

SECTION 02731
ELECTRICAL CONDUIT AND FITTINGS

02731.01 GENERAL

A. Description

Electrical conduit and fittings shall include, but not necessarily be limited to, furnishing conduit and fittings of the types and sizes shown on the Plans and in accordance with the Contract Document or as directed by the Engineer.

B. Related Work Included Elsewhere

1. Structure excavation; Section 02220.
2. Trench excavation; Section 02250.
3. General electrical work; Section 02730.
4. Precast electrical handboxes; Section 02732.
5. Electrical pull and junction boxes; Section 02733.
6. Contingent Temporary Accommodation of Traffic Graded Aggregate, Bituminous Concrete, Calcium Chloride; Section 02951
7. Contingent Patching Existing Pavement Bituminous Concrete, Portland Cement Concrete; Section 02952
8. Contingent Excavation Test Pit, Class 1A, Class 3A; Section 02953
9. Contingent Backfill Graded Aggregate, Selected, Borrow, Embankment; Section 02954
10. Contingent Excavation Support Timber Sheeting, Steel Sheeting; Section 02955
11. Contingent Underdrains; Section 02956
12. Contingent Cast-in-place Concrete Mix No. 1, Mix No. 3; Section 02957

C. Quality Assurance

The Engineer will inspect all materials and work to ensure compliance with the Contract Documents.

D. Submittals

Shop drawings shall be submitted as specified in the "General Provisions" for all conduit and fittings supplied. The shop drawings shall include general material information and working drawings giving all conduit sizes and layouts, the overall diameters and cross-sectional areas of the actual conductors to be installed, and the sum of the areas of the conductors in each conduit.

02731.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for electrical conduit and fittings.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. General Requirements for metallic conduit and fittings

MATERIAL	SPECIFICATION
Electrical Metallic Tubing	UL 797
Intermediate Metal Conduit	UL 1242
Rigid Metal Conduit	UL 6
Rigid Steel Conduit, Zinc Coated	ANSI C80.1
Metallic Outlet Boxes	UL 514A
Fittings for Conduit and Outlet Boxes	UL 514B

Steel electrical conduit and fittings shall meet the requirements of Federal Specification WW-C-581.

Fittings shall match conduit materials including special coatings or finish and be suitable for the purpose intended.

Threaded galvanized steel fittings, double locknuts, and insulated bushings shall be provided to fasten rigid steel conduit in a manner assuring electrical ground continuity. Insulated bushings shall be "OZ" type B.

2. Flexible conduit shall consist of a galvanized steel core over which is extruded a polyvinyl chloride cover. Conduit shall protect electrical conductors from moisture, oil, grease, dirt, chemicals, corrosive fumes, abrasions, etc.
3. Conduit shall be galvanized pipe meeting the requirements of ASTM A 120, Schedule 80.

4. General Requirements for nonmetallic conduit and fittings

MATERIAL	SPECIFICATION
Schedule 40 and 80 Rigid Polyvinyl Chloride (PVC) Conduit	UL 651
Electrical Plastic Tubing (EPT) and Electrical Plastic Conduit (EPC-40 and EPC-80)	NEMA TC 2
Nonmetallic Outlet Boxes, Flush Device Boxes and Covers	UL 514C
Electrical Nonmetallic Conduit (ENC)	NEMA TC 13
PVC Fittings for use with Rigid PVC Conduit and Tubing	NEMA TC 3
Flexible PVC Coated Conduit	UL 360
Liquid Tight Flexible Nonmetallic Conduit for Detector Sleeves	UL 1660

5. Exterior underground conduit shall be heavy wall virgin polyvinyl chloride (PVC), Schedule 40, in accordance with Article 347 of the National Electrical Code and Federal Specification W-C-1094 or W-C-575. PVC conduit shall be UL approved.

02731.03 EXECUTION**A. General**

All materials and workmanship shall conform to the rules and regulations of the National Electrical Code (NEC) and that of all applicable Anne Arundel County codes.

B. Bends

Bends shall be of long sweep, free from kinks and of such easy curvature as to permit the drawing in of conductors without damage to the conductors. The radius of curvature of the inner edge of bends shall not be less than 10 times the inside diameter of the conduit, except as may be otherwise noted on the Plans or in the "Special Provisions". Conduits shall not be flattened or distorted. The total angle of all bends between any two boxes or fittings shall not exceed two quarter bends. Bends in conduit shall not damage the protective coating.

C. Exposed Conduits

Exposed conduit runs shall be parallel to or at right angles to walls, slabs, girders, etc. and in locations giving greatest accessibility for painting and least accumulation of dirt. All exposed conduit runs shall be attached to steel, masonry, concrete, or timber by galvanized malleable iron or galvanized steel straps, clamps, or hangers of an approved type, held at not less than two points by galvanized steel bolts or lag screws. The runs shall be supported at not greater than 10 feet centers on horizontal runs unless otherwise specified and not less than 2 inches clear of the supporting members. Conduits mounted on structural steel members shall be securely clamped to prevent rattling and wear.

Exposed conduits shall be installed with runs parallel or perpendicular to walls and ceilings with right angle turns consisting of symmetrical bends or cast steel fittings. Offsets shall be

avoided where possible, but when required an approved hickey or conduit bending machine shall be used.

D. Capping Conduit Ends

During construction, all ends of conduits shall be capped by use of standard pipe cap or equal to prevent introduction of foreign material into conduit. All open ends of conduit provided for future use shall also be capped. All conduits shall be installed so that they will drain, and necessary holes and drains for this purpose shall be made as directed.

E. Conduit Encasements

All conduits, boxes, etc. to be encased in concrete must be accurately placed and rigidly held in position so that no variation from line or grade occurs when concrete is placed.

Conduits, fittings, and boxes shall be stored under cover and above ground.

Immediately after the encasement of the conduit, each conduit run and all fittings shall be cleared by a pull-through mandrel type device inserted in the presence of the Engineer to remove spilled concrete and/or debris. Immediately prior to the installation of conductors in any run, the conduits comprising that run shall again be checked. Any and all obstructions shall be removed to the satisfaction of the Engineer at the Contractor's expense.

F. Conduits, Fittings, and Boxes

Conduit runs shall be made with as few couplings as standard lengths will permit. Screw couplings shall be used. All cut ends shall be reamed.

Conduits shall have threaded ends coated with an approved material and be of sufficient length so that they will butt squarely and tightly in the coupling. Long running threads will not be permitted. Conduits shall be installed so as to be continuous and watertight between boxes and/or equipment.

Where conduits cross expansion joints in the structure, or where otherwise specified, they shall be provided with expansion fittings of an approved type. The electrical continuity of the conduit runs across the expansion fittings shall be assured by approved fittings.

Pull boxes shall be used wherever necessary to facilitate the installation of the conductors. Conduits entering into cast iron pull boxes or enclosures shall be secured with two lock nuts, and the projecting ends shall be equipped with an approved insulting bushing.

All conduit connections to cabinets or panels shall be made using concentric punched or out holes. Entrances into sheet metal enclosures made using incendiary methods such as oxy-acetylene torches, propane torches, or similar means are absolutely prohibited. Cabinets, boxes, and enclosures shall be completely cleaned of construction debris such as mortar, concrete, paint splashes, wire clippings, and metal shavings after construction is completed.

All metal surfaces of conduits, fittings, boxes, etc. in contact with concrete encasement shall be painted with one coat of RTCB-5 Tar. All surfaces of conduits, fittings, boxes, supports, etc. exposed to view (material between stringers and above bottom of stringers is not considered exposed to view) shall be painted to match the color of adjacent material. All galvanized surfaces shall be prepared in accordance with Section 09900.03 before the application of any paint.

After installation, all conduit which will not have circuit wire or cable pulled into it during construction shall have a No. 10 AWG copper clad or aluminum clad pull wire installed in it. The ends shall be closed with capped bushings or otherwise sealed in an approved manner to completely keep all moisture and foreign matter out of the conduit.

G. Horizontal Auguring Or Jacking

Conduit to be placed under existing pavements or paved shoulders may be installed by horizontal auguring or jacking methods subject to the approval of the Engineer. The Contractor must receive written approval from the Engineer prior to the commencement of work for other thrust boring methods.

The ducts for installation in augured holes shall be placed in a hole augured under the pavement between the handboxes. The duct shall be installed by pushing in sections and coupling them together as the work progresses. The advance end of the first section of rigid duct shall be capped before pushing it into the augured hole.

The ducts for installation by jacking shall be installed by thrusting sections under the pavement with a hydraulic ram. Sections of rigid duct shall have a pointed nose cap screwed onto the advance end to facilitate penetration.

The Contractor shall avoid disturbing the existing roadway surface or weakening the roadbed. Any damage to the existing pavement structure shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

H. Trenches and Conduit

Trenches for underground conduits shall be constructed in accordance with the details shown on the Plans and as specified in Section 02250.03.

All conduits shall be supported so that strain is not transmitted to outlet or pull boxes. Supports shall be sufficiently rigid to prevent distortion of conduits during backfilling or wire pulling.

02731.04 METHOD OF MEASUREMENT

Measurement for electrical conduit will be made along the centerline of the conduit of the length of each type and size satisfactorily installed in accordance with the Contract Documents. No separate measurement will be made for concrete encasement, fittings, spacers, or other accessories.

02731.05 BASIS OF PAYMENT**A. General**

Payment will be made for contingent items when ordered by the Engineer. Payment will be as specified in Sections 02951, 02953, 02954, 02955, 02956, and 02957.

B. Electrical Conduit

Payment for electrical conduit will be made at the price bid per linear foot for each size and type installed complete in place. The price bid shall include furnishing and installing conduit, fittings, and bushings; including excavation, backfill, and/or horizontal auguring or jacking; concrete encasement, and for all labor, materials, and equipment necessary to complete this item of work as shown and specified in strict accordance with the Contract Documents.