

10. Manhattan/CDT/Cole-Flex.
  11. RACO; a Hubbell Company.
  12. Thomas & Betts Corporation.
- C. ENT: NEMA TC 13.
- D. RNC: NEMA TC 2, Type EPC-40-PVC, Type EPC-80-PVC when exposed to physical damage.
- E. LFNC: UL 1660.
- F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: UL 514B.

#### **2.03 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS**

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Arcco Corporation.
  2. Endot Industries Inc.
  3. IPEX Inc.
  4. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Comply with UL 2024; flexible type, approved for plenum installation.

#### **2.04 METAL WIREWAYS**

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
  2. Hoffman.
  3. Square D; Schneider Electric.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: Screw-cover type.
- F. Finish: Manufacturer's standard enamel finish.

#### **2.05 NONMETALLIC WIREWAYS**

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
  2. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

- E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## 2.06 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
  - 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:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Thomas & Betts Corporation.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
  - 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:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Butler Manufacturing Company; Walker Division.
    - b. Enduro Systems, Inc.; Composite Products Division.
    - c. Hubbell Incorporated; Wiring Device-Kellems Division.
    - d. Lamson & Sessions; Carlon Electrical Products.
    - e. Panduit Corp.
    - f. Walker Systems, Inc.; Wiremold Company (The).
    - g. Wiremold Company (The); Electrical Sales Division.

## 2.07 BOXES, ENCLOSURES, AND CABINETS

- 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:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. RACO; a Hubbell Company.
  - 8. Robroy Industries, Inc.; Enclosure Division.
  - 9. Scott Fetzer Co.; Adalet Division.
  - 10. Spring City Electrical Manufacturing Company.
  - 11. Thomas & Betts Corporation.
  - 12. Walker Systems, Inc.; Wiremold Company (The).
  - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- F. Metal Floor Boxes: Cast metal, semi-adjustable, rectangular.
- G. Nonmetallic Floor Boxes: Nonadjustable, round.

- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
- K. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## **2.08 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING**

- A. Description: Comply with SCTE 77.
  - 1. Color of Frame and Cover: Gray.
  - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
  - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 5. Cover Legend: Molded lettering, as required for each service.
  - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  - 7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
  - 1. 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:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. NewBasis.

## **2.09 SLEEVES FOR RACEWAYS**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

## **2.10 SLEEVE SEALS**

- 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:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by a independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## 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: EMT.
  - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried with markings for underground and sunlight use.
  - 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.
  - 6. Application of Handholes and Boxes for Underground Wiring:
    - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
    - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: RMC identified for such use.
  - 3. Exposed and Subject to Severe Physical Damage: RMC. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.

- d. Vehicle apparatus bays.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to final connections to lighting equipment, Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations. No more than 6' in length with anti-short bushings installed at each connector prior to installing the conductors.
  6. Damp or Wet Locations: RMC.
  7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
  8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
  9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
  10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) 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.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

### 3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches (150 mm) 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. Support raceways as specified in Division 26 Section "Hangers and Supports."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
  1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. 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.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
  - 1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
  - 2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, 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 or LFNC in damp or wet locations not subject to severe physical damage.
- O. 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.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.03 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 2316 "Excavation" for pipe less than 6 inches (150 mm) in nominal diameter.
  - 2. Install backfill as specified in Section 31 2323 "Fill and Backfill."
  - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 2323, "Fill and Backfill."
  - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
  - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
  - 6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

**3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES**

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

**3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Concrete Slabs and Walls: Install galvanized steel sleeves for penetrations through poured concrete or CMU walls with a minimum of one (1) inch annular space.
- B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- C. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealers" for materials and installation.
- J. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using galvanized sheet metal sleeves and fire sealed in accordance with standard fire sealing practices. COR 16110-3.4.
- L. Underground, Exterior-Wall Penetrations or foundations: Install galvanized RMC with segmented link seals at exterior building penetrations.

**3.06 SLEEVE-SEAL INSTALLATION**

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install

in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

**3.07 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

**END OF SECTION 26 0533**



**SECTION 26 0534**  
**OUTLET, PULL AND JUNCTION BOXES**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. Provisions of Section 26 0510, "General Electrical Requirements".

**1.02 REFERENCES**

- A. National Electrical Manufacturers Association.
- B. American Society for Testing and Materials.
- C. National Electrical Code

**1.03 SUMMARY**

- A. Outlet Boxes.
- B. Pull Boxes.
- C. Junction Boxes.
- D. Floor Boxes.

**1.04 WARRANTY:**

- A. Warranty shall comply with the provisions of Section 26 0510, "General Electrical Requirements".

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. The size of each outlet or junction box shall be determined by the number and sizes of wires and conduits entering the box, but shall be not less than 4-inch square and 2-1/8-inches deep unless otherwise indicated.
- B. Outlet and junction boxes for interior use shall be galvanized or sherardized, one-piece pressed or welded steel, knockout type, except where other types of boxes are indicated or specified.
- C. Outlet and junction boxes for exterior use shall be lug type "Bell" boxes "250L" through "254L", "Crouse-Hinds FS" type, as applicable or equal.
- D. Outlet boxes shall be equipped with plaster rings, inserts and fixture studs as may be required. Knockout seals shall be provided where knockouts are not intact.
- E. Plastic, fiber or composition boxes shall not be permitted.
- F. Telecommunication Outlets: Voice and data wall outlet boxes shall be 4-11/16-inch square by 2-1/8-inch deep metal boxes, with plaster ring.
- G. Outlet boxes for hazardous locations (Class I, Groups A, B, C, and D; and Class II, groups D, F and G) shall be in accordance with U.L. 886.
- H. All exterior pull boxes, plates, fittings, etc., mounted below 10 feet – 0 inch in height shall be fitted with rustproof, tamperproof screws. Provide Owner with two (2) screw drivers (or wrenches) to fit special screws. Screws shall be Spanner, Key Slot, or Rosette.
- I. Boxes in concrete shall be of the type to allow placing of conduit without displacing reinforcing bars, and shall be type approved for concrete use. Boxes installed in poured concrete shall be packed with approved material to prevent concrete entering box. Do not use paper for such packing.
- J. Floor boxes shall be Walker Box Resource RFB or equal, no known equal series with brass plates and brass carpet flanges for carpeted areas.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. Outlet boxes shall be securely and independently fastened to the structure and in concealed work shall be supported flush with finished surface of walls or ceiling.
- B. Bar hangers fitted with fixture studs shall be used to support and outlet boxes in stud partitions and in furred or plastered ceilings.
- C. Fasteners shall be machine screws, nut and lock washers in metal, wood screws, in wood, or expansion shields or inserts in masonry or concrete. Wooden inserts will not be acceptable.
- D. Label outside of box to identify panel and circuit numbers. Use indelible markers, non-erasing type, for boxes above ceilings or in concealed locations.
- E. Fire alarm boxes shall be painted red.

**END OF SECTION**

**SECTION 26 0543****UNDERGROUND DUCTS AND RACEWAYS 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. Conduit, ducts, and duct accessories for direct-buried and concrete or slurry-encased duct banks and in single duct runs.
  - 2. Handholes and pull boxes.

**1.03 DEFINITION**

- A. RNC: Rigid nonmetallic conduit.

**1.04 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Duct-bank materials, including separators and miscellaneous components.
  - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  - 3. Accessories for handholes and pull boxes.
  - 4. Warning tape.
  - 5. Warning planks.
- B. Shop Drawings for Factory-Fabricated Handholes and Pull Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
  - 1. Duct entry provisions, including locations and duct sizes.
  - 2. Cover design.
  - 3. Grounding details.
  - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- C. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
  - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
  - 2. Drawings shall be signed and sealed by a qualified professional engineer.
- D. Product Certificates: For concrete and steel used in precast concrete pull boxes and handholes, comply with ASTM C 858.
- E. Qualification Data: For qualified professional engineer and testing agency.
- F. Source quality-control reports.
- G. Field quality-control reports.

**1.05 QUALITY ASSURANCE**

- A. Comply with IEEE C2.
- B. Comply with NFPA 70.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

#### **1.07 PROJECT CONDITIONS**

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager and owner no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's and Owner's written permission.

#### **1.08 COORDINATION**

- A. Coordinate layout and installation of ducts, handholes, and pull boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes, and pull boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to handholes and as approved by Architect.

#### **1.09 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

### **PART 2 - PRODUCTS**

#### **2.01 CONDUIT**

- A. Rigid Metal Conduit: Galvanized. Comply with ANSI C80.1 for Risers.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B with markings for "underground" and "sunlight" use.

#### **2.02 NONMETALLIC DUCTS AND DUCT ACCESSORIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. AFC Cable Systems.
  - 2. ARNCO Corporation.
  - 3. Beck Manufacturing.
  - 4. Cantex, Inc.
  - 5. CertainTeed Corp.
  - 6. Condux International, Inc.
  - 7. DCX-CHOL Enterprises, Inc.; ELECSYS Division.
  - 8. Electri-Flex Company.
  - 9. IPEX Inc.
  - 10. Lamson & Sessions; Carlon Electrical Products.
  - 11. Manhattan Wire Products; a Belden company.

- C. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- D. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- E. Duct Accessories:
  - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and retained to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
  - 2. Warning Tape: Underground-line warning tape specified in Section 26 0553, "Electrical Identification."
  - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
    - a. Color: Red dye added to concrete during batching.
    - b. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

### 2.03 PRECAST CONCRETE HANDHOLES AND PULL BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Christy Concrete Products.
  - 2. Cretex Concrete Products West, Inc.; Riverton Division.
  - 3. Elmhurst-Chicago Stone Co.
  - 4. Oldcastle Precast Group.
  - 5. Oldcastle Precast Inc.; Utility Vault Division.
  - 6. Utility Concrete Products, LLC.
  - 7. Wausau Tile Inc.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A153 (ASTM A153M) and ASTM A123 (ASTM A123M).
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or pull box.
  - 1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing stainless-steel bolts.
  - 2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing stainless-steel bolts.
  - 3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing stainless-steel bolts.
    - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    - b. Cover Handle: Recessed.
  - 4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing stainless-steel bolts.
    - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    - b. Cover Handle: Recessed.
  - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 6. Cover Legend: Molded lettering, As required for each service.
  - 7. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
  - 8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    - a. Extension shall provide increased depth of 12 inches (300 mm).
    - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
  - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
  - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
  - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
  - a. Type and size shall match fittings to duct or conduit to be terminated.
  - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
11. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

#### **2.04 HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE**

- A. Description: Comply with SCTE 77.
  1. Color: Gray.
  2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering,
    - a. As required for each service.
    - b. Tier level number, indicating that the unit complies with the structural load test for that tier according to SCTE 77.
  6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, retained to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
  7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Pull Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two. Handholes and pull boxes shall comply with the requirements of SCTE 7 Tier 5 loading.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. Hubbell Power Systems; Lenoir City Division.
    - e. NewBasis.
- C. High-Density Plastic Pull Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene, complying with SCTE 77 Tier 5 loading. Cover shall be polymer concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Carson Industries LLC.
  - b. Nordic Fiberglass, Inc.
  - c. Pencil Plastics.

### **PART 3 - EXECUTION**

#### **3.01 CORROSION PROTECTION**

- A. Aluminum shall not be installed in contact with earth or concrete.

#### **3.02 UNDERGROUND DUCT APPLICATION**

- A. Ducts for Electrical Cables over 600 V: RNC, NEMA Type EPC-80-PVC, in concrete-encased duct bank unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.
- C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank unless otherwise indicated.
- D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.
- F. Underground Ducts for Parking Lot Lighting Branch Circuits: RNC, NEMA Type EPC-80-PVC installed in direct-buried duct bank unless otherwise indicated.
- G. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- H. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank unless otherwise indicated.
- I. Underground Ducts Crossing Paved Paths, Walkways and Driveways: RNC, NEMA Type EPC-80-PVC, encased in reinforced concrete.

#### **3.03 UNDERGROUND ENCLOSURE APPLICATION**

- A. Handholes and Pull Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
  1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete, AASHTO HB 17, H-20 structural load rating.
  2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
  3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
  4. Units Subject to Light-Duty Pedestrian Traffic Only: High-density plastic, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) "Light-Duty" vertical loading.

#### **3.04 EARTHWORK**

- A. Excavation and Backfill: Comply with Division 31 Sections 31 2316, "Excavation" and "Fill and Backfill," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

### 3.05 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward pull boxes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm), both horizontally and vertically, at other locations unless otherwise indicated.
- C. Joints: Use approved cleaner and solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 ft. (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
  - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to handhole.
  - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 ft. (3 m) outside the building wall without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section 26 0533, "Raceways and Boxes for Electrical Systems."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
- H. Concrete or Slurry-Encased Ducts: Support ducts on duct separators.
  - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 ft. (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  - 2. Minimum slurry psi shall be determined by the engineer of record with a minimum of 2000 psi.
  - 3. Red dye shall be used for all duct bank concrete or slurry.
  - 4. Concreting Sequence: Pour each run of envelope between handholes or other terminations in one continuous operation.
    - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
  - 5. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of



concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

6. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  7. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  8. Minimum Space between Ducts: 4 inches (100 mm) between ducts and exterior envelope wall, 3 inches (75 mm) between ducts and exterior envelope bottom, 3 inches (75 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
  9. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  10. Stub-Ups: Use manufactured galvanized rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor with 20 mil PVC tape wrap the entire length.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, when coupling is connected to different materials, the coupling shall be of greater strength.
    - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
    - c. Minimum conduit bend radius shall be 12 X the conduit diameter.
  11. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.
- I. Direct-Buried Duct Banks:
1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
  2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 ft. (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
  3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section 31 2316, "Excavation" for pipes less than 6 inches (150 mm) in nominal diameter. Bedding material shall be granular with a sand equivalent (SE) > 30.psi
  4. Install backfill as specified in Division 31 Section 31 2323, "Fill and Backfill."
  5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section 31 2323, "Fill and Backfill."
  6. Minimum Space between Ducts: 4 inches (100 mm) between ducts and exterior envelope wall, 3 inches (75 mm) between ducts and exterior envelope bottom, 3 inches (75 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.

7. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
  - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

### **3.06 INSTALLATION OF CONCRETE HANDHOLES AND PULL BOXES**

- A. Precast Concrete Handhole Installation:
  1. Comply with ASTM C 891 unless otherwise indicated.
  2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
  3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
  1. Install handholes with bottom below the frost line.
  2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
  3. Where indicated, cast handhole cover frame integrally with handhole structure.
- C. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars

### **3.07 INSTALLATION OF HANDHOLES AND PULL BOXES OTHER THAN PRECAST CONCRETE**

- A. Install handholes and pull boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use pull box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level 6-inch- (15-cm-) thick bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: Set so cover surface will be flush with finished grade.
- D. Install handholes and pull boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Retain arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
  - 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
  - 2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

### **3.08 GROUNDING**

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding."

### **3.09 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
  - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
  - 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

### **3.10 CLEANING**

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

**END OF SECTION 260543**

**SECTION 26 0553  
ELECTRICAL IDENTIFICATION**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Field-painted identification of conduit.

**1.02 RELATED SECTIONS**

- A. Section 09 9000 - Painting and Coating.

**1.03 REFERENCES**

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Submittals for submittals procedures.
- B. Product Data: Provide catalog data for nameplates, labels, and markers.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation and installation of product.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

**1.06 EXTRA MATERIALS**

- A. See Section 01 6000 - Product Requirements for additional requirements.

**PART 2 PRODUCTS****2.01 NAMEPLATES AND LABELS**

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
  - 1. Each electrical distribution and control equipment enclosure.
  - 2. Communication cabinets.
- C. Letter Size:
  - 1. Use 1/8 inch (3 mm) letters for identifying individual equipment and loads.
  - 2. Use 1/4 inch (6 mm) letters for identifying grouped equipment and loads.
- D. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches and receptacles, and control device stations.

**2.02 WIRE MARKERS**

- A. Description: Cloth, tape, split sleeve, or tubing type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and at each load connection.
- C. Legend:
  - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
  - 2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

**2.03 CONDUIT MARKERS**

- A. Location: Furnish markers for each conduit longer than 6 feet (2 m).
- B. Spacing: 20 feet (6 m) on center.
- C. Color:
  - 1. 480 Volt System: Orange.
  - 2. 208 Volt System: Black.
  - 3. Fire Alarm System: Red.
  - 4. Telephone System: Blue.
- D. Legend:
  - 1. 480 Volt System: Orange.
  - 2. 208 Volt System: Black.
  - 3. Fire Alarm System: Red.
  - 4. Telephone System: Blue.

**2.04 UNDERGROUND WARNING TAPE**

- A. Description: 4 inch (100 mm) wide plastic tape, detectable type colored yellow with suitable warning legend describing buried electrical lines.

**PART 3 EXECUTION****3.01 PREPARATION**

- A. Degrease and clean surfaces to receive nameplates and labels.

**3.02 INSTALLATION**

- A. Install nameplates and labels parallel to equipment lines.
- B. Secure nameplates to equipment front using adhesive.
- C. Secure nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Identify conduit using field painting under provisions of Division 1.
  - 1. Paint colored band on each conduit longer than 6 feet (2 m).
  - 2. Paint bands 20 feet (6 m) on center.
  - 3. Colors:
    - a. 480 Volt System: Orange.
    - b. 208 Volt System: Black.
    - c. Fire Alarm System: Red.
    - d. Telephone System: Blue.
- E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches (75 mm) below finished grade.

**END OF SECTION**

**SECTION 26 0573**  
**OVERCURRENT PROTECTIVE DEVICES**

**PART 1 GENERAL****1.01 RELATED DOCUMENTS**

- A. The provisions of Section 26 0510," General Electrical Requirements" and Section 26 272 6, "Wiring Devices".

**1.02 REFERENCES**

- A. National Electrical Manufacturer Association FU 1.
- B. National Electrical Code.

**1.03 SUMMARY**

- A. Circuit breakers (each type and style).
- B. Circuit breaker handle padlock assembly.
- C. Fuses (each type and style).
- D. Disconnect switches (each type and size).
- E. Enclosures (each type and style).

**1.04 WARRANTY**

- A. Warranty shall comply with the provisions of Section 26 0510, "General Electrical Requirements".

**PART 2 PRODUCTS****2.01 CIRCUIT BREAKERS**

- A. Circuit breakers for panelboards, distribution panelboards, distribution switchboards, and main service equipment shall be the manufactured product of the same manufacturer as the equipment in which the circuit breaker is installed.
- B. Circuit breakers for panelboards and distribution panelboards shall be bolt-on type. Handle ties and dual, quad or tandem breakers are not acceptable. Mounting hardware, accessories, faceplates, enclosures, etc., shall be provided as required. Each and every circuit breaker shall be provided with a handle padlock attachment. This attachment shall allow the circuit breaker to be padlocked in either the "ON" or "OFF" position. Circuit breakers for distribution switchboards and main service equipment shall be as specified in Section 26 2 4 16, "Panelboards".
- C. Circuit breakers shall be quick-break on manual and automatic operation, and the handle mechanism shall be trip-free to prevent holding contact closed against a short circuit or sustained overload. Contacts shall be of high pressure butt-type and shall be made of a silver alloy material. Arc chutes shall be provided. Automatic thermal and magnetic tripping devices shall be located in each pole for the breaker. The thermal device shall provide time delay tripping on overloads and the magnetic device shall provide instantaneous tripping on short circuits. Circuit breakers with frame sizes above 100 amperes shall have an instantaneous-magnetic trip adjustment of ten times the circuit breaker's continuous amp rating (unless otherwise indicated). These adjustments shall be accessible from the front of the breaker.
- D. Circuit breakers used for switching lighting loads directly shall be approved Type "SW".
- E. Circuit breakers used to control motor loads directly shall be approved Type "HACR".
- F. Short circuit interrupting capacity shall be as indicated on the plans and shall in no case be less than 10,000 amps symmetrical at 208/120 volt.
- G. Circuit breakers provided for installation in existing switchboards or panelboards shall be of the same manufacturer as the existing switchboards or panelboards. The minimum A.I.C. shall not be less than that of the lowest rated device in the existing switchboard or panelboard.

**2.02 FUSES:**

- A. Fuse identification labels, showing size and type installed, shall be placed inside the cover of each switch or fused circuit breaker.
- B. All fuses shall be of one (1) manufacturer unless otherwise noted to ensure selective operation of protective devices.
- C. Fuses shall be as manufactured by Bussman, Gould-Shawmut, or Brush unless otherwise indicated.
- D. Fuses shall be of the following type:
  - 1. Fuses 601 A through 6000 A serving all type of loads shall be U.L. Class L, type KRP-C.
  - 2. Fuses installed in safety switches at motor locations shall be 600 V, FRS or 250V, FRN.
  - 3. Fuses 1/10 A through 600 A shall be U.L. Class RK1; 600V, LPS-RK; 250V, LPN-RK, unless otherwise noted.
- E. Spare fuses shall be provided in the amount of 20 percent of each size and type installed, but in no case shall be less than three (3) of each specified size and type supplied. These spares shall be neatly enclosed in a suitable cabinet or cabinets.

**2.03 DISCONNECT SWITCHES:**

- A. The disconnect switches shall be heavy duty 600 volt type, externally operated, quick-made, quick-break knife switches, fused or non-fused as required. The number of poles and ampere rating shall be as shown on plans. Fused switches shall have Class "R" rejection features. All switches shall have a U.L. listed short circuit withstand rating. Switches in interior dry locations shall be NEMA 1 enclosures. Switches in damp or exterior locations shall have NEMA 3R raintight enclosures. Switches shall be horsepower rated, unless otherwise specified.
- B. If double lugging or oversized wires are required, provide a wireway or splice box.
- C. Provide fuses as specified in this section. Fuses shall be installed so that the rating is clearly visible without removing fuse.
- D. Provide a nameplate on each switch as specified in Section 26 0553, "Identification For Electrical Systems". Nameplate shall indicate load served, source and circuit number.
- E. Submit data on switches with drawings of the main switchboard, distribution switchboards or distribution panelboards, where switches are an assembled part.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. Bolted connections shall be torque-tightened to manufacturer's specifications.
- B. Clipping of wires from standard cable to fit connector shall not be permitted. Appropriate connecting device shall be provided for multiple cable connections.
- C. Install disconnect switches in locations shown on plans. Test switches a minimum of three (3) times to ensure correct operation.

**3.02 TESTS:**

- A. Each and every circuit breaker shall be tested under load a minimum of three (3) times.

**END OF SECTION**

**SECTION 26 0923**  
**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 1 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes photoelectric relays, occupancy sensors, and multiple lighting relays and contactors.
- B. Related Sections include the following:
  - 1. Division 26 Section 26 27 26 – "Wiring Devices" for wall-box dimmers and manual light switches.

**1.03 SUBMITTALS**

- A. Product Data: Include dimensions and data on features, components, and ratings for lighting control devices.
- B. Samples: Occupancy sensors, one of each type.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 1– Operation and Maintenance Data.

**1.04 QUALITY ASSURANCE**

- A. Source Limitations: Obtain lighting control devices from a single source with total responsibility for compatibility of lighting control system components specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.
- C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.

**1.05 COORDINATION**

- A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

**PART 2 PRODUCTS****2.01 PRODUCTS**

- A. Contactors and Relays:
- B. Photoelectric Relays:
- C. Occupancy Sensors:

**2.02 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS**

- A. Line-Voltage Surge Protection: Include in all 120 - and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

**2.03 PHOTOELECTRIC RELAYS**

- A. Description: Solid state, with single-pole, double-throw dry contacts rated to operate connected relay or contactor coils or microprocessor input, and complying with UL 773A.
- B. Light-Level Monitoring Range: 0 to 3500 fc, with an adjustment for turn-on/turn-off levels.
- C. Time Delay: Prevents false operation.



- D. Outdoor Sealed Units: Weathertight housing, resistant to high temperatures and equipped with sun-glare shield.

#### 2.04 OCCUPANCY SENSORS

- A. Ceiling-Mounting or Wall Mounted Units: Unit receives control power from a separately mounted auxiliary power and control unit, and operates power switching contacts in that unit.
- B. Ceiling-Mounting Units for use with programmable, microprocessor-based systems: Unit receives 24-V dc power from a remote source and, on sensing occupancy, closes contacts that provide signal input the lighting control system.
- C. Switch-Box-Mounting Units: Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts rated 800 W at 120-V ac, and 1000 W at 277-V ac, minimum.
- D. Operation: Turns lights on when room or covered area is occupied and off when unoccupied, unless otherwise indicated.
  - 1. Time Delay for Turning Lights Off: Adjustable over a range from 1 to 15 minutes, minimum.
  - 2. Manual Override Switch for switch-box mounted units: Turns lights off manually regardless of elapsed time delay.
  - 3. Isolated Relay Contact: Operates on detection of occupancy or vacancy, as indicated, to activate an independent function (refer to Section 15940 – Sequences of Operation).
- E. Auxiliary Power and Control Units: As follows:
  - 1. Relays rated for a minimum of 20-A normal ballast load or 13-A tungsten filament or high-inrush ballast load.
  - 2. Sensor Power Supply: Rated to supply the number of connected sensors.
- F. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in the field by selection of jumpers or dip-switches on unit.

#### 2.05 MULTIPOLE CONTACTORS AND RELAYS

- A. Description: Electrically operated and mechanically held, and complying with UL 508 and NEMA ICS 2.
  - 1. Current Rating for Switching: UL listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballasts with 15 percent or less total harmonic distortion of normal load current).
  - 2. Control Coil Voltage: Match control power source.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Mount lighting control devices according to manufacturer's written instructions.
- C. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

#### 3.02 CONTROL WIRING INSTALLATION

- A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Section 26 0519 – "Building Wires and Cable" for low-voltage connections.
- B. Wiring Method: Install all wiring as specified in Division 26 Section 26 0533 – "Raceways, Fittings and Boxes."
- C. Bundle, train, and support wiring in enclosures.
- D. Ground equipment.

- E. Connections: 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.

### **3.03 IDENTIFICATION**

- A. Identify components and power and control wiring according to Section 26 0553 – "Electrical Identification."

### **3.04 FIELD QUALITY CONTROL**

- A. Schedule visual and mechanical inspections and electrical tests with at least seven days advance notice.
- B. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
- C. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.
- D. Verify settings of photoelectric devices with photometer calibrated within previous six months.
- E. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
  - 1. Continuity tests of circuits.
  - 2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
    - a. Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

### **3.05 CLEANING**

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

### **3.06 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train owner's maintenance personnel as specified below:
  - 1. Train owner maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of three hours training.
  - 2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
  - 3. Schedule training with owner, through Architect, with at least seven days advance notice.

### **3.07 ON-SITE ASSISTANCE**

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

**END OF SECTION**

**SECTION 26 2413  
SWITCHBOARDS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Switchboards.
- B. Switchboard accessories.

**1.02 RELATED SECTIONS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.
- B. Section 26 0526 - Grounding and Bonding.

**1.03 REFERENCES**

- A. ANSI C12.1 - American National Standard Code for Electricity Metering; 2008.
- B. ANSI C39.1 - American National Standard Requirements for Electrical Analog Indicating Instruments; 1981 (R1992).
- C. IEC 60051-1 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 1: Definitions and General Requirements Common To All Parts; International Electrotechnical Commission; 1997.
- D. IEC 60051-2 - Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories - Part 2: Special Requirements for Ammeters and Voltmeters International Electrotechnical Commission; 1984.
- E. IEEE C12.1 - American National Standard Code for Electricity Metering; Institute of Electrical and Electronic Engineers; 1988.
- F. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 1993 (R 2003).
- G. NECA 400 - Recommended Practice for Installing and Maintaining Switchboards; National Electrical Contractors Association; 2007.
- H. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- I. NEMA PB 2 - Deadfront Distribution Switchboards; National Electrical Manufacturers Association; 2012.
- J. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- K. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- L. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- D. Test Reports: Indicate results of factory production tests.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- F. Project Record Documents: Record actual locations of switchboards.
- G. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

#### **1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver in 48 inch (219 mm) maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

#### **1.07 MAINTENANCE MATERIALS**

- A. See Section 01 6000 - Product Requirements, for additional provisions.
- B. Furnish two of each key.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Siemens: [www.sea-siemens.com](http://www.sea-siemens.com)

#### **2.02 SWITCHBOARDS**

- A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- B. Ratings:
  - 1. Voltage: 120/240 volts.
  - 2. Configuration: Single phase, three wire, grounded.
  - 3. Main Bus: As indicated on the single line diagram.
  - 4. Integrated Equipment Rating: As indicated in the single line diagram (rms amperes symmetrical).
- C. Main Section Devices: Panel mounted.
- D. Distribution Section Devices: Panel mounted.
- E. Auxiliary Section Devices: Individually mounted.
- F. Bus Material: hard drawn Copper, 98% conductivity, standard size.
- G. Bus Connections: Bolted, accessible from front for maintenance.
- H. Fully insulate load side bus bars. Do not reduce spacing of insulated bus.
- I. Ground Bus: Extend length of switchboard.
- J. Insulated Ground Bus: Extend length of switchboard.
- K. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
  - 1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch

- circuits.
- 2. Include shunt trip and undervoltage release where indicated.
- L. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- M. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.
- N. Pull Section:
  - 1. In accordance with utility company's requirements.
- O. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- P. Enclosure: Type 1 - General Purpose; Type 3R - Raintight.
  - 1. Align sections at rear only.
  - 2. Switchboard Height: 90 inches (2250 mm), excluding floor sills, lifting members and pull boxes.
  - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

### **2.03 SOURCE QUALITY CONTROL**

- A. Shop inspect and test switchboard according to NEMA PB 2.
- B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify engineer at least 7 days before inspection is allowed.
- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify engineer at least 7 days before inspections and tests are scheduled.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Provide concrete housekeeping pad under the provisions of Section 03 3000.
- B. Verify that field measurements are as indicated on shop drawings.

### **3.02 INSTALLATION**

- A. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.
- B. Install in a neat and workmanlike manner, as specified in NECA 400.
- C. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- D. Install fuses in each switch.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.1.

### **3.04 ADJUSTING**

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.
- C. Adjust circuit breaker trip and time delay settings to values indicated.
- D. Adjust circuit breaker trip and time delay settings to values as instructed by engineer.

### **3.05 CLEANING**

- A. Touch up scratched or marred surfaces to match original finish.

**END OF SECTION**

**SECTION 26 2416**  
**PANELBOARDS**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.

**1.02 RELATED SECTIONS**

- A. Section 26 0526 - Grounding and Bonding.
- B. Section 26 0553 – Electrical Identification.
- C. Section 26 2813 - Fuses.

**1.03 REFERENCES**

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- D. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.
- E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- E. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**1.06 MAINTENANCE MATERIALS**

- A. Furnish two of each panelboard key.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Siemens: [www.sea-siemens.com](http://www.sea-siemens.com)

## 2.02 POWER DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1, circuit breaker type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: As indicated.
  - 1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
- D. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.
- E. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- F. Enclosure: NEMA PB 1, Type 1 or 3R, 6 inches (153 mm) deep, 20 inches (508 mm) wide, cabinet box.
- G. Cabinet Front: Surface type, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

## 2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.
- C. Minimum Integrated Short Circuit Rating: As indicated.
  - 1. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
- D. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
  - 1. Type SWD for lighting circuits.
  - 2. Type HACR for air conditioning equipment circuits.
  - 3. Class A ground fault interrupter circuit breakers where scheduled.
  - 4. Do not use tandem circuit breakers.
- E. Enclosure: NEMA PB 1, Type 1 or 3R.
- F. Cabinet Box: 6 inches (153 mm) deep, 20 inches (508 mm) wide for 240 volt and less panelboards, 20 inches (508 mm) wide for 480 volt panelboards.
- G. Cabinet Front: Flush or surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 26 0553.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling or below floor. Identify each as SPARE.

1. Minimum spare conduits: 5 empty 1 inch (DN27).

H. Ground and bond panelboard enclosure according to Section 26 0526.

**3.02 FIELD QUALITY CONTROL**

A. Perform field inspection and testing in accordance with Section 01400.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

**3.03 ADJUSTING**

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

**END OF SECTION**



**SECTION 26 2701**  
**ELECTRICAL UTILITY SERVICES**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Service racks.
- B. Metering transformer cabinets.
- C. Meter bases.

**1.02 RELATED SECTIONS**

- A. Section 26 2413 - Switchboards: Metering transformer compartment.

**1.03 REFERENCES**

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SYSTEM DESCRIPTION**

- A. System Characteristics: 120/240 volts, single phase, three-wire, 60 Hertz.
- B. Service Entrance:

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.
- C. Submit utility company-prepared drawings.

**1.06 QUALITY ASSURANCE**

- A. Utility Company:
- B. Perform work in accordance with utility company written requirements and NFPA 70.
  - 1. Maintain one copy of each document on site.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**1.07 PRE-INSTALLATION MEETING**

- A. Convene one week prior to commencing work of this section. Review service entrance requirements and details with Utility Company representative.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- B. Milbank Manufacturing: [www.milbankmfg.com](http://www.milbankmfg.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Siemens
- E. Cutler Hammer.

**2.02 COMPONENTS**

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
  - 1. Size: As required by utility.
- B. Meter Base: Furnished by utility company.
- C. Utility Transformer Pad: Prefabricated precast concrete transformer pad sized as required by utility company.

1. Manufacturers:
  - a. NewBasis (Associated Plastics): [www.newbasis.com](http://www.newbasis.com).
  - b. Formex Manufacturing: [www.formex.com](http://www.formex.com).
  - c. Highline Products: [www.highlineproducts.com](http://www.highlineproducts.com).
- D. Other Components: As required by utility company.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Arrange with utility company to obtain permanent electric service to the Project.
- B. Verify that field measurements are as indicated on utility company drawings.

**3.02 INSTALLATION**

- A. Install service rack, weatherhead, transformer pad, metering transformer cabinets, and meter base as required by utility company.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

**END OF SECTION**

**SECTION 26 2726  
WIRING DEVICES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Device plates and decorative box covers.
- E. Floor box service fittings.
- F. Access floor boxes.

**1.02 RELATED SECTIONS**

- A. Section 26 0533 – Raceways, Fittings and Boxes.

**1.03 REFERENCES**

- A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 2002 (R 2008).
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturer's Installation Instructions.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Products: Provide products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Cooper Wiring Devices: [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Leviton Manufacturing, Inc: [www.leviton.com](http://www.leviton.com).

**2.02 WALL SWITCHES**

- A. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
  - 1. Body and Handle: White plastic with toggle handle.
  - 2. Indicator Light: Light handle type switch.
  - 3. Locator Light: Lighted handle type switch; red color handle.
  - 4. Ratings:
    - a. Voltage: 120 - 277 volts, AC.

b. Current: 20 amperes.

B. Switch Types: Single pole, double pole, 3-way, 4-way, pilot gang, and locator.

### 2.03 WALL DIMMERS

A. Wall Dimmers: Semiconductor dimmer for incandescent lamps, Type as indicated on drawings, complying with NEMA WD 6 and WD 1.

1. Body and Handle: White plastic with linear slide.
2. Voltage: 120 volts.
3. Power Rating: Match load shown on drawings; 600 watts minimum.

B. Accessory Wall Switches: Match dimmer appearance.

### 2.04 RECEPTACLES

A. Receptacles: Heavy duty, industrial type, complying with NEMA WD 6 and WD 1.

1. Device Body: White plastic – Normal power, Red plastic – Emergency power
2. Configuration: NEMA WD 6, type as specified and indicated.

B. Convenience Receptacles: Type 5 - 20.

C. Single Convenience Receptacles.

D. Duplex Convenience Receptacles.

E. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

### 2.05 WALL PLATES

A. Decorative Cover Plates: White, smooth plastic.

B. Jumbo Cover Plates: White, smooth plastic.

C. Weatherproof Cover Plates: Gasketed cast metal with hinged.

D. Covers for weatherproof receptacles shall be such that the weatherproof integrity of the receptacle is maintained while in use.

### 2.07 FLOOR MOUNTED SERVICE FITTINGS

A. Pedestal Convenience Receptacles:

1. Housing: Satin aluminum.
2. Device Plate: Stainless steel.
3. Configuration: One duplex.

B. Flush Cover Convenience Receptacles:

1. Material: Brass.
2. Configuration: Duplex flap opening.

C. Pedestal Communication Outlets:

1. Housing: Satin aluminum.
2. Device Plate: Stainless steel.

D. Flush Cover Communication Outlets:

1. Material: Brass.
2. Configuration: 2-1/8 inch (54 mm) x 1 inch (25 mm) combination threaded opening.

E. Pedestal Combination Fittings:

1. Housing: Satin aluminum.
2. Device Plate: Stainless steel.
3. Configuration: One duplex convenience receptacle with one bushed opening, 1 inch (25mm) inside diameter.

F. Flush Cover Combination Fittings:

1. Material: Brass.
2. Configuration: Duplex flap opening with 2-1/8 inch (54 mm) x 1 inch (25 mm) combination threaded opening.

- G. Protective Ring: Brass finish.
- H. Split Nozzles: Brass finish.
- I. Carpet Rings: Brass.

## **2.08 ACCESS FLOOR BOXES**

- A. Manufacturers:
  - 1. Arc-Co./Division of Arcade Technology: [www.arc-co.com](http://www.arc-co.com).
  - 2. Unity Manufacturing: [www.unitymfg.com](http://www.unitymfg.com).
- B. Floor Boxes: As specified in Section 26 0534.
- C. Access Floor Boxes: Sheet metal box suitable for mounting in access floor system.
  - 1. Size: 4 x 4.
  - 2. Cover: Impact resistant plastic with grey enamel finish.
  - 3. Convenience Receptacle: One with isolated ground.
  - 4. Communications Receptacle: modular jack.
  - 5. Data Receptacle: One.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that floor boxes are adjusted properly.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- E. Verify that openings in access floor are in proper locations.

### **3.02 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

### **3.03 INSTALLATION**

- A. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on top.
- G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Use jumbo size plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- L. Install protective rings on active flush cover service fittings.

### **3.04 INTERFACE WITH OTHER PRODUCTS**

- A. Coordinate locations of outlet boxes provided under Section 26 0534 to obtain mounting heights specified and indicated on drawings.
- B. Install wall switch 48 inches (1.2 m) above finished floor.

- C. Install convenience receptacle 18 inches (450 mm) above finished floor.
- D. Install convenience receptacle 6 inches (150 mm) above counter.
- E. Install dimmer 48 inches (1.2 m) above finished floor.
- F. Install telephone jack 18 inches (450 mm) above finished floor.
- G. Install telephone jack for side-reach wall telephone to position top of telephone at 54 inches (1.4 m) above finished floor.
- H. Install telephone jack for forward-reach wall telephone to position top of telephone at 48 inches (1.2 m) above finished floor.
- I. Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 0534.

**3.05 FIELD QUALITY CONTROL**

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.
- F. Verify that each telephone jack is properly connected and circuit is operational.

**3.06 ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.

**3.07 CLEANING**

- A. Clean exposed surfaces to remove splatters and restore finish.

**END OF SECTION**

**SECTION 26 2813**  
**FUSES**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fuses.
- B. Spare fuse cabinet.

**1.02 REFERENCES**

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide data sheets showing electrical characteristics, including time-current curves.

**1.04 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**1.05 MAINTENANCE MATERIALS**

- A. See Section 01 6000 - Product Requirements, for additional provisions.
- B. Furnish two fuse pullers.
- C. Furnish three of each size and type fuse installed.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Cooper Bussmann: [www.bussmann.com](http://www.bussmann.com).
- B. Ferraz Shawmut, Inc: [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
- C. Littelfuse: [www.littelfuse.com](http://www.littelfuse.com).

**2.02 FUSES - GENERAL**

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.
- C. Main Service Switches Larger than 600 amperes: Class L (time delay).
- D. Main Service Switches: Class RK1 (time delay).
- E. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).
- F. Power Load Feeder Switches: Class RK1 (time delay).
- G. Motor Load Feeder Switches: Class RK1 (time delay).
- H. Lighting Load Feeder Switches Larger than 600 amperes: Class L time delay.
- I. Lighting Load Feeder Switches: Class RK1 (time delay).
- J. Other Feeder Switches Larger than 600 amperes: L time delay; L fast-acting.
- K. Other Feeder Switches: Class RK1 (time delay).
- L. General Purpose Branch Circuits: Class RK1 (time delay).

M. Motor Branch Circuits: Class L time delay.

N. Lighting Branch Circuits: Class G.

**2.03 SPARE FUSE CABINET**

A. Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

B. Doors: Hinged, with hasp for padlock.

C. Finish: Prime finish for field painting.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install fuses with label oriented such that manufacturer, type, and size are easily read.

B. Install spare fuse cabinet where indicated.

**END OF SECTION**



**SECTION 26 2816**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fusible switches.
- B. Nonfusible switches.

**1.02 RELATED SECTIONS**

- A. Section 26 2813 - Fuses.

**1.03 REFERENCES**

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.
- B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2013.
- C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2003.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Product Data: Provide switch ratings and enclosure dimensions.
- C. Project Record Documents: Record actual locations of enclosed switches.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Eaton Electrical/Cutler-Hammer: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. GE Industrial: [www.geindustrial.com](http://www.geindustrial.com).
- C. Square D: [www.squared.com](http://www.squared.com).
- D. Siemens: [www.sea-siemens.com](http://www.sea-siemens.com)

**2.02 COMPONENTS**

- A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
  - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
  - 2. Handle lockable in OFF position.
  - 3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.
- B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
  - 1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
  - 2. Handle lockable in OFF position.
- C. Enclosures: NEMA KS 1.
  - 1. Interior Dry Locations: Type 1.

2. Exterior Locations: Type 3R.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install fuses in fusible disconnect switches.
- C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

**3.02 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA STD ATS, except Section 4.
- B. Perform inspections and tests listed in NETA STD ATS, Section 7.5.

**END OF SECTION**

**SECTION 26 5600**  
**EXTERIOR LUMINAIRES**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Exterior luminaires and accessories.
- B. Poles.

**1.02 RELATED SECTIONS**

- A. Section 03 3000 - Cast-in-Place Concrete: Foundations for poles.

**1.03 REFERENCES**

- A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.
- B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2014.
- C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- D. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2002.
- E. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000 (ANSI/IES RP8).
- F. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2014.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Submittals, for submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.
- D. Test Reports: Indicate measured illumination levels.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- F. Maintenance Data: For each luminaire.

**1.05 QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Electrical Components: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store and handle solid wood poles in accordance with ANSI O5.1.

**1.07 COORDINATION**

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

**PART 2 PRODUCTS****2.01 LUMINAIRES**

- A. Furnish products as indicated in Schedule included on the Drawings.

- B. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 BALLASTS**

- A. Fluorescent Ballasts: ANSI C82.1, high power factor type electromagnetic ballast, suitable for lamps specified.
  - 1. Provide low-temperature ballast suitable for lamps specified.
  - 2. Voltage: 120 or 277 volts or match luminaire voltage.
  - 3. Certify fluorescent ballast design and construction by Certified Ballast Manufacturers, Inc.
  - 4. Product:
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Intensity Discharge (HID) Ballasts: ANSI C82.4, mercury vapor, metal halide, low pressure sodium lamp ballast, suitable for lamp specified.
  - 1. Voltage: Match luminaire voltage.
  - 2. Product:
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

## **2.03 LAMPS**

- A. Manufacturers:
  - 1. GE Lighting: [www.gelighting.com](http://www.gelighting.com).
  - 2. Philips Lighting Co of NA: [www.lighting.philips.com](http://www.lighting.philips.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Lamp Types: As specified for each luminaire.

## **2.04 POLES**

- A. Manufacturers:
  - 1. Furnish products as indicated on the drawings.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 501.
- B. Provide concrete bases for lighting poles at locations indicated, in accordance with Section 03 3000.
- C. Install poles plumb.
  - 1. Provide double nuts to adjust plumb.
  - 2. Grout around each base.
- D. Install lamps in each luminaire.
- E. Bond luminaires, metal accessories, and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.

### **3.02 FIELD QUALITY CONTROL**

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- B. Measure illumination levels to verify conformance with performance requirements. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

### **3.03 ADJUSTING**

- A. Aim and adjust luminaires to provide illumination levels and distribution indicated on Drawings.

### **3.04 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

**3.05 PROTECTION OF FINISHED WORK**

- A. Relamp luminaires which have failed lamps at Substantial Completion.

**END OF SECTION**

**SECTION 31 1000  
SITE CLEARING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Removal of existing debris.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- B. Section 01 5713 - Temporary Erosion Control.
- C. Section 01 7000 - Execution Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
- D. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- E. Section 31 2200 - Grading: Topsoil removal.
- F. Section 31 2323 - Fill and Backfill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

**1.03 PROJECT CONDITIONS**

- A. Conform to applicable regulations relating to environmental requirements, disposal of debris and use of herbicides.
- B. Coordinate clearing work with utility companies.
- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

**PART 2 PRODUCTS**

-- NOT APPLICABLE --

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Locate and identify utilities to remain.

**3.02 PROTECTION**

- A. Tag existing plants designated to remain.
- B. Protect utilities that remain, from damage.
- C. Protect bench marks and lot corner monumentation from damage or displacement.

**3.03 SITE CLEARING**

- A. Comply with other requirements specified in Section 01 7000 - "Execution Requirements".
- B. Clear areas required for access to site and execution of work.
- C. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- D. Remove trees, shrubs and stumps indicated.
- E. Clear undergrowth and deadwood without disturbing subsoil.

**3.04 EXISTING UTILITIES AND BUILT ELEMENTS**

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.

- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

**3.05 DEBRIS**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

**SECTION 31 2200  
GRADING**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Removal of topsoil.
- B. Rough grading the site for site structures, building pads, and parking areas..
- C. Finish grading.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 1000 - Site Clearing.
- B. Section 31 2316 - Excavation.
- C. Section 31 2323 - Fill and Backfill: Filling and compaction.

**1.03 SUBMITTALS**

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

**1.04 QUALITY ASSURANCE**

- A. Perform Work in accordance with the plans and these specifications.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. Topsoil: Topsoil excavated on-site.
  - 1. Graded.
  - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
- B. Other Fill Materials: See Section 31 2323.

**PART 3 EXECUTION****3.01 EXAMINATION**

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.

**3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

**3.03 ROUGH GRADING**

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

**3.04 SOIL REMOVAL**

- A. Stockpile excavated topsoil on site.
- B. Stockpile excavated subsoil on site.
- C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion.



**3.05 FINISH GRADING**

- A. Before Finish Grading:
  - 1. Verify building and trench backfilling have been inspected.
  - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

**3.06 TOLERANCES**

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

**3.07 FIELD QUALITY CONTROL**

- A. See Section 31 2323 for compaction density testing.

**3.08 CLEANING**

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

**END OF SECTION**

**SECTION 31 2316**

**EXCAVATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Excavating for footings, slabs-on-grade, and site structures.
- B. Trenching for utilities outside the building to utility main connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 57 13 - Temporary Erosion Control.
- B. Section 01 7000 - Execution Requirements: General requirements for dewatering of excavations and water control.
- C. Section 31 2200 - Grading: Soil removal from surface of site.
- D. Section 31 2323 - Fill and Backfill: Fill materials, filling, and compacting.

**PART 2 PRODUCTS**

-- NOT APPLICABLE --

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Locate, identify, and protect utilities that remain and protect from damage.

**3.02 EXCAVATING**

- A. Excavate to accommodate new structures and construction operations.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut utility trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excess excavated material from site.

**3.03 FIELD QUALITY CONTROL**

- A. See Section 01 4500 - "Quality Control", for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

**3.04 PROTECTION**

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

**END OF SECTION**

**SECTION 31 2323  
FILL AND BACKFILL**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Filling, backfilling, and compacting for site grading and footings, slabs-on-grade, and site structures.
- B. Backfilling and compacting for utilities outside the building to utility main connections.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 5713 - Temporary Erosion Control: Slope protection and erosion control.
- B. Section 03 3000 - Cast-in-Place Concrete.
- C. Section 31 22 00 - Grading: Site grading.
- D. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.
- E. Section 32 13 13 - Portland Cement Concrete Paving: Leveling bed placement under paving.

**1.03 REFERENCE STANDARDS**

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)); 2012.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN m/m<sup>3</sup>)); 2012.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

**1.04 DEFINITIONS**

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: 4 inches below finish grade elevations indicated on drawings, unless otherwise indicated.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - "Submittals", for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.
- D. Compaction Density Test Reports.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.

3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

## **PART 2 PRODUCTS**

### **2.01 FILL MATERIALS**

- A. General Fill: Subsoil excavated on-site.
  1. Graded.
  2. Free of lumps larger than 3 inches, rocks larger than 6 inches, and debris.
  3. Conforming to ASTM D2487 Group Symbol CL, or as approved by the Soils Engineer.
- B. Structural Fill: Subsoil excavated on-site.
  1. Graded.
  2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
  3. Conforming to ASTM D2487 Group Symbol CL.
- C. Concrete for Fill: Lean concrete, 1 or 2 sack slurry.
- D. Granular Fill: Coarse aggregate, conforming to State of California Department of Transportation standard.
- E. Sand: Conforming to State of California Department of Transportation standard.
- F. Sand in the pipe zone shall have a sand equivalent greater than 30.

### **2.02 ACCESSORIES**

- A. Geotextile Fabric: Non-biodegradable, woven, Structural Geogrid BX1200; manufactured by Tensar Earth Technologies, Inc., or approved equal by Architect; submittal required.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 2200 for additional requirements.
- C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

### **3.02 PREPARATION**

- A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

### **3.03 FILLING**

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- G. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
  1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.

**3.04 FIELD QUALITY CONTROL**

- A. See Section 01 45 00 - "Quality Control", for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

**3.05 CLEANING**

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

**END OF SECTION**

**SECTION 32 1313  
CONCRETE PAVING**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Concrete sidewalks, integral curbs, gutters, and parking areas.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 07 9005 - Joint Sealers: Sealant for joints.
- C. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- D. Section 31 2323 - Fill and Backfill: Compacted subbase for paving.

**1.03 REFERENCE STANDARDS**

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- E. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- G. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- I. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- J. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on joint filler and curing compound.

**PART 2 PRODUCTS****2.01 AGGREGATE BASE**

- A. Aggregate Base Course: Thickness and size of aggregate as indicated on the drawings.

**2.02 FORM MATERIALS**

- A. Wood form material, profiled to suit conditions.

**2.03 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength; deformed billet steel bars; unfinished.

**2.04 CONCRETE MATERIALS**

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: As specified in Section 03 3000.

- C. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch length.
- D. Admixtures: Fly ash is not allowed.

#### **2.05 ACCESSORIES**

- A. Curing Compound: ASTM C309, Type 1, Class A.
- B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
  - 1. Material: ASTM D1751, cellulose fiber.

#### **2.06 CONCRETE MIX DESIGN**

- A. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- B. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.
- C. Concrete Properties:
  - 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 4,500 psi.

#### **2.07 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Verify base conditions.

#### **3.02 PREPARATION**

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Notify Architect minimum 24 hours prior to commencement of concreting operations.

#### **3.03 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.

#### **3.04 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. 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.

#### **3.05 JOINTS**

- A. Place 3/8 inch wide expansion joints at 50 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
- B. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

**3.06 FINISHING**

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.
- C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

**3.07 JOINT SEALING**

- A. See Section 07 9005 for joint sealer requirements.
- B. Joint Sealant:
  - 1. Surface Preparation: All joints must be absolutely clean. For concrete, sandblasting is required. All curing compounds, old caulks, waterproofing compounds, etc., must be removed. Polyethylene rod or polyurethane foam is recommended as a joint-filler and backup material. Fillers treated with bituminous products, grease or oil, should not be used. Where present, they must be removed or separated by vinyl tape or polyethylene film. All surfaces must be primed with ELASTO-THANE PRIMER.
  - 2. Application: Apply by caulking gun, hand or pressure type, or pour from container. Bulk sealant can be applied by pumping equipment, trowel or putty knife. Press firmly into joint to assure good contact.

**3.08 FIELD QUALITY CONTROL**

- A. Field Inspection and testing will be performed under provisions of Section 01 4500 - "Quality Control".
- B. Testing firm will take cylinders and perform slump tests in accordance with ACI 301.

**3.09 PROTECTION**

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

**END OF SECTION**



**SECTION 32 1713**

**WHEEL STOPS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Precast concrete parking bumpers and anchorage.

**1.02 REFERENCE STANDARDS**

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- B. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- C. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- D. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Parking Bumpers: Precast concrete, conforming to the following:
  - 1. Nominal Size: 5 inches high, 9 inches wide, 6 feet long.
  - 2. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
  - 3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
  - 4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
  - 5. Air Entrainment Admixture: ASTM C260/C260M.
  - 6. Concrete Mix: Minimum 5,000 psi compressive strength after 28 days, air entrained to 5 to 7 percent.
  - 7. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
  - 8. Embed reinforcing steel, and drill or sleeve for two dowels.
  - 9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
  - 10. Minor patching in plant is acceptable, providing appearance of units is not impaired.

**PART 3 EXECUTION**

**3.01 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 2 dowels per unit.

**END OF SECTION**

**SECTION 32 1726**  
**TACTILE WARNING SURFACING**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete for sidewalks and platforms.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser; 1984 (Reapproved 2009).
- C. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine; 2011.
- D. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method; 2007e1.
- E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- F. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2010.
- G. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010.
- H. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes; 2002 (Reapproved 2013).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.
- C. Samples: For each product specified provide two samples, 8 inches square, minimum; show actual product, color, and patterns.
- D. Shop Drawings: Submit plan and detail drawings. Indicate:
  - 1. Locations on project site. Demonstrate compliance with referenced accessibility standards.
  - 2. Sizes and layout.
  - 3. Pattern spacing and orientation.
  - 4. Attachment and fastener details, if applicable

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.
- B. Installer Qualifications: Company certified in writing by product manufacturer as having successfully completed work substantially similar to the work of this section.

**PART 2 PRODUCTS****2.01 MANUFACTURERS**

- A. Plastic Tactile and Detectable Warning Surface Tiles:
  - 1. Armor-Tile, a brand of Engineered Plastics, Inc: [www.armortiletransit.com](http://www.armortiletransit.com).
  - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.

## 2.02 TACTILE AND DETECTABLE WARNING DEVICES

- A. Plastic Tactile and Detectable Warning Tiles: ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes, integral radius cut lines on back face of tile; with factory applied removable protective sheeting.
  - 1. Material Properties:
    - a. Water Absorption: 0.20 percent, maximum, when tested in accordance with ASTM D570.
    - b. Slip Resistance: 0.50 minimum dry static coefficient of friction, when tested in accordance with ASTM D2047.
    - c. Compressive Strength: 25,000 pounds per square inch, minimum, when tested in accordance with ASTM D695.
    - d. Tensile Strength: 10,000 pounds per square inch, minimum, when tested in accordance with ASTM D638.
    - e. Flexural Strength: 25,000 pounds per square inch minimum, when tested in accordance with ASTM D790.
    - f. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, or antifreeze, when tested in accordance with ASTM D543.
    - g. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, or antifreeze, when tested in accordance with ASTM D1308.
    - h. Abrasion Resistance: 300, minimum, when tested in accordance with ASTM C501.
    - i. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84.
    - j. Accelerated Weathering: Delta-E of less than 5.0 at 2,000 hours exposure, when tested in accordance with ASTM G155.
  - 2. Shape: Rectangular.
  - 3. Dimensions: 36 inches by 48 inches.
  - 4. Pattern: In-line pattern of truncated domes complying with ADA Standards.
  - 5. Color: FED-STD-595C, Table IV, Federal Yellow No. 33538.

## 2.03 ACCESSORIES

- A. Fasteners: ASTM A666, Type 304 stainless steel
  - 1. Type: Countersunk, color matched composite sleeve anchors
  - 2. Size: 1/4 inch diameter and 1-1/2 inches long.
- B. Adhesive: Type recommended and approved by surfacing tile manufacturer.
- C. Sealant: Elastomeric sealant of color to match adjacent surfaces; approved by surfacing tile manufacturer.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. When installation location is near site boundary or property line, verify required location using property survey.
- B. Verify that work area is ready to receive work:
  - 1. If existing conditions are not as required to properly complete the work of this section, notify Architect.
  - 2. Do not proceed with installation until deficiencies in existing conditions have been corrected.
- C. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

### 3.02 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's written instructions.
  - 1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.

2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.
- B. Field Adjustment:
  1. Cut units to size and configuration shown on drawings.
  2. Do not cut plastic tiles to less than 9 inches wide in any direction.
  3. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
  4. Orient so dome pattern is aligned with the direction of ramp.
  5. Align truncated dome pattern between adjacent units.
- C. Install units fully seated to substrate, square to straight edges and flat to required slope.
- D. Align units so that tops of adjacent units are flush and joints between units are uniform in width.

**3.03 INSTALLATION, SURFACE APPLIED PLASTIC TILES**

- A. Cure concrete surfaces for a minimum of 4 days before installing units.
- B. When installing multiple adjacent units, leave a 1/8 inch gap between tiles to allow for expansion.
- C. Drill fastener holes straight, true and to depth recommended by manufacturer.
- D. Apply adhesive to back of unit as recommended by manufacturer.
- E. Mechanically fasten to substrate. Avoid striking or damaging the unit itself during installation.
- F. Apply sealant to edges in cove profile.

**3.04 CLEANING PLASTIC UNITS**

- A. Remove protective plastic sheeting within 24 hours of installation.
- B. Remove excess sealant or adhesive from joints and edges.
- C. Clean four days prior to date of scheduled inspection.
- D. Clean 4 days prior to date of scheduled inspection.

**3.05 PROTECTION**

- A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.
- B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 33 3413  
SEPTIC TANKS**

**PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Septic tank, distribution box, and filter drainage field system.

**1.02 RELATED REQUIREMENTS**

- A. Section 31 2316 - Excavation: General requirements for trenching for drainage field and connecting piping.
- B. Section 31 2323 - Fill and Backfill: General requirements for backfilling piping trenches including compaction testing.

**1.03 REFERENCE STANDARDS**

- A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2016.
- B. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate special procedures for septic tank installation.
- C. Project Record Documents: Accurately record actual locations and inverts of buried pipe, components, and connections.

**1.05 QUALITY ASSURANCE**

- A. Conform to applicable code and regulations for work of this section.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of systems.

**PART 2 PRODUCTS****2.01 SEPTIC TANK AND DISTRIBUTION BOX**

- A. Manufacturers:
  - 1. Jensen Precast; -: [www.jensenprecast.com](http://www.jensenprecast.com).
  - 2. Substitutions: See Section 01 6000 - PRODUCT REQUIREMENTS.
- B. Septic Tank: Reinforced precast concrete construction, 4,000 psi 28 day minimum strength, concrete partitioned chambers, concrete lid with lift rings, vent, inlet inspection hole, inlet turned down minimum 12 inches below effluent level.
- C. Distribution Box: Reinforced concrete, single inlet, two outlets, gate, removable cover with lift ring.

**2.02 CONNECTING PIPE MATERIALS**

- A. Cast Iron Pipe Type \_\_\_\_: ASTM A74 extra heavy grade, hub and spigot joint; nominal inside diameter of \_\_\_\_ inch:
- B. Plastic Pipe (PVC): ASTM D2729; nominal inside diameter of \_\_\_\_ inch, bell and spigot solvent sealed joints.
- C. Fittings: Same material as pipe, tee bends, elbows, cleanouts, reducers, ends to suit pipe joint.

**2.03 FILTER DRAIN PIPE MATERIALS**

- A. Plastic Pipe (PVC): ASTM D2729; plain end, nominal inside diameter of \_\_\_\_ inch.
- B. Use perforated pipe at filter field system; unperforated through sleeves and at junction with distribution box.

**2.04 BEDDING AND BACKFILL MATERIALS**

- A. Provide bedding and backfill materials as specified in Section 31 2323 and as follows:

- B. Tank Bedding Material: Granular fill.
- C. Tank Backfill Material: Granular fill.
- D. Connecting Piping Bedding Material: Granular fill.
- E. Connecting Piping Backfill Material: Granular fill.
- F. Filter Drain Bedding Material: Granular fill.
- G. Filter Drain Cover Material: Granular fill.

**PART 3 EXECUTION**

**3.01 EXCAVATING AND TRENCHING**

- A. See Section 31 2316 and Section 31 2323 for general requirements.

**3.02 TANK INSTALLATION**

- A. Hand trim excavation for accurate placement of tank to elevations indicated.
- B. Place bedding material level in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.
- C. Install septic tank and distribution box and related components on bedding in accordance with manufacturer's instructions.
- D. Backfill around sides of tank, tamped in place and compacted to 95 percent.

**3.03 CONNECTING PIPING INSTALLATION**

- A. Connect outlet between building sanitary piping and septic tank, between septic tank and distribution box, between distribution box and filter field header.
- B. Slope piping to each successive component, minimum of 1/4 inch per foot.
- C. Cover pipe with backfill, sides and top. Place geotextile fabric over cover prior to backfilling.

**3.04 PROTECTION**

- A. Do not permit vehicular traffic over drainage field.

**END OF SECTION**

# Advertising Order Confirmation

# The Press Enterprise



**NOTICE INVITING BIDS**

**NOTICE IS HEREBY GIVEN** that the County of Riverside ("County") invites sealed Bids for the construction of the following project ("Work");

**RIVERSIDE COUNTY FIRE DEPARTMENT STATION # 77 - LAKE RIVERSIDE EXPANSION PROJECT**

Bids shall be prepared in conformance with the Instructions to Bidders and other Bidding Documents. Bids must be received, by hand delivery or mail, by the Clerk of the Board located on the 1st floor of the County Administrative Center, 4080 Lemon Street, Riverside, CA 92501, no later than the Bid Closing Deadline of 1:00 p.m. on 10/09/2018, to be thereafter on said date and at said location publicly opened and read aloud. The Bidder assumes sole responsibility for timely receipt of its Bid.

On and after 09/13/2018, and up to forty-eight (48) hours prior to the Bid Closing Deadline, copies of Bidding Documents will be available to Bidders for pick-up by Bidder at, or for mailing to Bidder upon written request by Bidder submitted to, Mission Reprographics, 2050 E. Colorado St., Suite 1, Riverside, CA 92507. At the time of such pick-up or request for mailing, Bidder shall be required to pay to Mission Reprographics, in cash or by check, the fee of thirty-five dollars (\$35) for each hard copy. Bidder shall be required to pay to Mission Reprographics, in cash or by check or money order made payable to Mission Reprographics, the Bidding Documents may also be viewed in person between the hours of 8:00 a.m. and 5:00 p.m. Monday through Friday (except Holidays) at EDA, 3403 10th Street, Suite 400, Riverside, CA 92501.

Pursuant to Labor Code section 1771.1, any contractor bidding, or subcontractor to be listed on a bid proposal subject to Public Contract Code section 4104, shall not be qualified to bid after March 1, 2015, unless currently registered and qualified to perform public works pursuant to Labor Code section 1725.5. No Contractor or subcontractor may enter into a contract (after April 1, 2015) without proof of current registration to perform public works.

**Bids will only be accepted from bidders who have previously pre-qualified with the County of Riverside, established and approved by the Board of Supervisors on 5/22/18, item number 3-7, General County Facilities Level 1.**

A mandatory Pre-Bid Conference will be conducted on 9/25/2018, commencing promptly at 10:00 a.m., at 4937 Comanche Ct, Aguirre, CA 92536. Attendance at the mandatory Pre-Bid Conference is required as a condition of bidding. Sign language services are available for the Pre-Bid Conference upon written request received by (951) 955-8274 at ETRK by at least three (3) business days prior to the Pre-Bid Conference.

The Bidder receiving the Award by the County is required:

- (1) to furnish a Performance Bond and Payment Bond as provided in the Instructions to Bidders and other Bidding Documents;
- (2) both at the time Bidder submits its Bid and other Bid Submittals and at the time of Award, to: (a) hold a contracting license, active and in good standing, issued by the Contractors State License Board for the State of California for the following license classification(s): "B" General Contractor with the appropriate "C" Class specialty subcontractors license classification(s); and (b) hold, or designate a Subcontractor that holds, the certification(s) required by Applicable Laws to perform the following work: Mechanical, C20, Building Plumbing C36, Electrical & Low-Voltage/Information Technology C10/C7, Fire Protection C16; and
- (3) to comply with the provisions of the California Labor Code, including, without limitation, Sections 1771.4, 1773.1, 1774, 1775 and 1776 of the California Labor Code and including, without limitation, the obligations to pay the general prevailing rates of wages in the locality in which the work is to be performed and comply with Section 1777.5 of the California Labor Code as well as the requirements of the Department of Industrial Relations, 94 West Furlong Street, Suite 348, San Bernardino, CA 92401, and are available to any interested party on request.

**THIS IS A PUBLIC WORKS PROJECT AND SUBJECT TO COMPLIANCE MONITORING AND ENFORCEMENT BY THE DEPARTMENT OF INDUSTRIAL RELATIONS.** The awarded prime contractor shall post job site notices as prescribed by regulation starting January 1, 2015. Contractor or subcontractor shall furnish records specified in Labor Code section 1776 to the Labor Commissioner.

Substitution of securities for any moneys withheld by County shall be permitted as provided for by Section 22300 of the California Public Contract Code.

Capitalized terms used herein shall have the meanings assigned to them in the Bidding Documents. For information contact: Economic Development Agency, 3403 10th St., Riverside, CA 92501.

EDA  
3.10 of 05/01/18

Product	Requested Placement	Requested Position	Run Dates	# Inserts
PE Riverside: Full Run	Legals CLS	County Legal - 1076~	09/14/18, 09/15/18, 09/16/18, 09/17/18, 09/18/18, 09/28/18	6