

SECTION 13553

ATMS CONDUIT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnish and install conduit for ATMS field elements and communication.

1.2 RELATED SECTIONS

- A. Section 00725, Scope of Work
- B. Section 02061: Select Aggregate
- C. Section 02705: Pavement Sawing
- D. Section 02741: Hot Mix Asphalt (HMA)
- E. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork
- F. Section 02892: Traffic Signal
- G. Section 03575: Flowable Fill
- H. Section 13554: Polymer Concrete Junction Box
- I. Section 13555: ATMS Cabinet

1.3 REFERENCES

- A. ASTM D2241: Standard Specification for Poly-Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
- B. American National Standards Institutes (ANSI).
- C. National Electric Code (NEC).

- D. NEC Article 346: Rigid Metal Conduit
- E. NEC Article 347: Rigid Nonmetallic Conduit
- F. National Electrical Manufacturers Association: (NEMA).
- G. NEMA Article TC-2: Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
- H. NEMA Article TC-3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- I. Underwriters Laboratories (UL).

PART 2 PRODUCTS

2.1 MATERIALS

- A. Conduit and Fittings:
 - 1. Schedule 40 PVC rated at 194 degrees F, as specified. NEMA TC-2, NEMA TC-3, UL Listed.
 - 2. HDPE (high density polyethylene) SDR11 rated, as specified. ASTM D 2241.
 - 3. Rigid steel as specified. UL-6.
 - 4. Galvanized as specified. ANSI C80.1.
- B. Multi-Conduit
 - 1. New, prefabricated.
 - 2. Minimum of 4 each 1¼ inch conduit.
 - 3. Label: FIBER OPTIC COMMUNICATIONS, permanent 1/2 inch black letters, every 6 ft, on outside of each conduit.
 - 4. Color code each conduit or cell.
- C. Provide all materials used in the installation of conduits, such as bends, adapters, couplings, glue, plugs and fittings, to meet or exceed all of the recommendations of the conduit manufacturer for suitable installation.
- D. Provide special termination kits from the conduit manufacturer for terminating the conduit in vaults and junction boxes. Provide kits that form a watertight seal of conduit to structure wall.

- E. Use complete conduit sections in nominal 20 ft sections; couplings and fittings to provide for watertight integrity.
- F. Use complete conduit rigid bend sections (11 1/4, 22 1/2, 45, 90 degree angles) complete with bell and spigot. Do not field bend conduit.
- G. Provide #14 solid copper conductor pull wire, Type THHN, for each empty conduit or cell.
- H. Provide fiber optic and electrical buried cable marker warning tape that meets the following requirements:
 - 1. Material: Composite reinforced thermoplastic.
 - 2. Tape Color: Orange (communication) or Red (electric).
 - 3. Length: 5 ft minimum.
 - 4. Text: "Caution Buried Communication Cable" or "Caution Buried Electric" (front and back).
 - 5. Text Color: Black.
 - 6. Width: 3 inch minimum (face or diameter).
- I. Provide jacketed #14 THHN solid green locator wire.
- J. Provide locator wire connection device that meets the following requirements:
 - 1. Screw clamp connection type.
 - 2. Suitable for 22 to 8 AWG.
 - 3. Rated 50 amps.
 - 4. Rated 600 V.
 - 5. Provide zinc bichromate plated steel mounting rail for locator wire connection device.
- K. Backfill
 - 1. Flowable Fill: Section 03575.
 - 2. Free Draining Granular Backfill Borrow: Section 02061.
 - 3. Native material: 96 percent compaction.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Plans depict conduit routing in schematic form only. Base final routing on actual field conditions at the time of construction, including Blue Stake markings, to prevent conflicts with existing utilities.
- B. When installing conduit that houses communication cable, do not allow conduit to deflect vertically or horizontally along its length by a ratio greater than 10:1, (e.g. no more than 4 inch deflection per 40 inch in length).
- C. When installing conduit, do not allow the sum total of the vertical and horizontal deflection of conduit between any two junction boxes to exceed 360 degrees.
- D. Do not place conduit directly above parallel utilities.
- E. If the planned location of conduit is parallel to the existing traffic signal or ATMS conduit, locate conduit within 1 ft of existing parallel conduit run.
- F. Install all conduit bends to have a radius that is:
 - 1. Not less than 12 times the inside diameter of the conduit.
 - 2. Not less than the minimum bend radius of the cable installed within, per cable manufacturer's specifications.
- G. Install conduits that cross finished curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces by boring, jacking, or drilling. Entirely replace any damaged section at no additional cost to the Department.
- H. Obtain appropriate permits before work commences.

3.2 TRENCH FOR CONDUIT

- A. Paved Surface (asphalt concrete):
 - 1. Prior to any backhoe use, sawcut roadway to roadway base on both sides of trench to provide clean, straight wall for T-patch.
 - 2. Use flowable fill to within 3 1/2 inch-6 inch of the existing roadway surface, depending on the existing pavement thickness.
 - 3. Minimum soil compaction under pavement: 96 percent.
 - 4. Evenly apply tack coat before final backfill.

5. Restoration patch: match the composition, density, and elevation ($\pm 1/4$ inch), of the existing surface.
- B. Sidewalk or Decorative Pavement.
1. Use flowable fill to within 3 1/2 inch-6 inch of the existing roadway surface, depending on the existing pavement thickness.
 2. Minimum soil compaction under pavement: 96 percent.
 3. Restore sidewalk or decorative pavement to original condition or better after work is completed.
- C. Unpaved Surface:
1. Use backfill that matches the composition, density, and elevation (± 0.2 inch), of the existing surface.
 2. Dispose of surplus material daily.
- D. Conduit under Railroad Right-of-Way: Refer to Section 00725, Article: Railway Highway Provisions, and appropriate Railroad, such as Union Pacific Railroad, Standard Specifications:
1. Coordinate all work with appropriate Railroad personnel.
 2. Complete Railroad Safety Training.
- E. Minimum cover of conduit:
1. Minimum cover in sidewalks, paved ditches, unlined ditches, gutters: 2 ft.
 2. Minimum cover in highway right of way under pavement surface: 3 ft.
 3. Minimum cover within 20 ft of edge of pavement where signs or delineators are located: 5 ft.
 4. Where final landscape above conduit is not finished and has elevation greater than adjacent curb, use top back of curb as base elevation for determining minimum cover.
- F. Warning Tape:
1. Install orange warning tape with black legend CAUTION - BURIED COMMUNICATION CABLE in all trenches containing multi-duct conduit or conduit containing communication cables.
 2. Install red warning tape with black legend CAUTION - BURIED ELECTRIC in all other trenches.
 3. Not required when flowable fill is directly overlaid with asphalt pavement or PCCP.
 4. Not required when boring conduit.

- G. Locator Wire:
1. Install #14 THHN solid green locator wire continuously in 1 inch conduit and bond to grounding rods within each junction box.
 2. Mount locator wire connection device to the side wall of each junction box using a mounting rail.
 3. Connect the locator wire to the terminal block and connect the terminal block to the ground rod.
 4. Weld or clamp locator wire at transition if a sweep is used in place of a junction box at a transition between GRS and PVC. Provide corrosion protection as per NEC Article 346 at location of weld or clamp.

3.3 INSTALL CONDUIT

- A. Place all conduits in the same trench before surfacing.
- B. Above ground use galvanized rigid steel; underground use PVC or HDPE. Apply corrosion protection per NEC Article 346 to any portion of galvanized rigid steel conduit buried in the ground or encased in concrete.
- C. Seal uncapped conduit ends inside junction box with duct seal. Insert seals a minimum of 2 inches inside the conduit.
- D. Install #14 stranded THHN pull wire in all empty conduit including all cells of multi-duct conduit.
1. On each end of conduit install plug with 1/4 inch hole for pull wire.
 2. Leave 2 ft of pull wire outside of the plug and fasten securely to plug.
- E. Place all conduit that passes through a structural member in a metallic sleeve.
- F. Secure conduit on structures with standard galvanized iron conduit clamps using at least 5/16 inch diameter concrete expansion anchors at maximum 5 ft spacing.
- G. Use conduit expansion fittings at structure expansion joint crossings.
- H. Install all conduits so the backfill completely surrounds all exterior surfaces of the conduit. Separate multi-duct conduits using a commercially available conduit spacer or approved equivalent.

- I. Install a bushing or adapter at ends of all nonmetallic conduit that contains a conductor per NEC Article 346, to protect the conductor from abrasion. Install rounded bushings on the ends of metal conduits per NEC Article 347.
- J. Fill all new and existing conduit to less than 40 percent as per NEC.
- K. Install bends in the multiconduit to be manufactured sweeps (11 1/4, 22 1/2, 45, 90 degree angle) with conduit compatible bell and spigot ends.
- L. Prior to pouring flowable fill, anchor the conduit in trench, at 16 ft intervals, to maintain the required conduit depth during pour.
- M. Minimum separation between all conduit is 1.5 inch. The separation between individual conduit within a single cluster of multi-duct conduit are permitted to be closer.
- N. Minimum separation between all conduit and the wall of the trench is 1.5 inch.
- O. Place the locator wire conduit on the plane of the uppermost conduit in the trench. The separation between the locator wire conduit and other conduit may be less than 1.5 inch.
- P. In native earth, do not place flowable fill closer than 6 inch to finished grade.
- Q. If flowable fill is used, encapsulate conduit a minimum of 3 inch above the top conduit with flowable fill.

3.4 USE OF OCCUPIED CONDUIT

- A. Maintain the physical condition and functional integrity of all cabling and wiring in existing occupied conduit.
- B. Prior to installing fiber optic cable in an occupied conduit:
 - 1. Remove any existing fiber optic cable/copper wire
 - 2. Re-pull new and existing fiber optic cable/copper wire together
 - 3. Perform all necessary fiber splices, replace any impacted fiber cable spider fan-out kits
 - 4. Perform all additional necessary work needed to restore existing fiber optic system

3.5 REPAIR/RESTORATION

- A. Restore all areas, including landscaping, concrete pavement, asphalt, finished curbs and gutters, box culverts, sewers, underground water mains, sprinkler systems, sidewalks, concrete flatwork, textured or decorative surfaces, that were damaged during conduit and junction box installation.
- B. Coordinate with local utilities for utility repair. Advise the Engineer of all repairs.

END OF SECTION