRAMING AND ROOF DECK TO BE PRESSURE WASHED AND CLEAR SEALED.
- NEW 20 YEAR 3 TAB SHINGLES OVER 30 LB. BUILDING FELT. BASIS OF DEISGN; GAF, ROYAL SOVEREIGN, CHARCOAL.
- EXISTING FASCIA BOARD TO BE CLEANED AND PREPARED FOR NEW PAINT FINISH ON EXTERIOR VERTICAL FACE AND BOTTOM EDGE ONLY.
- NEW EXTERIOR HOSE BIB, PIPING AND MOUNTING POST. REWORK WATER PIPING TO BE BELOW GRADE. REFER TO CIVIL DRAWINGS.
- NEW CEILING FAN PROVIDED AND INSTALLED BY OWNER. CONTRACTOR TO COORDINATE INSTALLATION OF NEW FANS WITH OWNER.
- NEW LIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.
- ASPHALT PAVING. REFER TO CIVIL DRAWINGS FOR CONCRETE ALTERNATE.
- LINE OF PICNIC SHELTER ROOF OVERHANG ABOVE.
- LINE OF BUILDING H ROOF OVERHANG ABOVE.
- EXISTING YARD HYDRANT, POSTS, AND PIPING TO BE REWORKED. REFER TO CIVIL DRAWINGS FOR WORK SCOPE.
- DEMOLISH EXISTING SHINGLES AND BUILDING FELT DOWN TO SHEATHING.

Seal



27 JUNE 2023

**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS**

Project Number 23236  
Drawn By LMG  
Checked By RHW  
Date 30 APR 2025

Revisions  
A 6/3/25 Addendum 2

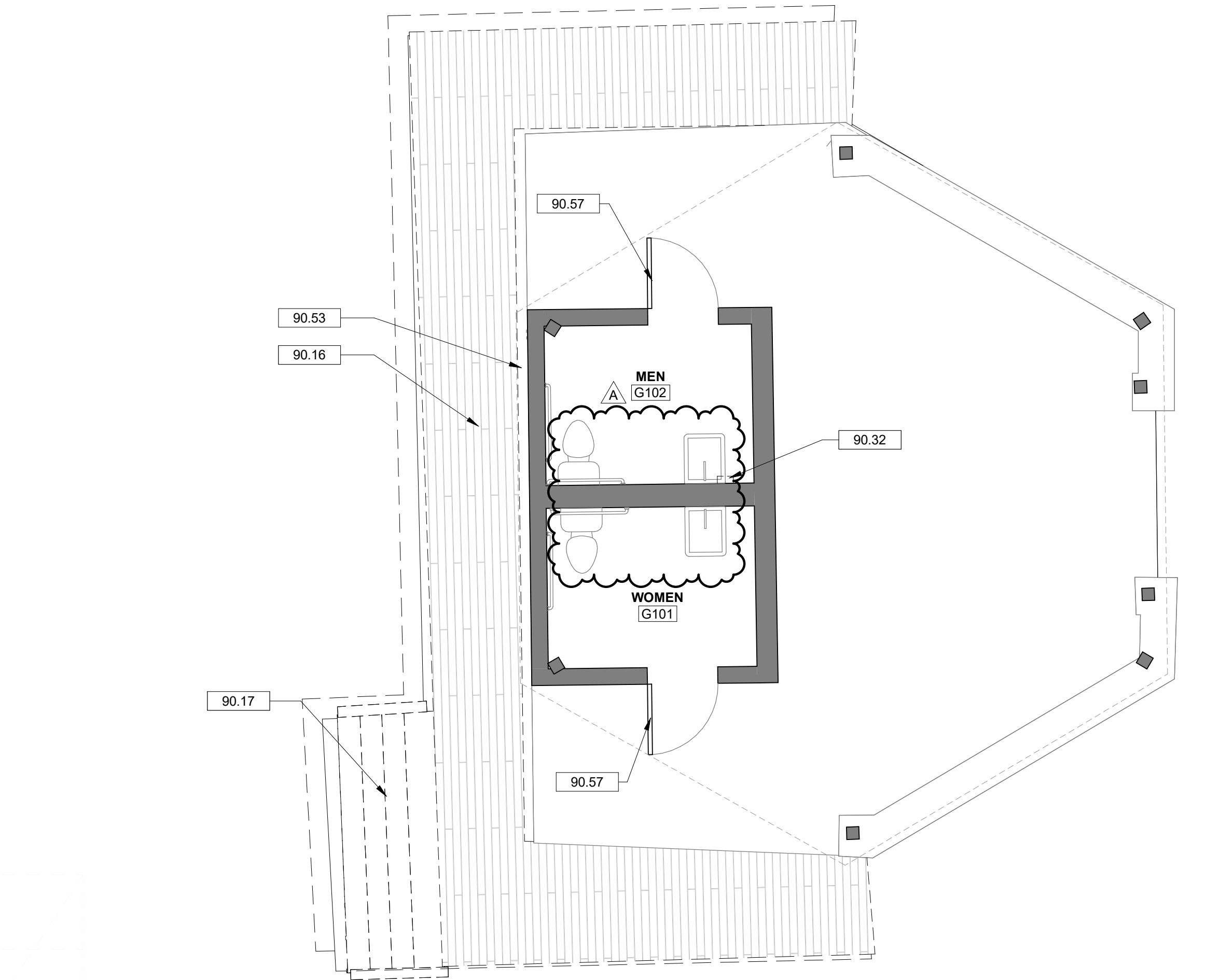
Drawing

**BUILDINGS E AND F -  
PLANS AND DETAILS**

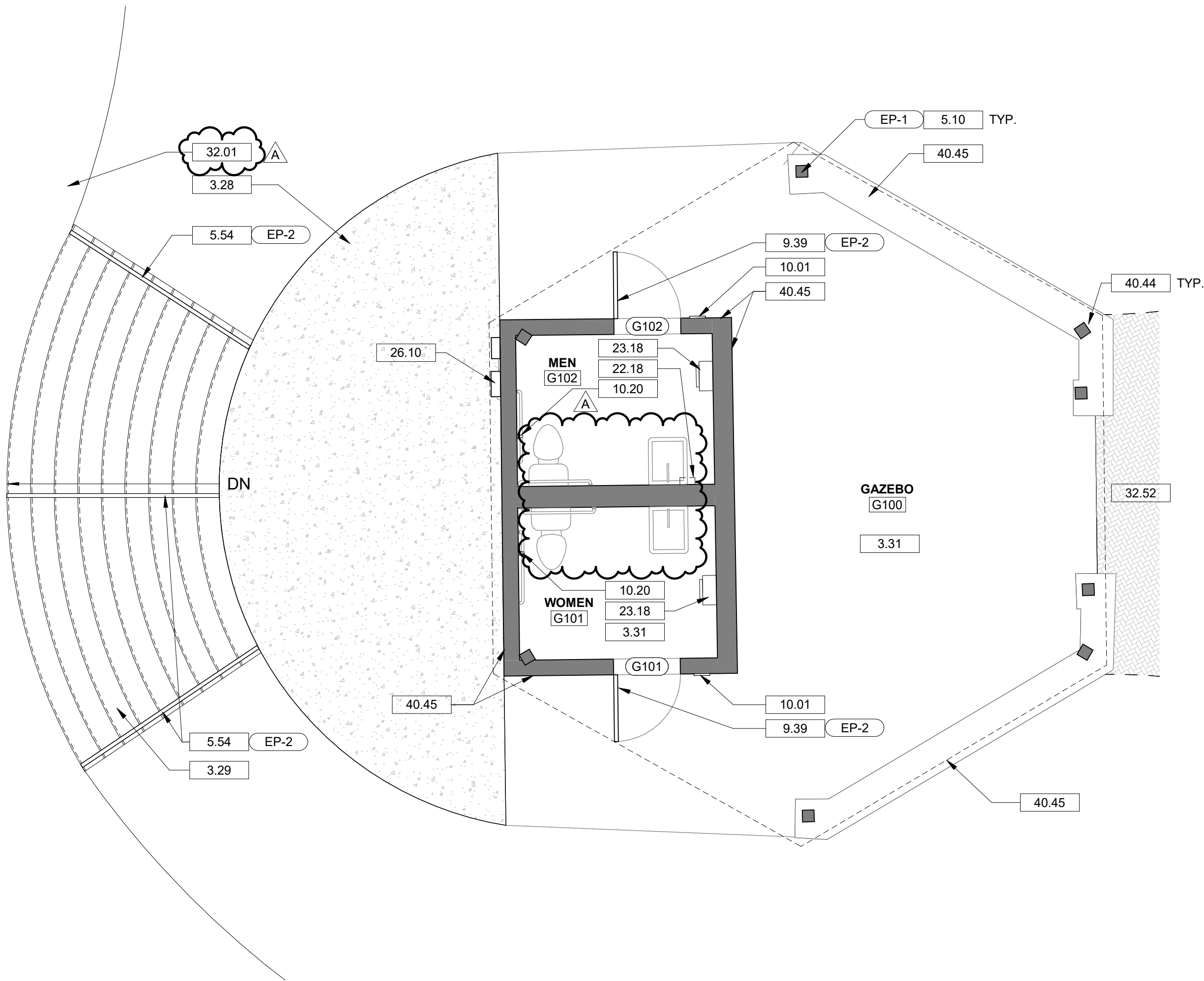
**A1.05**



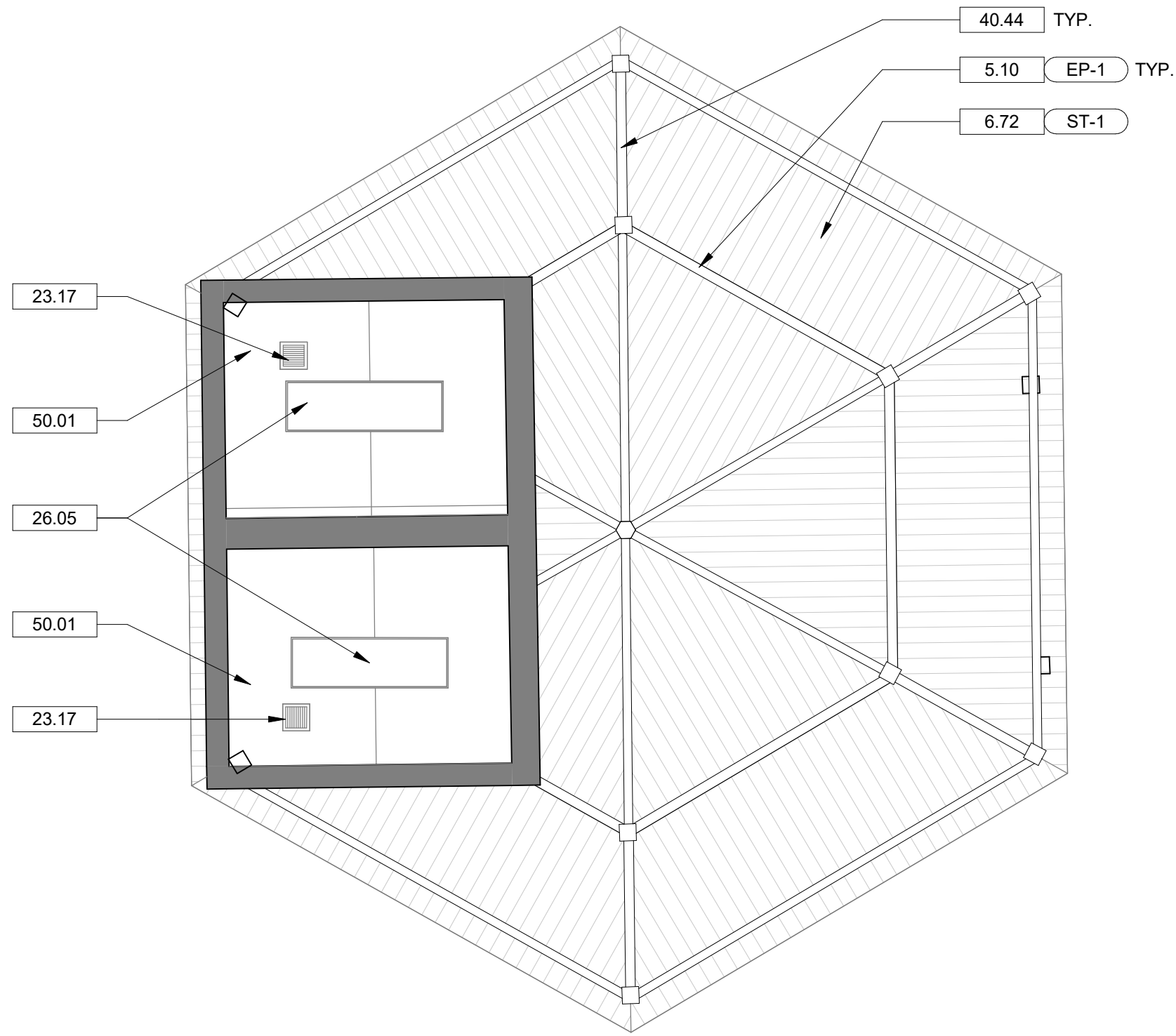
Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



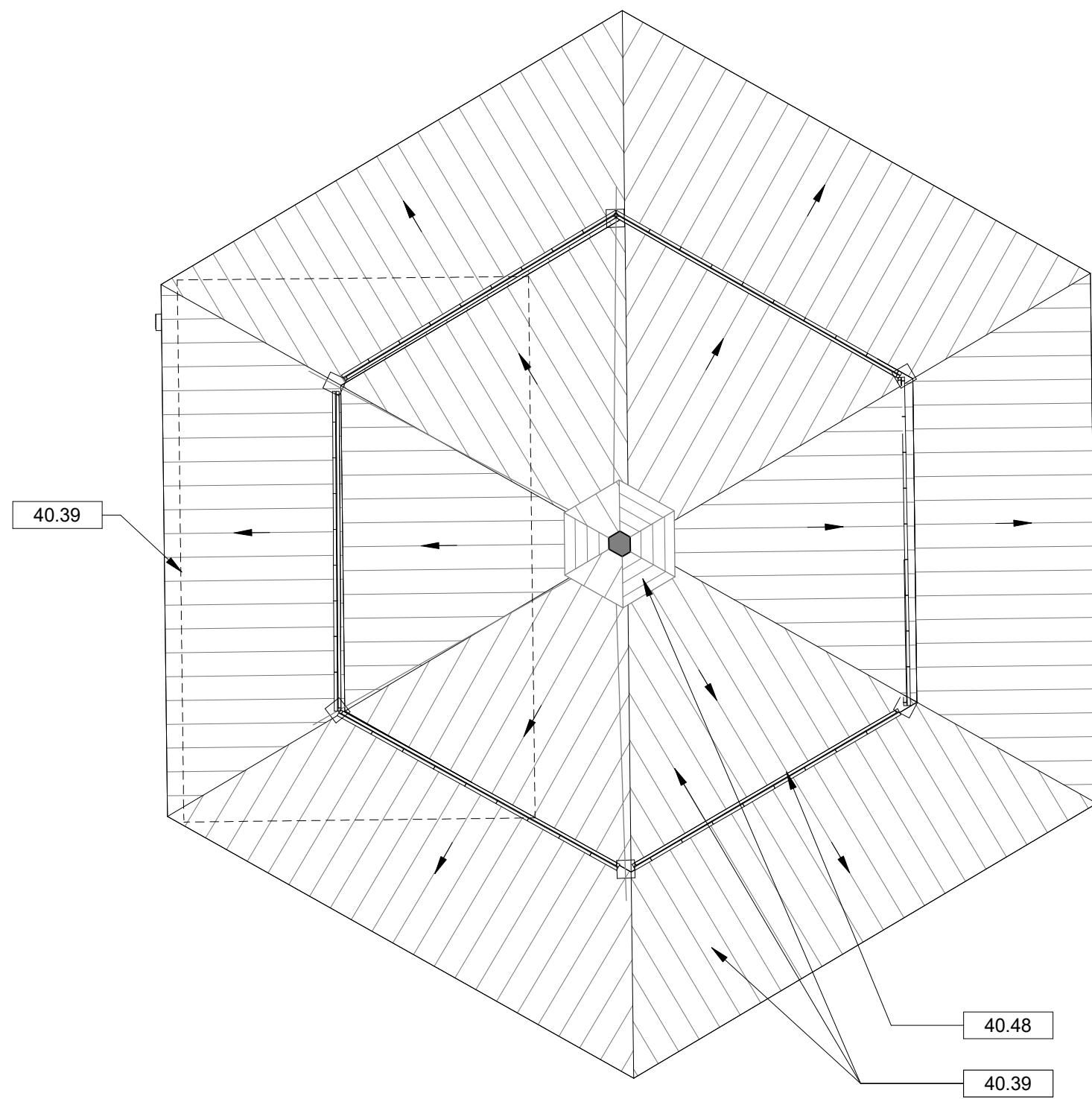
1 BUILDING G - DEMOLITION FLOOR PLAN  
A1.06 1/4" = 1'-0"



3 BUILDING G - FLOOR PLAN  
A1.06 1/4" = 1'-0"



2 BUILDING G - REFLECTED CEILING PLAN  
A1.06 1/4" = 1'-0"



4 BUILDING G - ROOF PLAN  
A1.06 1/4" = 1'-0"

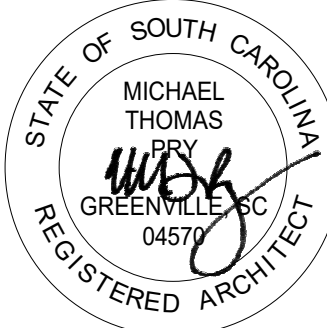
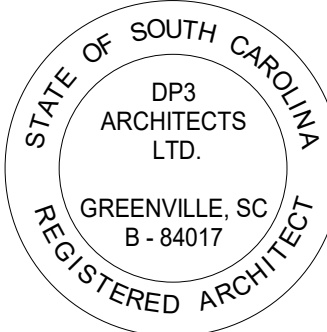
## GENERAL FLOOR PLAN NOTES

- GENERAL CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND REPORT DISCREPANCIES IMMEDIATELY TO THE ARCHITECT.
- DIMENSIONS ARE TO CENTERLINE OF COLUMN LINES, FACE OF INTERIOR SURFACE, FACE OF EXTERIOR WALL SHEATHING AND FACE OF MASONRY, UNLESS NOTED OTHERWISE.
- THE CONTRACTOR SHALL COORDINATE ALL UNDERGROUND PIPING, MECHANICAL AND ELECTRICAL WORK.
- DOOR JAMBS ARE 6" NEAREST PERPENDICULAR WALL, UNLESS NOTED OTHERWISE.
- DO NOT SCALE DRAWINGS. USE WRITTEN DIMENSIONS FOR ALL MEASUREMENTS.
- LUMBER AND BLOCKING IN CONTACT WITH MASONRY AND CONCRETE SHALL BE PRESSURE TREATED.
- ALL ELECTRICAL CONDUIT, OUTLETS, AND LOW VOLTAGE TO BE REPLACED. SEE ELCTRICAL DRAWINGS FOR FULL SCOPE.

## DRAWING NOTES

- NEW CONCRETE WALKING PATH. REFER TO CIVIL DRAWINGS.
- NEW CONCRETE STAIR. REFER TO CIVIL DRAWINGS.
- PRESSURE WASH EXISTING CONCRETE FLOOR.
- EXISTING METAL POLIGON FRAME STRUCTURE TO REMAIN. SAND AND PREPARE METAL FOR NEW PAINT FINISH.
- ACCESSIBLE HANDRAILS. PAINT. REFER TO CIVIL DRAWINGS.
- EXISTING TONGUE AND GROOVE WOOD ROOF DECK. SAND AND PREPARE TO RECEIVE NEW STAIN FINISH.
- ALL EXISTING HOLLOW METAL DOORS AND FRAMES TO RECEIVE NEW PAINT FINISH. CLEAN AND PREPARE FOR NEW FINISH.
- RESTROOM SIGN.
- NEW ACCESSIBLE VERTICAL 18" GRAB BAR.
- NEW INSTANTANEOUS WATER HEATER. INSTALLED UNDER LAVATORY TO FEED LAVATORIES ON BOTH SIDES OF WALL. REFER TO PLUMBING DRAWINGS.
- EXISTING EXHAUST FAN TO REMAIN. REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR RECONDITIONING.
- NEW ELECTRIC UNIT HEATER. REFER TO MECHANICAL AND ELECTRICAL DRAWINGS.
- EXISTING LIGHT FIXTURE TO REMAIN, RECONDITION. REFER TO ELECTRICAL DRAWINGS.
- NEW ELECTRICAL PANEL. REFER TO ELECTRICAL DRAWINGS.
- ASPHALT PAVING. REFER TO CIVIL DRAWINGS FOR CONCRETE ALTERNATE.
- NEW BRICK PAVEMENT WALKWAY. REFER TO CIVIL DRAWINGS.
- SOFT WASH ALL SURFACES OF EXISTING METAL ROOF, COPINGS, AND FASCIA.
- SOFT WASH ALL SURFACES OF EXISTING STEEL FRAME STRUCTURE INCLUDING COLUMNS AND ROOF FRAMING MEMBERS.
- SOFT WASH EXISTING EXTERIOR MASONRY VENEER. TYPICAL AT ALL BUILDING SIDES AND ALL SEAT WALL SURFACES.
- SOFT WASH EXISTING COPING.
- EXISTING CEILING TO REMAIN. RESECURE EXISTING SUBSTRATE TO FRAMING AT BOARD PERIMETERS, CAULK JOINTS AND PREPARE FOR NEW PAINT FINISH. REPLACE COMPROMISED BOARDS (QUANTITY TWO).
- DEMOLISH EXISTING WOOD WALKWAY.
- DEMOLISH EXISTING STAIRS.
- PREPARE FOR NEW WATER HEATER. REFER TO PLUMBING DRAWINGS.
- REMOVE EXISTING ELECTRICAL PANEL. PREPARE FOR NEW WORK. REFER TO ELECTRICAL DRAWINGS.
- DEMOLISH EXISTING RESTROOM SIGNAGE. PREPARE DOOR FOR NEW PAINT FINISH.

Seal



27 JUNE 2023

**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY**  
**REUNION PARK**  
**IMPROVEMENTS**

Project Number 23236  
Drawn By LMG  
Checked By RHW  
Date 30 APR 2025

Revisions  
A 6/3/25 Addendum 2

Drawing

**BUILDING G - PLANS**  
**AND DETAILS**

**A1.06**

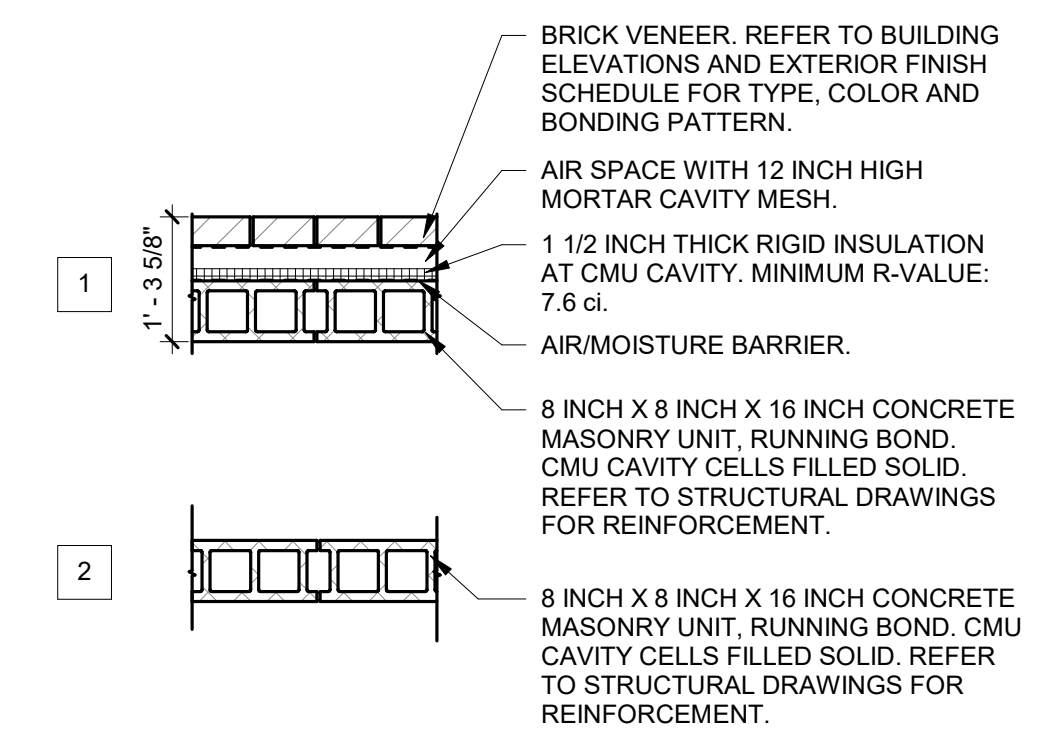


Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.

## GENERAL FLOOR PLAN NOTES

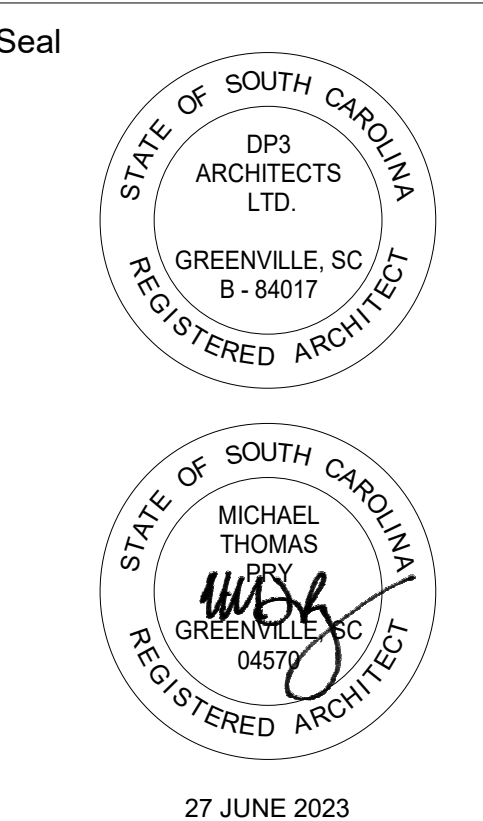
- A. GENERAL CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS AND REPORT DISCREPANCIES IMMEDIATELY TO THE ARCHITECT.
- B. DIMENSIONS ARE TO CENTERLINE OF COLUMN LINES, FACE OF INTERIOR SURFACE, FACE OF EXTERIOR WALL SHEATHING AND FACE OF MASONRY, UNLESS NOTED OTHERWISE.
- C. THE CONTRACTOR SHALL COORDINATE ALL UNDERGROUND PIPING, MECHANICAL AND ELECTRICAL WORK.
- D. DOOR JAMBS ARE 6" NEAREST PERPENDICULAR WALL, UNLESS NOTED OTHERWISE.
- E. DO NOT SCALE DRAWINGS. USE WRITTEN DIMENSIONS FOR ALL MEASUREMENTS.
- F. LUMBER AND BLOCKING IN CONTACT WITH MASONRY AND CONCRETE SHALL BE PRESSURE TREATED.
- G. ALL ELECTRICAL CONDUIT, OUTLETS, AND LOW VOLTAGE TO BE REPLACED. SEE ELECTRICAL DRAWINGS FOR FULL SCOPE.

### WALL TYPE LEGEND



### DRAWING NOTES

- 3.28 NEW CONCRETE WALKING PAD. REFER TO CIVIL DRAWINGS.  
6.85 5/8 INCH GROOVED PLYWOOD SOFFIT, STAIN.  
6.107 4X8 CEDAR BEAM, STAIN. REFER TO STRUCTURAL DRAWINGS.  
6.109 NEW 6X6 HEAVY TIMBER CEDAR POST. REFER TO STRUCTURAL STAIN  
7.23 PREFINISHED STANDING SEAM METAL ROOFING SYSTEM.  
7.47 NEW PREFINISHED METAL SLUITER  
8.03 18"X18" ACCESS DOOR, FIELD LOCATE FOR ACCESS TO J-BOXES. PAINT TO MATCH CEILING.  
9.10 5/8 INCH GYPSUM WALL BOARD.  
10.01 RESTROOM SIGN.  
23.16 EXHAUST FAN. REFER TO MECHANICAL DRAWINGS.  
23.18 NEW ELECTRIC UNIT HEATER. REFER TO MECHANICAL AND ELECTRICAL DRAWINGS.  
26.04 NEW LIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.  
26.09 NEW WALLPACK. REFER TO ELECTRICAL DRAWINGS.  
26.10 NEW ELECTRICAL PANEL. REFER TO ELECTRICAL DRAWINGS.  
32.01 ASPHALT PAVING. REFER TO CIVIL DRAWINGS FOR CONCRETE ALTERNATE  
40.14 NEW 12'X12' PAVEMENT SHELTER BEAM  
40.42 EXISTING POLYGON PICNIC SHELTER FRAME. REFER TO DRAWING "BUILDING E - PLANS AND DETAILS"  
40.47 LINE OF PICNIC SHELTER ROOF OVERHANG ABOVE.



**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
5 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
[www.DP3architects.com](http://www.DP3architects.com)

Project



# NEWBERRY COUNTY REUNION PARK IMPROVEMENTS

Project Number 23236  
 Drawn By LTG  
 Checked By RHW  
 Date 30 APR 2025

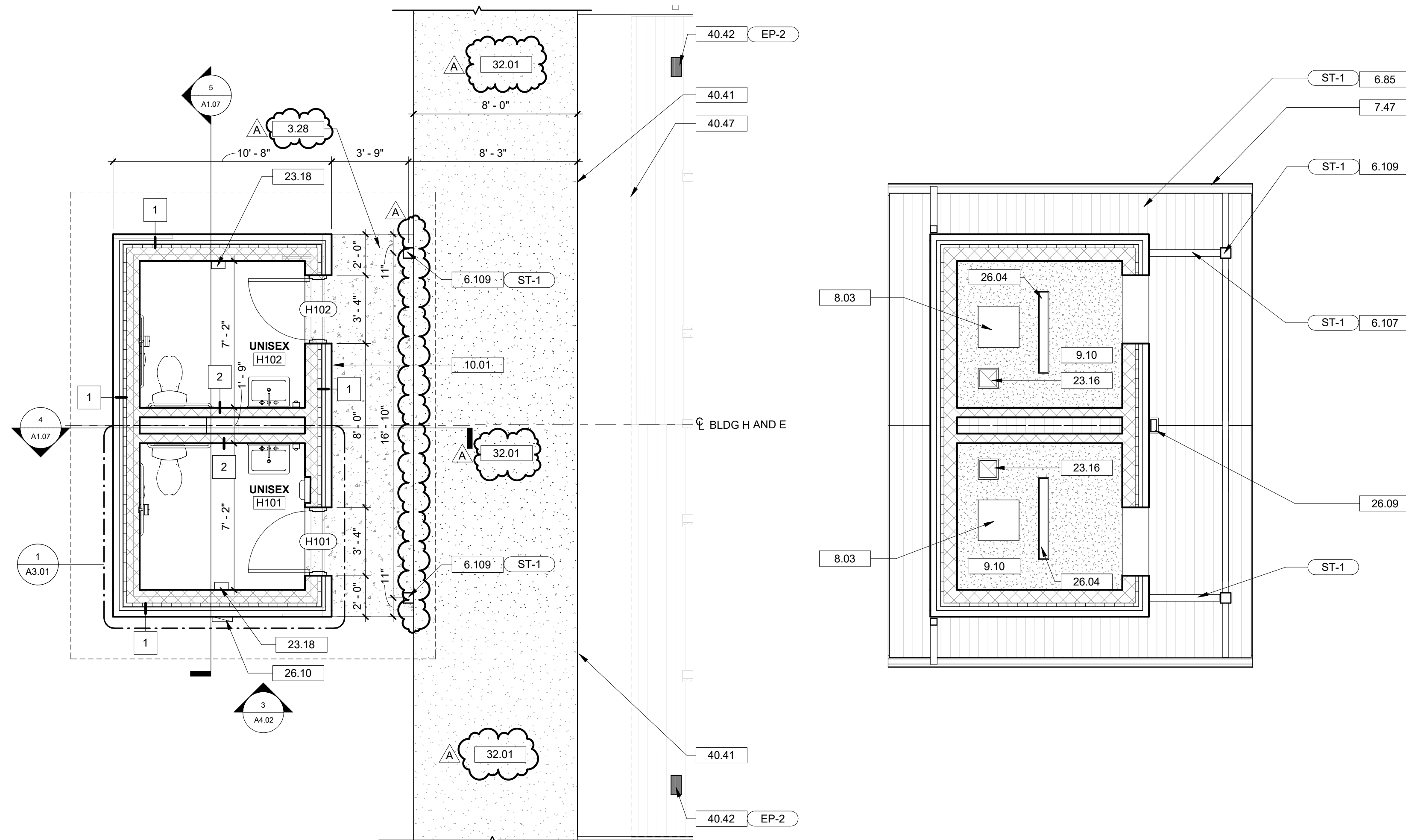
Revisions

A	6/3/25	Addendum 2
---	--------	------------

### Drawing

## BUILDING H - PLANS AND BUILDING SECTIONS

## A1.07



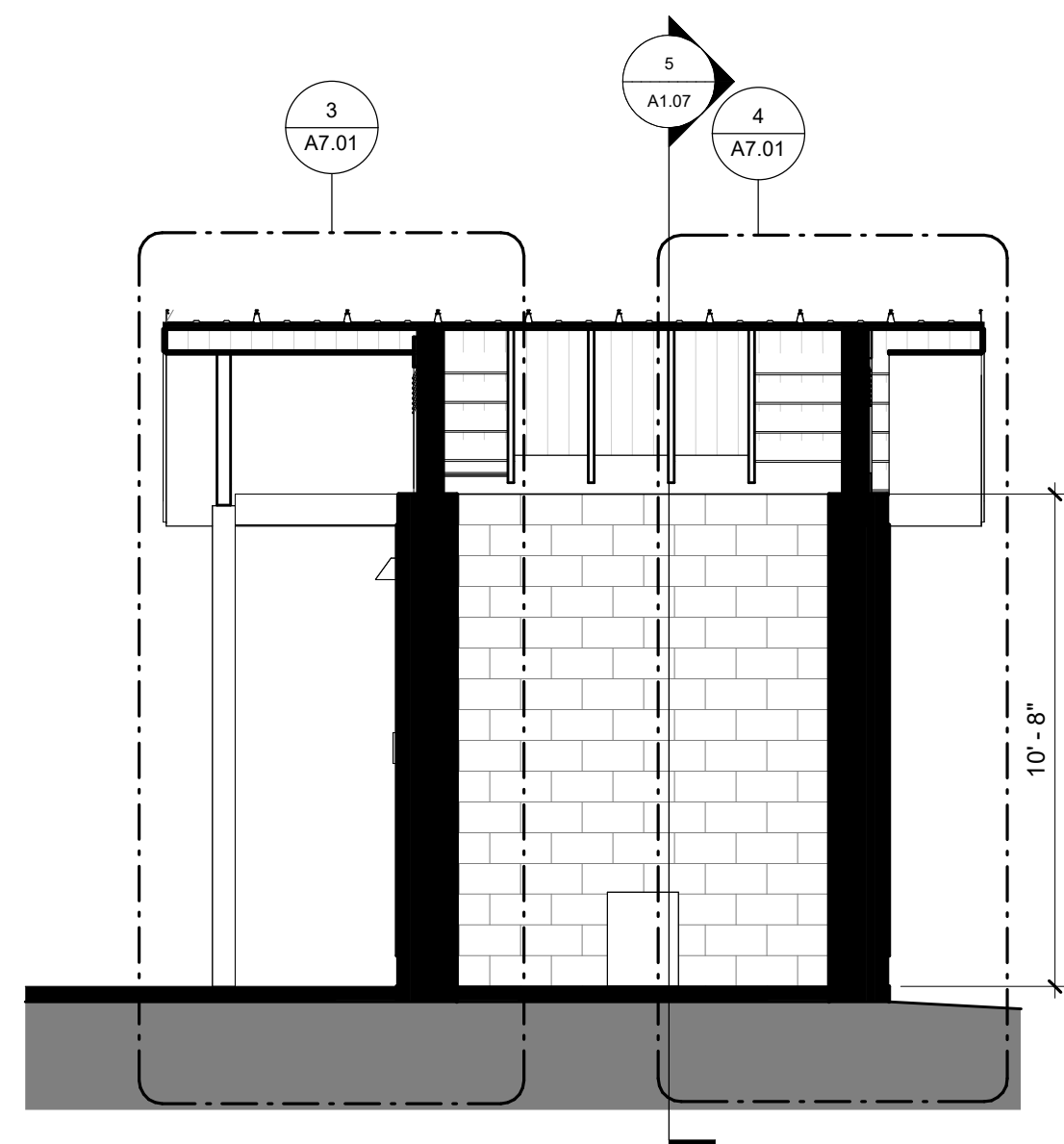
1 BUILDING H - FLOOR PLAN  
A1.07 1/4" = 1'-0"



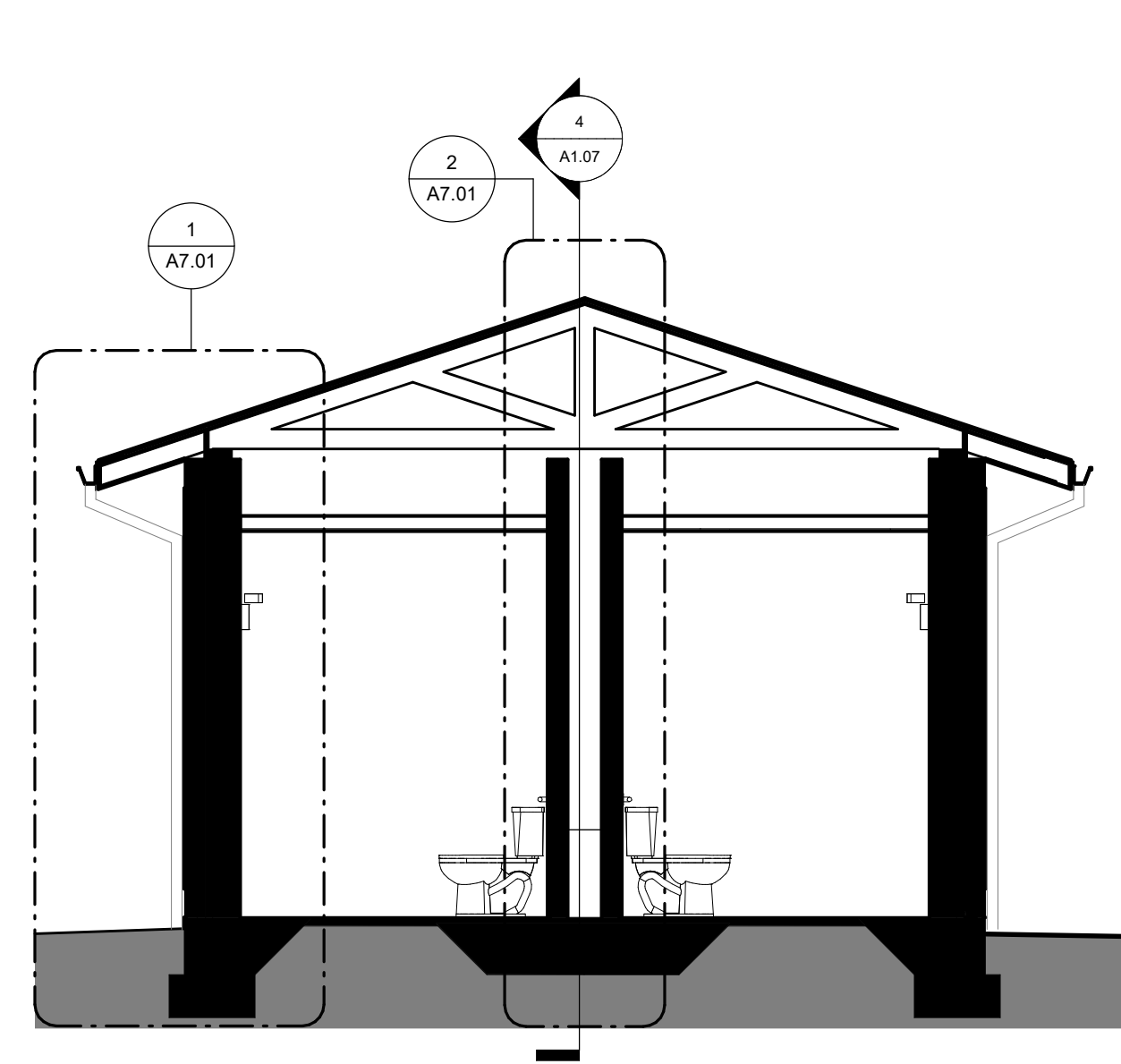
2 BUILDING H - REFLECTED CEILING PLAN



3 BUILDING H - ROOF PLAN

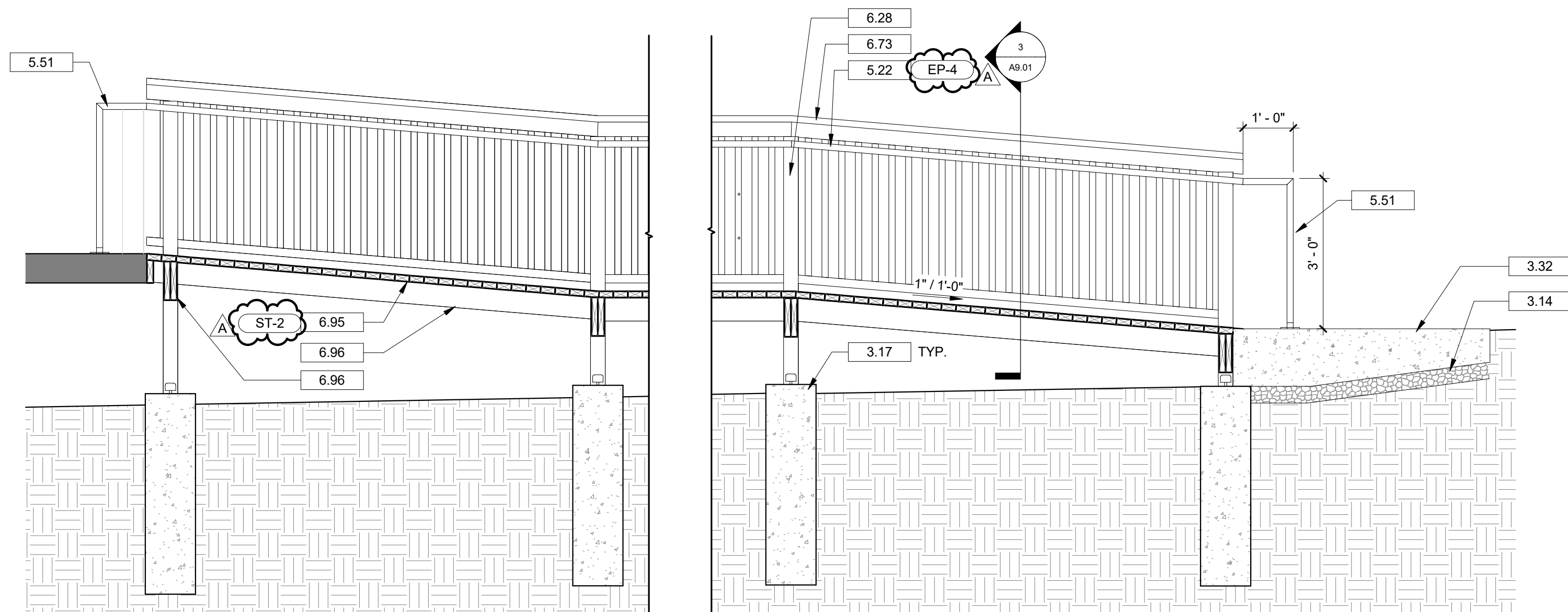


4 BUILDING H - LONGITUDINAL SECTION  
A1.07 1/4" = 1'-0"

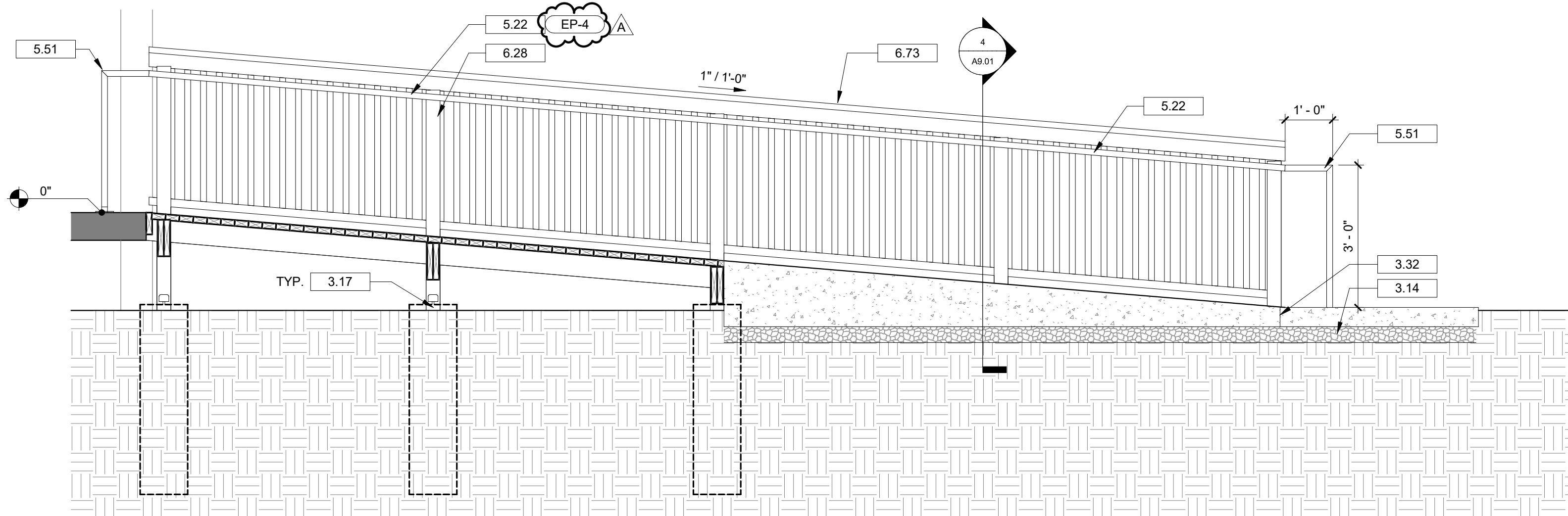


5 BUILDING H - TRANSVERSE SECTION  
A1.07 1/4" = 1'-0"

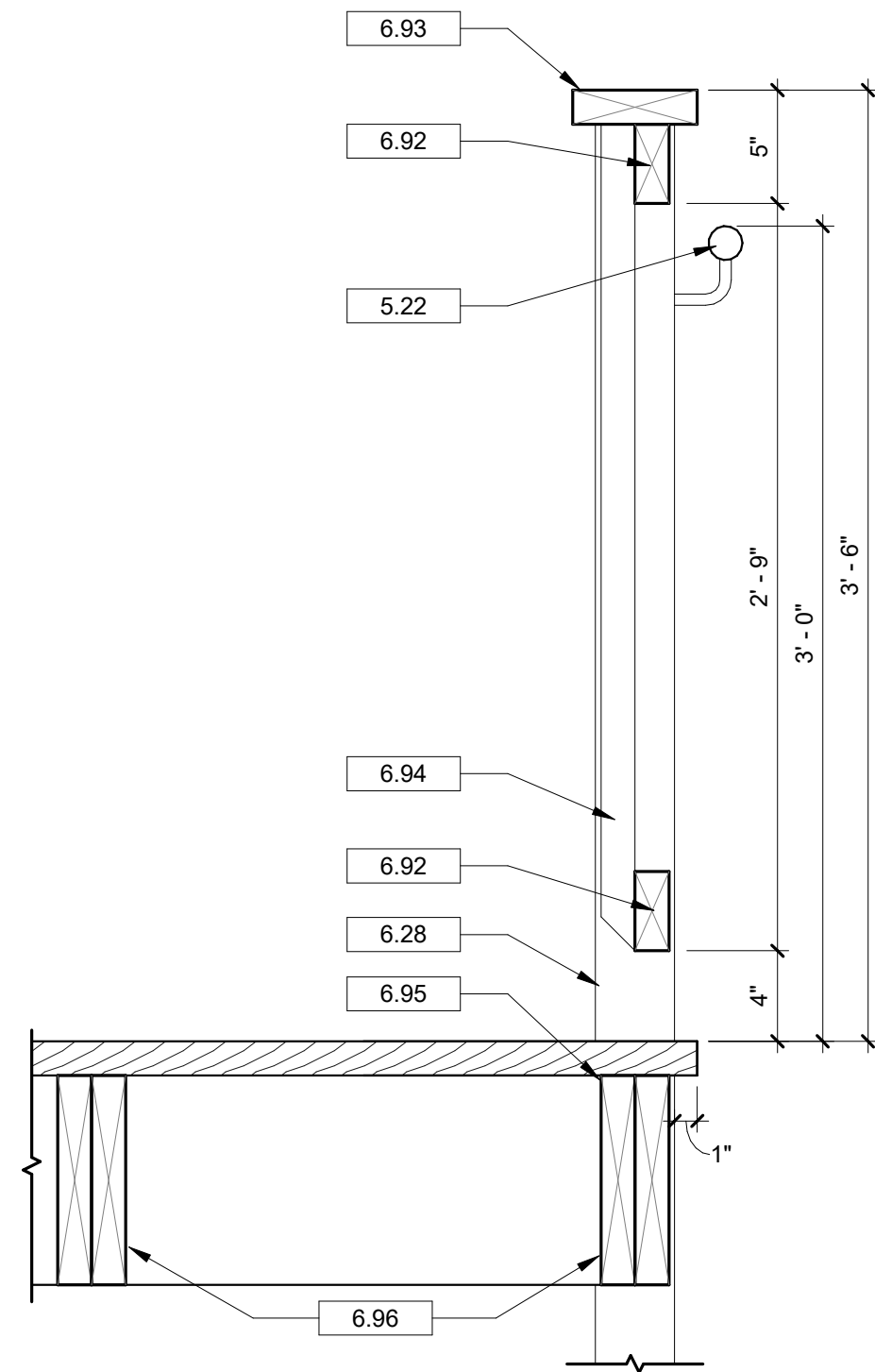
Copyright : These Drawings are the property of DP3 Architects, Ltd., and reuse on any other project without written permission will result in legal action.



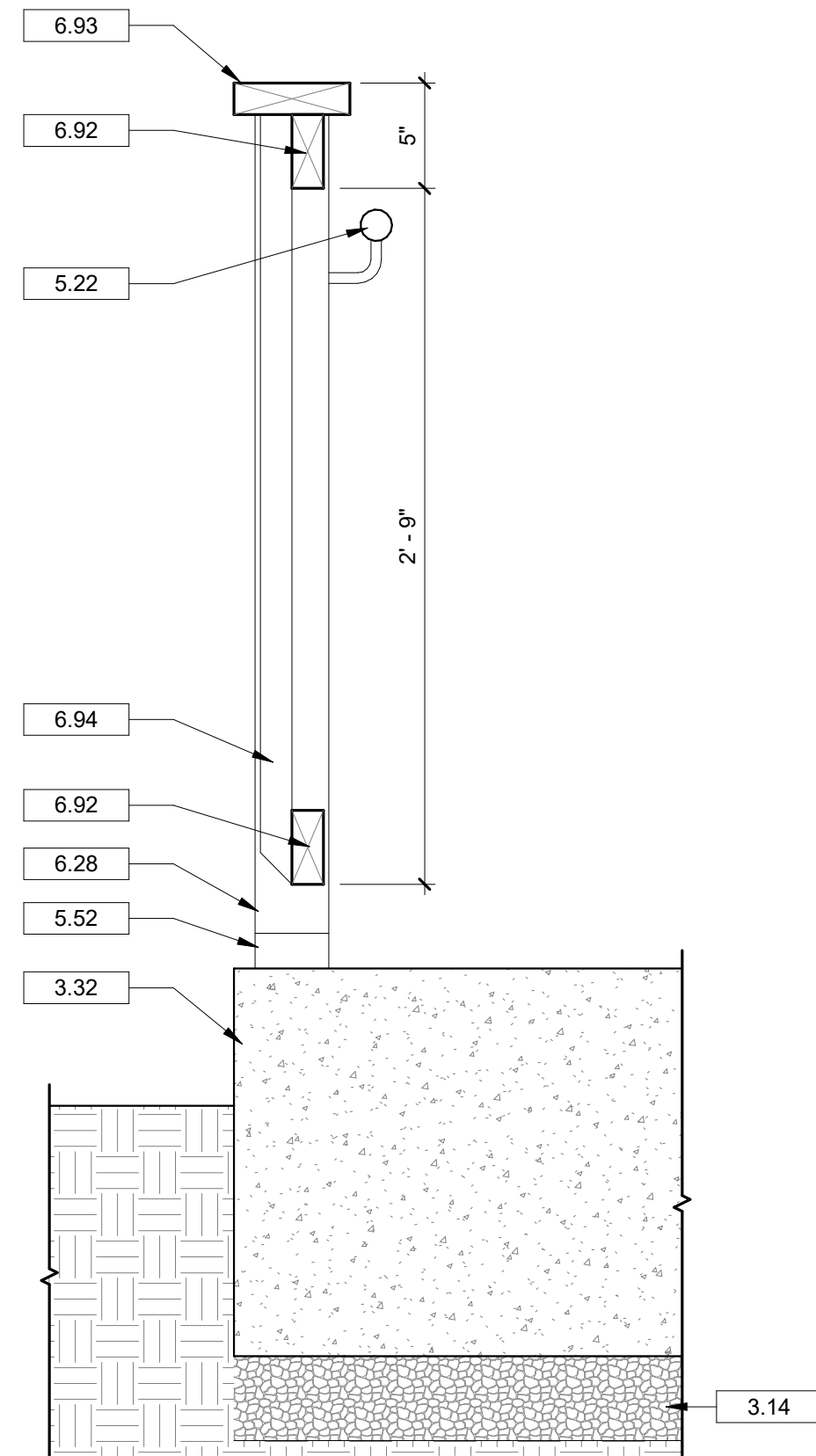
1 BUILDING C - RAMP SECTION  
A9.01 1/2" = 1'-0"



2 BUILDING D - RAMP SECTION  
A9.01 1/2" = 1'-0"



3 HANDRAIL SECTION  
A9.01 1 1/2" = 1'-0"

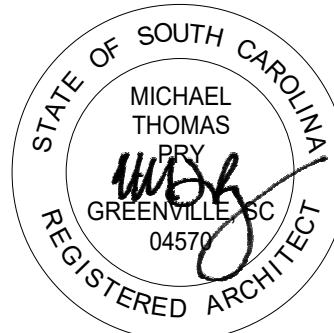


4 HANDRAIL SECTION ON CONCRETE  
A9.01 1 1/2" = 1'-0"

## DRAWING NOTES

- 3.14 COMPACTED STONE. REFER TO STRUCTURAL DRAWINGS.  
3.17 CONCRETE FOOTING. REFER TO STRUCTURAL DRAWINGS FOR SIZE, TYPE OF REINFORCEMENT AND DEPTH.  
3.32 NEW CONCRETE LANDING. REFER TO STRUCTURAL AND CIVIL DRAWINGS.  
5.22 1-1/2" DIAMETER CONTINUOUS METAL HANDRAIL SECURED TO BRACKETS AT EACH POST. PAINT.  
5.51 CONNECT HANDRAIL TO BASE PLATE. REFER TO STRUCTURAL DRAWINGS.  
5.52 EXTEND HANDRAIL 1'-0" PAST BOTTOM/TOP OF RAMP SURFACE AND RETURN TO WALKING SURFACE. SECURE TO SURFACES WITH A METAL DECK FLANGE ANCHOR.  
6.28 4 INCH X 4 INCH PRESSURE TREATED WOOD POST. MAX 6' SPACING. REFER TO FINISH SCHEDULE AND TO STRUCTURAL DRAWINGS.  
6.73 WOOD RAILING. SEE SECTION.  
6.92 2X4 PRESSURE TREATED WOOD RAILRUNNER. PREPARE FOR STAIN FINISH.  
6.93 2X6 PRESSURE TREATED WOOD TOP RAIL. PREPARE FOR STAIN FINISH.  
6.94 2X2 PRESSURE TREATED WOOD BALUSTER. CUT 45 ANGLE AT BOTTOM. PREPARE FOR STAIN FINISH.  
6.95 5/4 PRESSURE TREATED WOOD DECK BOARDS. PREPARE FOR STAIN FINISH.  
6.96 DOUBLE 2X10 PRESSURE TREATED WOOD STRINGER. PREPARE FOR STAIN FINISH.

Seal



27 JUNE 2023

**DP3**  
ARCHITECTS

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
www.DP3architects.com

Project



**NEWBERRY COUNTY  
REUNION PARK  
IMPROVEMENTS**

Project Number 23236  
Drawn By LTG  
Checked By RHW  
Date 30 APR 2025

Revisions  
A 6/3/25 Addendum 2

Drawing

**BUILDING C & D -  
VERTICAL  
CIRCULATION PLANS  
& DETAILS**

**A9.01**



# PRINT ALL INFORMATION

Mandatory Pre-Bid Sign-In Sheet		Wednesday, May 21st – 10:00 AM
Project:	Little Mountain Reunion Park	<b>NOTE:</b>  Print all information clearly. DP3 Architects is not responsible for any information that is not legible. This Pre-Bid Sign-In Sheet will be included in Addendum Number One for the convenience of the bidders.
DP3 Project Number:	23236	
Bid Date:	18 June 2025	
Time:	3:00 PM	
Location:	Derrick Center Library 20 Depot Street Little Mountain, SC 29075 Phone: 803.321.2100	

Name of Individual	Firm Name	Firm Address	Firm Phone	E-Mail
Jesse Baker	W. E. Baker & Son	502 Broom St. Whitman SC 29178	803 694 2368	Jbaker@webakerinc.com
Brandy West	West Electrical	2447 Wilson Rd Newberry	803 276 1884	brandy@westelectrical.com
Donnie Browning	Randolph & Son Builders	1010 Culp Rd. Pineville NC 28134	704-588-7116 704-400-0423	jeff@randolphbuilders.com manish@randolphbuilders.com
Steffen Shealy	Lindler's Const. of SC, LLC	8253 Hwy 34 Newberry SC 29108	803-924-1674	Steffen@lindlers.com
Andrew West	West Electrical	2447 Wilson Rd. Newberry	803-276-1884	awest@westelectrical.com
John Williamson	AOS Specialty Contractors	1224 Two Notch Rd Lexington, SC 29073	919.369.5280	john@aosscc.org



# PRINT ALL INFORMATION

Name of Individual	Firm Name	Firm Address	Firm Phone	E-Mail
Michael Christie	Universal Civil Construction	1721 Price House Rd. Rockbrook, SC 29376	803-260-8177	Mchristie@universalcivilconstruction.com
Jason Prouse	HAMMER CONSTRUCTION	752 ALBION RD COLUMBIA, SC 29205	803-783-7033	JASON@HAMMERLLC.COM
Caleb Wade	Sossamon Construction CO, Inc	510 Old Post Rd. Gaffney, SC, 29341	864-489-6148	Caleb@sossamonconstruction.com
Steve Lawrence	Palmetto Construction Management	1030 Bypass 25 NE Greenwood SC 29649	864-992-0663	steve@palcm.com
Leslie Ashley	Carolina Recreation + Design	4207 Burnwood Trail, Denver NC 28037	949-412-1055	leslie@carolina-recreation.com
Mickey Edwards	Bunnell Lammons ENG	720 Grace Rd Columbia SC	803-832-1380	mickey.edwards@BLECORP.COM
Greg Matthews	ON-SITE BUILDERS LLC	100 MISSISSIPPI DR. Clinton SC	(864) 554-4233	g.matthews@onsitebuildersllc.com
David Harmon	West Electrical Contractors		803-924-0408	Dharmon@WestElectrical.com

# PRINT ALL INFORMATION

Name of Individual	Firm Name	Firm Address	Firm Phone	E-Mail
Jacup Graham	Green Acres Construction	2374 Hughey Ferry Rd 29126	803 944-0837	jacup@greenacres construction.com
Andrew Evans	Trident Vekem Construction	701 Nora Lane Mt Pleasant SC 29464	864-314-5529	aevans@tridentvekem.com
Alex Laws	MAR Construction	2401 Wilson rd Newberry SC 29108	864-640-2866	estimating@marconstruction.com