

Section 16402

UNDERGROUND DUCT BANKS

PART 1 GENERAL

1.01 SUMMARY

This section includes underground concrete encased electrical duct banks. Concrete encased duct banks are defined as an individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common concrete envelope.

1.02 MEASUREMENT AND PAYMENT

No separate payment for work performed under this Section. Include cost of same in Contract price bid for work of which this is a component part.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. NFPA 70: National Electrical Code (NEC)

1.04 SUBMITTALS

- A. Submit all products covered under this specification and per the requirements of Section 01330 – “Submittal Procedures.”
- B. Catalog cut sheets of the ducts and spacers.
- C. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.
- D. Provide preliminary and final dimensioned layout drawings indicating number of conduits, size and location of conduits, and wiring/instrumentation being ran through each of the conduits. Final drawings shall show section view of duct bank identifying circuits’ size and location of conduits, and wiring/instrumentation being run through each of the conduits.

1.05 RELATED REQUIREMENTS

- A. Section 01330 – “Submittal Procedures”
- B. Section 02317 – “Excavation and Backfill for Utilities”

- C. Section 03315 - "Concrete for Utility Construction"
- D. Section 16195 - "Electrical Identification"
- E. Related work as called for on Plans or specified elsewhere in this or other Sections.

1.06 – 1.07 (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Have duct spacers and associated hardware packed and crated to avoid damage during shipment and handling.
- B. Clearly mark packages or crates stating that the material is for electrical duct banks only.

1.09 – 1.13 (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. Thomas and Betts
- B. Underground Devices Inc.
- E. Walker Division, Butler Manufacturing Company
- F. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

A. Conduit:

Construct ducts using schedule 80 rigid PVC conduit. PVC conduit shall comply with NEMA TC2, WCA, and NEC.

B. Spacers:

1. Secure conduit with non-magnetic, universal, interlocking-type spacers for both horizontal and vertical duct arrangements.
2. Spacer Material: High density polyethylene.
3. Provide minimum spacing between conduits per NEC requirements unless otherwise shown on Plans.

C. Concrete:

Use steel reinforced, red concrete (Class B 2,000 PST @ 28 days) as duct encasement. Refer to Section 03315 - "Concrete for Utility Construction."

- D. Where unprotected service conductors are routed through a pull box with other conductors a divider wall shall be provided in the pull box for separation as required by the NEC.

2.03 – 2.04 (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Plans indicate the intended routing of duct banks and direct buried conduit.
- B. Site conditions may affect actual routing of duct banks. Contractor shall determine the exact locations of each duct bank after careful consideration has been given to the location of other utilities, grading, and paving. If routing needs to be modified, a revised routing layout shall be submitted to the Project Manager and approved by the Engineer prior to excavation and construction of duct banks.
- C. All materials shall be installed in accordance with manufacturer's instructions.
- D. Comply with Section 02317 – "Excavation and Backfill for Utilities" for trenching, backfilling and compacting.

3.02 PREPARATION AND GENERAL INSTALLATION REQUIREMENTS

- A. Verify from Plans and field survey that the location of duct banks does not interfere with any existing or new underground facilities.
- B. Verify that materials are on site in proper condition and that sufficient quantity is on hand for the work.
- C. Verify that trenches are in the correct places and prepared with sufficient depth and width to accommodate the duct banks, reinforcing rod, and concrete.
- D. Be prepared for inspection of the duct banks before reinforcing rod is installed.
- E. Before pouring concrete, verify that the ducts are free of debris and properly installed in the support and spacer systems and that the ducts are properly fitted together and firmly held in place by the hold down hardware.
- F. Provide 24-hour notice to the Project Manager, Engineer and the Local Code Inspector for cover-up inspection before pouring electrical conduit duct banks.

- G. Do not place concrete or soil until conduits have been observed by the Project Manager. Duct banks shall be sloped at a minimum of 4 inches per 100 feet or as detailed on the Plans.
- H. During construction and after conduit installation is complete; the ends of all conduits shall be plugged.

3.03 INSTALLATION

- A. Use the size and types of conduit as indicated on the Plans for the various duct banks required for the project.
- B. Install duct banks so that the top of the concrete encased duct, at any point:
 - 1. Is not less than 24 inches below grade or as specified in the Plans
 - 2. Is below sub-grading of pavement
- C. Conduit supports and spacers:
 - 1. Supports and spacers for rigid nonmetallic conduit shall be placed on maximum centers as indicated for the following conduit sizes:
 - a. 1 inch and less: 3 feet
 - b. 1-1/4 to 3 inches: 5 feet
 - c. 3-1/2 to 6 inches: 7 feet
 - 2. Supports and spacers for rigid steel conduit shall be placed on maximum centers as indicated for the following conduit sizes:
 - a. 1 inch and less: 10 feet
 - b. 1-1/4 to 2-1/2 inches: 14 feet
 - c. 3 inches and larger: 20 feet
 - 3. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
- D. Joints in conduit shall be staggered at intervals of 6 inches vertically.
- E. All conduit joints shall be watertight and in accordance with manufacturer's recommendations.
- F. Make duct bank installations and penetrations through foundation walls watertight.

- G. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 2-inch minimum concrete separation between the outer surfaces of the conduits.
- H. Provide a 3-inch minimum concrete covering on both sides, top and bottom of concrete envelopes around conduits. Add red dye at the rate of 8 pounds per cubic yard to concrete used for envelopes for easy identification during subsequent excavation.
- I. Firmly fix ducts in place during pouring of concrete. Carefully spade and vibrate the concrete to ensure filling of spaces between ducts.
- J. Make bends with sweeps of radius not less than 6 times the smallest diameter of the raceway.
- K. Make a transition from non-metallic to PVC-coated metallic rigid conduit where duct banks enter structures or turn upward for continuation above grade.
1. Rigid PVC conduits shall be terminated with end bells
 2. Steel conduits shall be terminated with insulated bushings
 3. Exception to this requirement:

Rigid non-metallic conduit may be extended directly to manholes, handholes, pad mounted transformer boxes and other exterior pad mounted electrical equipment when the conduit is concealed within the enclosure.
- L. Make bends of 30 degrees or more using rigid galvanized steel.
- M. Reinforce duct banks throughout, where indicated on the Plans.
1. Unless otherwise noted on the Plans, reinforce with No. 5 longitudinal steel bars placed at each corner and along each face at a maximum parallel spacing of 12 inches on centers, and No. 5 tie-bars transversely placed at 18 inch maximum longitudinal intervals.
 2. Maintain a maximum clearance of 2 inches from bars to the edge of the concrete encasement.
- N. Where ducts enter structures such as handholds, manholes, pull boxes, or buildings, terminate the ducts in suitable end bells, insulated L-bushings, Meyers hubs or couplings on steel conduits. Tag conduit pull boxes with stamped, stainless steel tags. Identify as designated in cable and conduit schedule.
- O. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials which can damage or contribute to corrosion of ducts or prevent adequate compaction of fill.

- P. Install a bare stranded copper duct bank ground in each duct bank envelope. Make ground electrically continuous throughout the entire duct bank system. Connect ground conductor to switchgear and MCC ground buses and to steel conduit extensions of the underground duct system or coil ground conductor in pull box for future connections.
- Q. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately one-fourth inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to remove any particles of earth, sand or gravel that may have been left in the duct. Re-pull the rag or sponge swab until the swab emerges clean.
- R. Use hemp rope to pull conductors into PVC conduit. Do not use nylon or wire cable for this purpose.
- S. Install a warning ribbon approximately 12 inches below finished grade over underground duct banks. Refer to Section 16195 - "Electrical Identification."
- T. For manholes and pull boxes below grade, install wire racks to support cables properly around the perimeter and keep them dry.
- E. For manholes and pull boxes below grade, construct a French drain, or other drainage as detailed on the Plans.
- F. All manhole and underground (U.G.) pull boxes used for electrical construction are to have the work "Electrical" permanently embossed on cover.

3.04 – 3.10 (NOT USED)

END OF SECTION