SECTION 337119 - ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES

This Section specifies concrete-encased conduit and duct, and concrete manholes and handholes.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Rigid steel conduit.

Plastic conduit.

Plastic duct.

Reinforced resin conduit.

Precast concrete manholes.

Handholes.

Underground duct markers.

Cast-in-place manhole accessories.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 031000 - Concrete Forming and Accessories: Product and execution requirements for forms for cast-in-place manholes.

Section 032000 - Concrete Reinforcing: Product and execution requirements for reinforcement for cast-in-place manholes.

Section 033000 - Cast-in-Place Concrete: Product and execution requirements for concrete for cast-in-place manholes.

Section 071113 – Bituminous Dampproofing: Product and execution requirements for dampproofing of manhole exteriors.

Section 310000 - Earthwork: Product and execution requirements for excavation, backfill, and trenching required by this Section.

Section 310001 – Earthwork Materials: Requirements for backfill to be placed by this Section.

Section 334200 - Stormwater Conveyance: Requirements for drainage from manholes.

* + - 1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

LEED requires compliance with specific editions of referenced standards. Consider including publication dates for referenced standards in this Section to ensure that the correct standard is used for LEED compliance.

* + - * 1. American National Standard Institute:

ANSI C80.1 - American National Standard for Electric Rigid Steel Conduit.

* + - * 1. ASTM International:

ASTM A48 - Standard Specification for Gray Iron Castings

ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.

ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.

ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.

ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures.

* + - * 1. National Electrical Manufacturers Association:

NEMA FB 1 - Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing (EMT) and Cable.

NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

NEMA TC 6 and 8 - Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installations.

NEMA TC 9 - Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation.

NEMA TC 14 - Aboveground Reinforced Thermosetting Resin Conduit and Fittings.

* + - * 1. UL, Inc.:

UL 651A - Type EB and A Rigid PVC Conduit and HDPE Conduit.

* + - 1. COORDINATION
         1. Coordinate Work of this Section with existing underground utilities and structures.
      2. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Section 013300 - Submittals: Requirements for submittals.
        2. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        3. Manufacturer’s installation instructions shall be provided along with product data.
        4. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        5. Product Data: Submit manufacturer information for [**metallic conduits**] [**, nonmetallic conduits**] [**, ducts**] [**, manhole accessories**] [**, handholes**] [**, and**] <**\_\_\_\_\_\_\_\_**>.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel conduit and precast concrete manholes within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.
        2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

* + - * 1. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
        2. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
        3. Qualifications Statement:

Coordinate following subparagraph with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer.

Remove paragraph if not a LEED project.

* + - 1. SUSTAINABLE DESIGN SUBMITTALS
         1. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design submittals.
         2. Manufacturer's Certificate:

Certify that products meet or exceed specified sustainable design requirements.

Insert material certifications list below to suit products specified in this Section and Project sustainable design requirements. Specific certificate submittal and supporting data requirements are specified in Section 018113.

Materials Resources Certificates:

Certify source and origin for [**salvaged**] [**and**] [**reused**] products.

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project Site.

* + - * 1. Product Cost Data:

Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

Provide cost data for following products:

Edit list of material cost data below to suit products specified in this Section and Project sustainable design requirements. Specific cost data requirements are specified in Section 018113.

Salvaged, refurbished, and reused products.

Products with recycled material content.

Regional products.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. CLOSEOUT SUBMITTALS
         1. Project Record Documents:

Record actual routing and elevations of underground conduit and duct.

Record actual locations and sizes of manholes [**and**] [**handholes**].

* + - 1. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
      1. QUALIFICATIONS

Coordinate following Paragraph with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
      1. MOCKUPS

Include this Article for full-size erected assemblies required for review of construction, coordination of Work of several Sections, testing, or observation of operation.

* + - * 1. Size: Construct mockup of [**plastic ducts**] <**\_\_\_\_\_\_\_\_**>, [2] <\_\_\_\_\_\_\_\_> feet long.
        2. Locate where [**directed by Director’s Representative**] [**indicated on Drawings**].
        3. Incorporate accepted mockup as part of Work.

\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Remove mockup [**when directed by Director’s Representative**] <**\_\_\_\_\_\_\_\_**>.
      1. DELIVERY, STORAGE, AND HANDLING
         1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
         2. Store products according to manufacturer instructions.
         3. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

1. PRODUCTS
   * + 1. SYSTEM DESCRIPTION

Insert other applicable service names in following Paragraph.

* + - * 1. Interconnected system of encased conduits, ducts, and manholes [**handholes**] to distribute [**medium-voltage power**] [**, low-voltage power**] [**, telephone**] [**, data communications**] [**, and**] <**\_\_\_\_\_\_\_\_**>.
        2. Routing:

Conduit and duct routing and manhole [**handhole**] locations are shown in approximate locations on Drawings unless dimensions are indicated.

Route and locate for completion of duct bank system.

If Drawings do not indicate complete duct bank system, include description of system extent in following Paragraph.

* + - * 1. <**\_\_\_\_\_\_\_\_**>.
        2. Medium-Voltage Systems: [**Rigid steel conduit**] [**Rigid plastic conduit**] [**Rigid plastic underground conduit**] [**Plastic utility duct**] [**Reinforced resin conduit**].
        3. Low-Voltage Systems: [**Rigid steel conduit**] [**Rigid plastic conduit**] [**Rigid plastic underground conduit**] [**Plastic utility duct**] [**Reinforced resin conduit**].
        4. Telephone Systems: [**Rigid steel conduit**] [**Rigid plastic conduit**] [**Rigid plastic underground conduit**] [**Plastic utility duct**] [**Plastic communications duct**] [**Reinforced resin conduit**].
        5. Data Communications Systems: [**Rigid steel conduit**] [**Rigid plastic conduit**] [**Rigid plastic underground conduit**] [**Plastic utility duct**] [**Plastic communications duct**] [**Reinforced resin conduit**].

Insert other applicable service names in following Paragraph.

* + - * 1. <**\_\_\_\_\_\_\_\_**> Systems: [**Rigid steel conduit**] [**Rigid plastic conduit**] [**Rigid plastic underground conduit**] [**Plastic utility duct**] [**Plastic communications duct**] [**Reinforced resin conduit**] <**\_\_\_\_\_\_\_\_**>.
      1. RIGID STEEL CONDUIT
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8825&mf=04&src=wd):

Allied Tube and Conduit, 16100, South Lathrop Ave., Harvey, IL 60426.

Emerson Electric Co., 9377 W. Higgins Rd., Rosemount, IL 60018.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description:

Rigid Steel Conduit: Comply with ANSI C80.1.

Fittings:

Comply with NEMA FB 1.

Material: Steel.

* + - 1. PLASTIC CONDUIT
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8826&mf=04&src=wd):

Harvel Plastics, Inc., (610) 252-7350, 300 Kuebler Rd, Easton, PA 18040

Oxford Plastics, (800) 567-9182, 1011 Centre Rd, Suite 312, Wilmington DE 19805.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description:

Schedule 80 is extra-strength conduit.

Rigid Plastic Conduit:

Comply with NEMA TC 2.

Material: PVC, Schedule [**40**] [**80**].

Fittings and Conduit Bodies: Comply with NEMA TC 3.

Rigid Plastic Underground Conduit: [**UL 651A, Type A PVC**] [**UL 651A, Type EB PVC**] [**HDPE, Schedule 40**] [**Fiberglass-reinforced epoxy**].

* + - 1. PLASTIC DUCT
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8827&mf=04&src=wd):

General Plastics, Inc., (888) 275-3171, 3500 North Harrison, Shawnee, OK 74801.

Harrison Machine and Plastic Corp., (330) 527-5641, 11614 State Route 88, Garrettsville, OH 44231.

Perry Fiberglass Products, Inc., (321) 609-9036, 5415 Village Drive Rockledge, Florida 32955

Harvel Plastics, Inc., (610) 252-7350, 300 Kuebler Rd, Easton, PA 18040

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

Type EB duct is suitable for encased burial only; Type DB duct has thicker wall and does not typically require encasement.

* + - * 1. Plastic Utilities Duct:

Material: [**PVC**] [**ABS**].

Type: [**EB**] [**DB**].

* + - * 1. PVC Utility Duct Fittings: Comply with NEMA TC 9.
        2. Plastic Communications Duct and Fittings:

Comply with NEMA TC 6 and 8 and with NEMA TC 9.

Type: [**EB**] [**DB**].

* + - 1. REINFORCED RESIN CONDUIT
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8828&mf=04&src=wd):

Champion Fiberglass, Inc., (281) 655-8900, 6400 Spring Stuebner Rd., Spring, TX 77389.

Atkore FRE Composites, (719) 565-3311, 60 Greenhorn Drive, Pueblo, CO 81004.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

Type SW is standard wall thickness, available in 4-, 5-, and 6-inch (DN103, DN129, and DN155) sizes.

Type HW is heavy wall thickness, available in 2-, 3-, and 4-inch (DN53, DN78, and DN103) sizes.

Consult referenced standard and manufacturer's product data for additional application information; coordinate with regulatory requirements.

* + - * 1. Conduit and Fittings:

Comply with NEMA TC 14.

Type: [**SW**] [**HW**].

* + - * 1. Joining Method: [**Tapered bell-and-spigot joints**] [**Threaded joints**] [**Saw-cut system**].
      1. PRECAST CONCRETE MANHOLES
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8829&mf=04&src=wd):

Fort Miller Co., Inc., (518) 695-5000, PO Box 98, Schuylerville, NY 12871

Monarch Products, (717) 938-8303, 385 Sipe Road, York Haven, PA 17370.

Oldcastle Infrastructure, (888) 965-3227, 8392 Riverview Parkway, Littleton, CO 80125.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description: Precast manhole designed according to ASTM C858, comprising modular, interlocking sections complete with accessories.

Class A-16 is equivalent to AASHTO HS20-44, Class A-12 to AASHTO HS15-44, and Class A-8 to AASHTO H10-44. Class A-0.3 is suitable for walkways and stipulates 300-psf (1470-kg/sq. m) loading.

* + - * 1. Loading: ASTM C857, Class [**A-16**] [**A-12**] [**A-8**] [**A-0.3**].
        2. Shape: [**Square**] [**Rectangular**] [**Rectangular with truncated corners**] [**As indicated on Drawings**].
        3. Nominal Inside Dimensions: <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> feet.
        4. Corner Panel Width: <\_\_\_\_\_\_\_\_> feet.
        5. Inside Depth: <\_\_\_\_\_\_\_\_> feet.
        6. Wall Thickness: <\_\_\_\_\_\_\_\_> inches.
        7. Base Section:

Sump:

Size: [**3**] <\_\_\_\_\_\_\_\_> inches deep by [**14**] <\_\_\_\_\_\_\_\_> inches in diameter.

Furnish cast sleeve and two [**1**] <\_\_\_\_\_\_\_\_>-inch ground rod openings.

* + - * 1. Top Section: Furnish [**39**] <\_\_\_\_\_\_\_\_>-inch- diameter, grooved opening for frame and cover.
        2. Riser Casting:

Diameter: [**6**] [**12**] inches.

Furnish manhole steps cast into frame.

* + - * 1. Frames and Covers:

Comply with ASTM A48.

Material: Class 30B gray cast iron.

Diameter: [**27**] [**30**] inches.

Surfacing: Machine finished with flat bearing surfaces.

Furnish cover cast with [**ELECTRIC**] [**TELEPHONE**] <**\_\_\_\_\_\_\_\_**> in large letters [**to indicate utility**].

* + - * 1. Duct Entry Provisions: [**Single duct knockouts**] [**Window knockouts**] [**Windows with plastic duct terminators and diaphragms**].
        2. Duct Entry Locations: [**<\_\_\_\_\_\_\_\_> each end, <\_\_\_\_\_\_\_\_> each side**] [**As indicated on Drawings**].
        3. Duct Entry Diameter: [**4**] [**6**] <\_\_\_\_\_\_\_\_> inches.
        4. Cable Pulling Irons:

Galvanized rod and hardware.

Locate opposite each duct entry.

Furnish watertight seal.

* + - * 1. Cable Rack Inserts:

Minimum Load Rating: 800 lb.

Locate at <\_\_\_\_\_\_\_\_> feet o.c.

* + - * 1. Cable Rack Mounting Channel:

Material: Steel channel.

Size: [**1-1/2 by 3/4**] [<\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_>] inches by [**48**] <\_\_\_\_\_\_\_\_> inches long.

Furnish cable rack arm mounting slots [**1-1/2**] <\_\_\_\_\_\_\_\_> inches o.c.

* + - * 1. Cable Racks:

Material: Steel channel.

Size: [**1-1/2 by 3/4 by 14**] [<\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_>] inches.

Furnish fasteners to match mounting channel.

* + - * 1. Cable Supports: [**Porcelain**] [**Maple**] clamps and saddles.

Note that Steps are not typically included on NYS DOCCS and OCFS Projects. Confirm with OGS PM.

* + - * 1. Manhole Steps:

Description: [**Polypropylene plastic manhole step with 1/2-inch steel reinforcement**] <**\_\_\_\_\_\_\_\_**>.

Cast steps at [**12**] <\_\_\_\_\_\_\_\_> inches o.c., vertically.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Ladder:

Material: Aluminum.

Length: [**To meet Project conditions**] [**As indicated on Drawings**].

Furnish top hook to engage manhole step in riser casting.

Furnish one ladder for each manhole.

* + - * 1. Sump Covers:

Material: Class 30B gray cast iron.

Comply with ASTM A48.

* + - 1. HANDHOLES
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8830&mf=04&src=wd):

Armorcast Products Company, (818) 982-3600, 9140 Lurline Ave., Chatsworth, CA 91311.

Oldcastle Infrastructure Inc., (888) 965-3227, 7921 Southpark Plaza, Ste. 200, Littleton, CO 80120.

Hubbell, (800) 346-3062, 3621 Industrial Park Drive, Lenoir City, TN 37771.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description: Molded composite material, comprising modular and interlocking sections, and complete with accessories.

Class A-16 is equivalent to AASHTO HS20-44, Class A-12 to AASHTO HS15-44, and Class A-8 to AASHTO H10-44. Class A-0.3 is suitable for walkways and stipulates 300-psf (1 470-kg/sq. m) loading.

* + - * 1. Loading: ASTM C857, Class [**A-16**] [**A-12**] [**A-8**] [**A-0.3**].
        2. Shape: [**Square**] [**Rectangular**] [**As indicated on Drawings**].
        3. Nominal Inside Dimensions: <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> inches.
        4. Inside Depth: <\_\_\_\_\_\_\_\_> inches.
        5. Wall Thickness: <\_\_\_\_\_\_\_\_> inches.

Insert other utility names in following Paragraph as required for Project.

* + - * 1. Covers:

Description: Molded composite with tamperproof fasteners.

Furnish cover embedded with [**ELECTRIC**] [**TELEPHONE**] <**\_\_\_\_\_\_\_\_**> [**to indicate utility**].

* + - * 1. Duct Entry Provisions: [**Singe duct**] [**Window**] knockouts.
        2. Duct Entry Locations: [**<\_\_\_\_\_\_\_\_> each end, <\_\_\_\_\_\_\_\_> each side**] [**As indicated on Drawings**].
        3. Duct Entry Diameter: [**4**] [**6**] <\_\_\_\_\_\_\_\_> inches.

Remove paragraph if not a LEED project.

* + - 1. SUSTAINABILITY CHARACTERISTICS

Insert sustainable design characteristics in this Article to suit content of this Section and Project sustainable design requirements specified in Section 018113.

* + - * 1. Section 018113 - LEED Documentation Requirements: Requirements for sustainable design compliance.
        2. Material and Resource Characteristics:

Recycled Content Materials: Furnish materials with maximum available recycled content [**including:**] [**.**]

Insert list of materials specified in this Section required to have recycled content.

<**\_\_\_\_\_\_\_\_**>.

Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site [**including:**] [**.**]

Insert list of materials specified in this Section required to be regional materials.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. ACCESSORIES
         1. Underground Duct Markers:

[Manufacturers](http://www.specagent.com/LookUp/?ulid=8831&mf=04&src=wd):

Kolbi Pipe Marker Co., (800) 499-8450, 416 Campus Dr., Arlington Heights, IL 60004.

Marking Services, Inc., (800) 234-0135, 8265 N. Faulkner Rd., Milwaukee, WI 53224.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

Underground Warning Tape: [**4**] <\_\_\_\_\_\_\_\_>-inch- wide plastic tape, [**detectable type,**] colored [**red**] [**yellow**] <**\_\_\_\_\_\_\_\_**>, and with suitable warning legend describing buried electrical lines.

Consider using following subparagraph for nonmetallic duct.

Trace Wire: Magnetic detectable conductor, [**clear**] [**brightly colored**] plastic covering, and imprinted with [**ELECTRIC SERVICE**] <**\_\_\_\_\_\_\_\_**> in large letters.

* + - 1. SOURCE QUALITY CONTROL
         1. Testing: Provide shop testing of completed assembly.
         2. Inspection: Inspect manholes according to ASTM C1037.

Include one or both of following Paragraphs to require Director’s inspection or witnessing of test at factory.

* + - * 1. Director’s Inspection:

Make completed <**product name**> available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and test at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on fabricator's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved fabricator.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify routing and termination locations of duct bank prior to excavation for rough-in.
          2. Verify locations of manholes prior to excavating for installation.
       2. PREPARATION

Consider using following Paragraph if existing construction is to remain in place.

* + - * 1. Existing Work:

Abandoned duct bank to remain in place.

Maintain access to existing duct bank and other installations remaining active and requiring access.

Extend existing duct bank installations using materials and methods [**compatible with existing electrical installations**].

Clean and repair [**existing**] duct banks to remain or to be reinstalled.

* + - 1. INSTALLATION
         1. Duct Banks:

Install duct to locate top of ducts at depths as indicated on Drawings.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Edit following subparagraph to meet Project conditions. Repeat subparagraph to specify more than one condition, for example if there are different depths for locations under finished grade, walkways, and roadways.

Install [**power**] [**communications**] <**\_\_\_\_\_\_\_\_**> conduit and duct such that top of duct bank is located minimum <\_\_\_\_\_\_\_\_> inches below [**finished grade**] <**\_\_\_\_\_\_\_\_**>.

Conduit and Duct Slope:

Minimum [**4 inches per 100 feet**] [**0.33 percent**].

Slope conduit and duct towards manholes and away from building entrances.

Cut conduit and duct square using saw or pipe cutter, and de-burr cut ends.

Insert conduit and duct to shoulder of fittings, and fasten securely.

Connecting:

Join nonmetallic conduit and duct using adhesive as recommended by manufacturer.

Wipe nonmetallic conduit and duct dry and clean before joining.

Apply full even coat of adhesive to entire area inserted in fitting.

Allow joint to cure for minimum 20 minutes.

Install no more than equivalent of three 90-degree bends between pull points.

Install fittings to accommodate expansion and deflection.

Terminate conduit and duct at manhole entries using end bell.

Stagger conduit and duct joints vertically in minimum [**6**] <\_\_\_\_\_\_\_\_>-inch- thick concrete encasement.

Separators and Chairs:

Provide suitable separators and chairs, installed not greater than [**4**] <\_\_\_\_\_\_\_\_> feet o.c.

Secure separators and chairs to trench bottom prior to pouring concrete.

Band conduits and ducts together before backfilling or placing concrete.

Securely anchor conduit and duct to prevent movement during concrete placement.

Place concrete as specified in Section [**033000 - Cast-in-Place Concrete**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Use mineral pigment to color concrete [**red**] <**\_\_\_\_\_\_\_\_**>.

Install ducts with minimum [**3**] <\_\_\_\_\_\_\_\_> inches of concrete cover at bottoms, tops, and sides.

Install [**two**] <**\_\_\_\_\_\_\_\_**> No. [**4**] <**\_\_\_\_\_\_\_\_**> steel reinforcing bars in top of bank under paved areas.

Connect to existing concrete encasement using dowels.

Connect to manhole wall using dowels.

Provide suitable pull string in each empty duct, except sleeves and nipples.

Swab duct, and provide suitable caps to protect installed duct against entrance of dirt and moisture.

Backfill trenches as specified in Section [**310000- Earthwork**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Duct Markers:

Interface installation of underground duct markers with backfilling as specified in Section [**310000 - Earthwork**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Install [**6**] <\_\_\_\_\_\_\_\_> inches below finished surface.

* + - * 1. Precast Manholes:

Excavate for manhole installation as specified in Section 310000 - Earthwork.

Install and seal precast sections according to ASTM C891.

Install manholes plumb.

Use precast neck and shaft sections to bring manhole cover to finished elevation.

Attach cable racks to inserts after manhole installation is complete.

Install drains in manholes and connect to [**Site drainage system**] [**4-inch pipe terminating in 1/3-cu. yd. crushed gravel bed**] [**4-inch pipe terminating in <\_\_\_\_\_\_\_\_>-cu. yd. crushed gravel bed**] as specified in Section [**334200 - Stormwater Conveyance**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Backfill manhole excavation as specified in Section 310000 - Earthwork.

* + - * 1. Precast Handholes:

Excavate for handhole installation as specified in Section 310000 - Earthwork.

Install and seal precast sections according to ASTM C891.

Install handholes plumb.

Backfill handhole excavations as specified in Section 310000 - Earthwork.

* + - * 1. Cast-in-Place Manholes:

Excavate for manhole installation as specified in Section 310000 - Earthwork.

Formwork: Form inside and outside manhole surfaces as specified in Section [**031000 - Concrete Forming and Accessories**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Reinforcing: Install reinforcing as specified in Section [**032000 - Concrete Reinforcing**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Concrete:

As specified in Section [**033000 - Cast-in-Place Concrete**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Air entrained.

Compressive Strength: 2,000 psi at 28 days.

Shape: [**Square**] [**Rectangular**] [**As indicated on Drawings**].

Nominal Dimensions: <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> feet.

Inside Depth: <\_\_\_\_\_\_\_\_> feet.

Wall Thickness: <\_\_\_\_\_\_\_\_> inches.

Base:

Provide [**14**] <\_\_\_\_\_\_\_\_>-inch drain opening.

Provide two [**1**] <\_\_\_\_\_\_\_\_>-inch ground rod openings.

Slope to drain at [**0.25 inch/foot**] [**2 percent**].

Top:

Provide [**39**] <\_\_\_\_\_\_\_\_>-inch- diameter opening.

Cast 1/2-inch rod in opening to accept ladder hook.

Duct Entry: Cast duct openings into walls as indicated on Drawings.

Cable Pulling Irons: Locate opposite each duct entry.

Cable Rack Inserts: Locate at <\_\_\_\_\_\_\_\_> feet o.c.

Construct brick collar with **[30**] <\_\_\_\_\_\_\_\_>-inch clear opening to bring cover to indicated elevation.

Manhole Steps: Cast steps at [**12**] <\_\_\_\_\_\_\_\_> inches o.c., vertically.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Install ladder in each manhole.

Attach cable racks to inserts after manhole construction has been completed.

Install drains in manholes and connect to [**Site drainage system**] [**4-inch pipe terminating in 1/3-cu. yd. crushed gravel bed**] [**4-inch pipe terminating in <\_\_\_\_\_\_\_\_>-cu. yd. crushed gravel bed**] as specified in Section [**334200 - Stormwater Conveyance**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, as specified in Section [**071100 - Dampproofing**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Backfill manhole excavations as specified in Section 310000 - Earthwork.

END OF SECTION 337119