SP- 151036
(New)

SPECIAL PROVISIONS
FOR
FIBER OPTIC

Polk County
STP-S-C077(217)--5E-77

Effective Date
March 20, 2018

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

I. GENERAL INFORMATION

A. Submittals

The Des Moines Water Works (DMWW) will review all shop drawings for materials related to fiber optic construction. Shop drawings shall be provided to DMWW 2 weeks prior to any fiber optic construction. The Contractor shall submit these shop drawings to:

Des Moines Water Works
Attn.: Katie Vandal
2201 George Flagg Parkway
Des Moines, Iowa 50321

B. Preparation

Notify DMWW (515-283-8729) 48 hours prior to the start of any fiber optic related construction.

Verify proposed grades prior to construction to ensure adequate finished cover will be provided over fiber optic.

D. Qualified Fiber Optic Installers

Fiber optic installer must be able to perform the complete installation without subcontractors. Fiber optic cable installer shall be solely responsible and accountable for the fiber integration including the physical installation (trenching, plowing, and directional drilling) through the required splicing, final testing, and documentation.

To be deemed a qualified fiber optic installer; the fiber optic installer must be able to satisfactorily submit the items listed below. If the items below cannot be satisfactorily met, as determined by the Contracting Authority, the fiber optic installer shall be considered non-qualified.

Submit for review by Contracting Authority, an equipment inventory list demonstrating the type and quantity of outside plant installation equipment owned by the fiber optic installer. At a minimum, the fiber optic installer must own and operate the following types and quantities of equipment:

1. Backhoe: Qty. 1
2. Directional drilling rig: Qty. 1

Submit, for review by Contracting Authority, an equipment inventory list detailing the type and quantity of special tools and instrumentation owned by the fiber optic installer. At a minimum, the fiber optic installer must own and operate the following types and quantities of instrumentation:

1. Optical Time Domain Reflectometer (capable of testing at both 1310 nm and 1550 nm wavelengths): Qty. 1
2. Core-to-Core Fusion Splicer: Qty. 1

Submit, for review by Contracting Authority, a client and project reference list that quantifies the installation of not less than 50 miles of outside plant fiber optic or telecommunication cabling within the last 5 calendar years. Provide project names and point of contact for each project and client.

II. BASIS OF PAYMENT

No other payment will be made for work covered by this Special Provision, but will be considered incidental to the contract unit price bid for the individual items for which the work was done. Payment for each item shall be considered full compensation for furnishing all material, equipment, tools, labor, and warranty for the construction of each item including excavation, backfill, compaction, and other incidental work to complete the construction in accordance with the contract documents.

III. INDEX OF SECTIONS

A. Section 01 60 00 – Electrical Requirements

B. Section 01 61 30 – Raceway and Boxes

C. Section 01 67 40 – Communication and Data Processing

SECTION 01 60 00 – ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section describes the scope of work for the fiber optic installation and the codes and standards that shall govern the work.

1.02 RELATED SECTIONS

A. Section 01 61 30 – Raceway and Boxes.

B. Section 01 67 40 – Communication and Data Processing.

1.03 SUMMARY OF WORK

A. Testing of single-mode fiber optic cable prior to installing new fiber optic cable.

B. Installation of single-mode fiber optic segment between new splice vault locations as shown on plans.

C. Installation of segment includes the installation of splice vaults, pull boxes, HDPE conduit, splices closures, ground rods, test stations, warning tape, warning signs, and all other miscellaneous components to make a complete fiber optic connection between cable ends.

D. Installation methods include trenching, plowing, and directional drilling.

E. Installation areas include easements, and right-of-way.

F. A significant portion of the new fiber optic cable will parallel feeder main. Coordination with other contractors is required.

G. Surface restoration and seeding.

H. Testing of fiber optic cables.

1.04 CODES AND STANDARDS

A. Work must comply with latest edition of National Electric Code.

B. Electrical equipment shall be UL listed and approved for installation at locations specified.

**** END OF SECTION ****

SECTION 01 61 30 RACEWAY AND BOXES

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. This section describes the required conduit for the Project.

1.02 RELATED SECTIONS

A. Section 01 60 00 – Electrical Requirements.

B. Section 01 67 40 – Communication and Data Processing.

1.03 REFERENCES

A. National Electrical Code (NEC).

B. National Electrical Contractors Association (NECA) – Standard of Installation.

C. National Electrical Manufacturer Association (NEMA) – TC-7.

D. National Fire Protection Association (NFPA).

E. Underwriters Laboratories (UL) 651 – Rigid Non-Metallic Continuous Length HDPE Conduit.

1.04 SUBMITTALS

A. Provide properly identified catalog data for high-density polyethylene conduit.

B. Installation of the material and equipment is prohibited without the proper review process. Review process is complete when the Contractor possesses a submittal that has been marked “Reviewed” or “Reviewed as Noted”.

PART 2 PRODUCTS

2.01 HIGH-DENSITY POLYETHYLENE CONDUIT

A. General: standard trade sizes with print markings in compliance with UL 651-A specifications for continuous length HDPE coiled conduit.

B. Color: Orange

C. Material: high-density polyethylene.

D. Size: minimum 2 inches.

E. Wall thickness: Schedule 80.

F. Manufacturer: Endot Industries, or approved equal.

G. HDPE conduit required under all road/driveway crossings:
   1. Contractor may use existing innerduct under existing crossings where appropriate.

2. Contractor may bore new innerduct as needed.

PART 3 EXECUTION

3.01 GENERAL

A. Install where noted on Plans.

B. Trim cut ends of HDPE conduit on the inside and outside to remove rough edges to comply with NEC Section 353.28.

C. All field bends shall be complete in a manner that effectively maintains internal diameter of the conduit. Radius of curvature for bends shall comply with NEC Table 354.24.

**** END OF SECTION ****

SECTION 01 67 40 COMMUNICATION AND DATA PROCESSING

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. This Section describes the single-mode fiber optic cable, splice closure with accessories, optical fiber access tool, ground rod, splice vaults, outdoor pull boxes, fiber optic test stations, warning signs, and warning tape that are required with the Project. Excavate a minimum of 125 feet of existing fiber to facilitate the new splice in the new enclosure.

B. This Section also includes specific information regarding the testing requirements and the related documentation of testing that shall be submitted to the Contracting Authority.

1.02 RELATED SECTIONS

A. Section 01 60 00 – Electrical Requirements.

B. Section 01 61 30 – Raceway and Boxes.

1.03 REFERENCES

A. National Electrical Code (NEC) – Latest edition.

B. National Electrical Contractors Association (NECA) – Standard of Installation.

C. National Fire Protection Association (NFPA).

1.04 SUBMITTALS

A. Provide properly identified catalog data on the following items:
   1. Single-mode fiber optic cable.
   2. Splice closures, splice trays, heat-shrink fusion splice protectors, add-a-cable kits, grommets, OFAT (optical fiber access tool), and ground rod.
   3. Splice vaults and outdoor pull boxes.
   4. Fiber optic test stations, warning signs, and warning tape.

B. Installation of these materials and equipment is prohibited without the proper review process. Review process is complete when the Contractor possesses a submittal that has been marked “Reviewed” or “Reviewed as Noted”.

C. Additional submittals are also required to document the fiber optic testing that is required before and after installation of fiber optic cable. The amount of testing is significant and the amount of documentation is well defined. See Part 3 of this Section for all details regarding the required testing and the related documentation to be submitted to Contracting Authority.

PART 2 PRODUCTS

2.01 SINGLE-MODE FIBER OPTIC CABLE

A. Direct-bury, 12 strand single-mode fiber optic cable. Inner and outer medium density polyethylene jacket with corrugated steel armor, ripcord, water-blocking material, dielectric strength elements, central dielectric strength member, and gel-free buffer tubes, with six fibers per tube. OFS AllWave zero water peak fiber optic cable, or an approved equal.

B. Geometrical Characteristics:
   1. Cladding Diameter: 125.0 +/- 0.7 μm
   2. Core/Clad Concentricity Error: less than 0.5 μm
   3. Cladding non-circularity: less than 1.0%
   4. Splice Loss (zero water peak to zero water peak splicing): less than 0.02 dB
   5. Coating Diameter: 245 μm to 260 μm

C. Transmission and Attenuation Characteristics:
   1. 0.35 dB/km @ 1310 nanometer wavelength
   2. 0.31 dB/km @ 1385 nanometer wavelength
   3. 0.25 dB/km @ 1550 nanometer wavelength
   4. Cut-off wavelength less than 1260 nanometers
   5. Macrobending attenuation is less than or equal to 0.05 dB for each of the following conditions:
      a. 1 turn (32 mm diameter) @ 1550 nm
      b. 100 turns (50 mm diameter) @1310 nm and @ 1550 nm
      c. 100 turns (60 mm diameter) @ 1550 nm and @ 1625 nm

D. Physical Characteristics:
   1. Minimum bend diameter (with load): 30 times cable diameter
   2. Minimum bend diameter (no load): 20 times cable diameter
   3. Minimum bend diameter (storage coils): 20 times cable diameter
   4. Maximum rated cable load: 600 lbf

2.02 SPLICE CLOSURES AND ACCESSORY ITEMS

A. Equipment for Splicing of Newly Installed Single-Mode Fiber Optic Cable:
   1. Splice Closure: Corning's SCF-4C18-01, or an approved equal.
   2. 12 Fiber Splice Tray: Corning's SCF-ST-099, or an approved equal.
   3. Heat-Shrink Fusion Splice Protector Parts Kit (60 mm long): Corning's 2806031-01, or an approved equal.
   4. Add-A-Cable Kits (as needed): Corning's SCF-KT-4CBL.
   5. 2-Hole Grommet (1 per splice closure): Corning's SCF-G62-L3, or an approved equal, to be installed in express ports of closure.
   6. Ground Rod: 3/4 inch by 10-foot-long copper-bonded steel ground rod. Blackburn's 7510, or an approved equal.

2.03 SPLICE VAULTS AND PULL BOXES

A. Open-bottom, stackable, precast polymer concrete structures suited for outdoor below-grade installations. Varying dimensions and depths with extra heavy-duty and bolted 22,500 pound rated lid.

B. Splice Vault:
   1. Minimum dimensions: 30-inch-wide by 48-inch-long by 36-inch-deep.
   2. Lid Marking: “FIBER OPTICS”.
   3. Manufacturer: MacLean Highline, PHG304836XE002, or approved equal.

C. Pull Boxes:
   1. Minimum dimensions: 24-inch-wide by 36-inch-long by 24-inch-deep.
   2. Lid Marking: “FIBER OPTICS”.
   3. Manufacturer: MacLean Highline, PHG243624XE002, or approved equal.

2.04 FIBER OPTIC TEST STATIONS, WARNING SIGNS, AND WARNING TAPE

A. Fiber Optic Test Stations (To be installed at each splice vault): 6-foot tubular white post with double-sided orange, square cap w/black lettering and test station components. Vikimatic’s Tel-A-Marker Part # TMP 0620W-TS, or an approved equal. Contact at Vikimatic is Ms. Shelly Young 330-334-2333 or myoung@gocsc.com. Station will contain the following pieces of written information (black lettering on orange background):
   1. “WARNING”.
   2. “BURIED FIBER OPTIC CABLING”.
   3. “BEFORE EXCAVATING OR IN EMERGENCY CALL TOLL FREE “1-800-292-8989”.
   4. “DES MOINES WATER WORKS”.

B. Warning Signs: Existing warning signs to be relocated as needed.

C. Warning Tape: corrosion-resistant detectable marking tape with a 0.30 mil solid foil encased in a protective plastic jacket. Tape shall contain lettering every 35.25-inches stating “CAUTION BURIED FIBER OPTIC CABLE”. Terra Tape Sentry Line Detectable, or an approved equal.

PART 3 EXECUTION

3.01 INSTALLATION OF SINGLE-MODE FIBER OPTIC CABLE

A. Install at approximate locations shown on Plans.

B. Install per details and notes also on Plans.

C. Coordinate with DMWW’s personnel to disconnect existing F.O. transmitting equipment at both ends of communication circuit. Coordinate for bidirectional cable testing at completion of job.

D. Install fiber optic cable per manufacturer’s instructions.
   1. Adhere to the minimum bend diameters for load, no load, and on-reel conditions.
   2. Adhere to the maximum allowable pulling tension.

E. Open trenches and pits shall not be left unattended. Provide barricades and safety fence, as necessary.

F. Installation methods include trenching, plowing, and directional drilling. See Plans for details regarding each installation method. Backfill of trenched-in fiber optic cable shall comply with the following:
   1. Keep trench as narrow as possible.
   2. Sand shall be installed 3 inches above and below the fiber cable.

3. Backfill with clean material (large rocks, stones, vegetation, or other non-suitable or frozen backfill material is prohibited from being placed in the trench); backfill material shall be installed in 6-inch lifts and be compacted to 95% maximum density per ASTM D698, Moisture-Density Relations of Soils Using 5.5 lb. Rammer and 12" Drop (Standard Proctor Method).
4. Backfill after Engineer has obtained necessary field measurements regarding the fiber location.
5. Any excess material shall be spread about the installation area and smoothed to match existing elevations; if this is not possible, material shall be hauled to an off-site location by the Contractor.

3.02 FIBER OPTIC SPLICING AND INSTALLATION OF SPLICE VAULTS AND PULL BOXES

A. Fusion splice all fibers.
   1. Strip, clean, and cleave fibers per manufacturer's instructions and industry standards.
   2. Complete splice using a core-to-core alignment fusion splicer with either PAS or LID technology. Follow manufacturer's instructions.
   3. Mechanical splicing of fibers is prohibited.
   4. Nominal loss per splice shall be 0.02 dB.
   5. Protect splices using the specified heat-shrink fusion splice protectors, trays, and closures.
   6. Use specified grommet and add-a-port accessory (if needed) to facilitate the following at each splice closure:
      a. Entry/exit of all fiber optic cables.
      b. Entry/exit of all 6-gauge tracing wires. For each fiber cable that enters the closure, connect a 6-gauge THHN solid or stranded insulated conductor to the armor of the fiber optic cable (connection shall take place inside the closure) and route the 6-gauge out of the closure via express port and specified grommet.

B. Installation of Splice Vaults and Fiber Optic Test Stations:
   1. Install splice vaults at approximate locations shown on Plans.
   2. Install splice vaults per manufacturer's instructions and details shown on Plans.
   3. Coil approximately 100 feet of fiber at each splice vault.
   4. Additional splice vaults are prohibited without Contracting Authority approval. Such splice vaults shall be provided and installed at Contractor's expense and at locations approved by Contracting Authority.
   5. Install ground rod inside each splice vault. Connect a 6-gauge THHN solid or stranded insulated conductor to the ground rod.
   6. Extend 1-inch PVC conduit from splice vault to fiber optic test station.
   7. Extend all 6-gauge conductors from the splice closure and ground rod to the fiber optic test station.
   8. Fabricate shunt plate and install atop fiber optic test station. See detail provided in Plans for related details.
   9. Color code test station wiring to facilitate tracing efforts. See detail provided in Plans for additional details.

C. Installation of Pull Boxes:
   1. Pull boxes may be installed at Contractor's discretion, unless notes on Plans specify additional limitations.
   2. Install pull boxes per manufacturer's instructions and details shown on Plans.

3.03 INSTALLATION OF SIGNAGE AND WARNING TAPE

A. Warning signs shall be installed every 1000 feet and at every major change in direction.

B. Warning tape shall be installed with fiber optic cable that is plowed or trenched. Depth is as defined on the plans.

3.04 TESTING OF FIBER OPTIC CABLES

A. The following fiber test is required prior to installation of fiber optic cable.
   1. Certified on-reel OTDR testing by Contractor.
      a. Perform tests at 1310 nm and 1550 nm.
      b. Confirm losses do not exceed the specified maximum.
      c. Submit five copies to Contracting Authority.

B. Following the complete installation of new fiber optic segment, final testing of the fiber strands will be required.
   1. Bi-directional OTDR testing at both 1310 nm and 1550 nm is required.
   2. Testing shall be accomplished in the presence of the Contracting Authority.
   3. Prior to testing the fiber strands, calculate the maximum optical power loss expected for each wavelength. For purposes of calculating the expected maximum loss, assume 0.1 dB/splice and 0.3 dB/connector. If measured loss is in excess of the calculated maximum by more than .25 dB then:
      a. Inspect and then clean and repair any deficiencies in the installation.
      b. Retest fiber strand.
      c. Repeat process until acceptable test results are obtained.
   4. Submit five copies to Contracting Authority.

**** END OF SECTION ****