SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR MEDIUM VOLTAGE ELECTRICAL SYSTEM AND FOR COMMUNICATIONS SYSTEM

PART 1 - DESIGN DIRECTIVES

1.1 DESIGN CRITERIA

A. ELECTRICAL MANHOLE LOCATIONS, PLANNING

- 1. Projects shall plan for a new electrical 3-way manhole to serve the mediumvoltage loop feeder serving the building.
- 3-way electrical manholes shall be planned to allow for no more than eight (8) sets of feeder cables to enter and be spliced or terminated within the manhole.
- B. COMMUNICATIONS MANHOLE LOCATIONS, PLANNING
 - 1. Projects shall plan for a new 3-way manhole to serve the Communications

C. ELECTRICAL MANHOLE CONSTRUCTION and ACCESSORIES

- 1. Manholes may be cast-in-place or precast.
 - a. CAD drawings for cast-in-place manholes are available from FOM-Engineering upon request.
- 2. 3-way Typical campus manhole is a 3-way manhole. Minimum interior dimensions shall be no less than: 8'x8'x8'H. See drawing.
- 3. 2-way 2-way manholes may be used in special cases. Minimum interior dimensions shall be no less than -
- 4. Small manhole a small manhole, used by special exception, for a loop feeder pull-through only (no splicing) shall be minimum 5 feet x 7 feet x 6.5 feet in height. The manhole cover shall be 36 inch minimum to allow cable 180-degree loop bending radius for an unspliced installation. These smaller manholes shall be allowed only by approval from FOM-Engineering. Racks shall be required. A grounding loop inside the manhole is not required. (Precast product, Shea MH-576 with 36" opening)
- 5. Ductbank window openings shall be recessed from the interior with a chamfered edge (minimum 1"). PVC conduits (flush bell-ends) shall be recessed 3" from inside wall into ductbank window openings.
- 6. Manhole ring-neck extensions shall be concrete ring with the opening sufficient for the manhole cover. No brick extensions shall be allowed.
- 7. Sump Pit
 - a. Shall be located to the long side, not directly under the manhole opening.
 - b. Shall be 12"x 12", minimum 4" depth.
- 8. Pulling Irons shall be located opposite and below each ductbank.

- 9. Grounding provisions:
 - a. Provide stub-out of rebar at 12" from ceiling, along long wall. Alternative: provide #4/0 bare copper welded to rebar and extending to interior and exterior 24 "-minimum. Coat copper with non-corrosive paint or tape.
 - b. Provide 1" core drilled hole at 12" from ceiling, along long wall.

D. COMMUNICATION MANHOLE/HANDHOLE CONSTRUCTION and ACCESSORIES

- 1. Manholes may be cast-in-place or precast.
 - a. CAD drawings for cast-in-place manholes are available from FOM-Engineering upon request.
- 2. 3-way Typical campus manhole is a 3-way manhole. Minimum interior dimensions shall be no less than: 8'x8'x8'H. See drawing.
- 3. 2-way 2-way manholes may be used in special cases. Minimum interior dimensions shall be no less than -
- 4. Small manhole a small manhole, used by special exception, shall be minimum 4 feet x 4 feet x 4 feet in height.
- 5. Ductbank window openings shall be recessed from the interior with a chamfered edge (minimum 1"). PVC conduits (flush bell-ends) shall be recessed 3" from inside wall into ductbank window openings.
- 6. Manhole ring-neck extensions shall be concrete ring with the opening sufficient for the manhole cover. No brick extensions shall be allowed.
- 7. Sump Pit
 - a. Shall be located to the long side, not directly under the manhole opening.
 - b. Shall be 12"x 12", minimum 4" depth.
- 8. Pulling Irons shall be located opposite and below each ductbank.
- E. MANHOLE COVERS
 - 1. Electrical Manhole Covers
 - a. Cover Dimensions:
 - 1) 30" diameter where all feeders will terminate inside the manhole
 - 2) 36" diameter, two-piece where feeders will be pulled through the manhole in one continuous loop.
 - b. Electrical manhole covers shall read "ELECTRIC"
 - 2. Communications Manhole covers (data/voice, fiber and copper communications) shall read "TELECOM"
 - a. Cover Dimensions: 30" diameter
 - b. Communications Manhole covers shall read "TELECOM"

F. Sump Pump Pit Grate - shall be polypropylene or other non-conductive, non-corrosive material.

1.2 ELECTRICAL MANHOLE RACKS, GROUNDING

- A. Grounding at manholes shall be provided per "Neutral and Bonding Connections" detail drawing available from FOM.
- B. Racks Provided by Dartmouth FO&M, installed by contractor,

1.3 DUCTBANKS, RACEWAYS

- A. Conduits shall be separated by means of manufactured interlocking "chairs" spaced at no more than 5 feet apart along the length of the duct bank. Spacing between conduits shall not be less than 3 inches.
- B. Steel reinforcement of concrete duct banks shall be required:
 - 1. Where transitioning to a structure (eg., building, manhole, utility tunnel), or
 - 2. Where the duct bank crosses a road and or driveway, (coordinate other driving areas with Dartmouth FO&M) or
- **1.4** Where other existing underground utilities are (or may be in the future) located above or below or adjacent (within 25 feet) to the new ductbank.
 - 1. Steel reinforcement shall extend minimum five feet from structure and/or beyond edge of the road/driveway.
 - 2. Steel reinforcement shall be designed by a structural engineer or shall be per the Dartmouth Standard ductbank design (#5 bars with #3 ties 12" on center).
 - B. Raceways in steel reinforced concrete duct banks shall be schedule 40 PVC.
 - C. Raceways in telecommunications and low voltage power duct banks shall be 4-inch.
 - D. Raceways in medium voltage power applications shall be 5-inch.
 - E. When a duct bank enters an existing or precast manhole or enters a building wall the following two methods are acceptable for attachment to the existing structure:
 - 1. Core drill the existing structure and transition the PVC raceway to rigid metal conduit (ferrous) at the penetration.
 - a. These rigid conduit stubs shall be a minimum of 5 feet long and shall be terminated in the existing wall through segmented link seals.
 - b. The reinforcing steel of the new cast in place duct bank shall extend into the existing wall and be secured with epoxy suitable for the environment.
 - c. Before the duct bank is poured the exterior of the existing wall shall be treated with water stop Rx to provide a watertight joint.
 - d. Grounding bushings shall be installed on the conduit stubs inside the basement or utility vault.

- 2. Saw cut a window into the existing structure suitable to allow the entrance of the PVC ducts and reinforcing steel.
 - a. In this arrangement the weight of the duct bank will bear on the wall through which it is installed.
 - b. The duct bank reinforcing steel shall extend into the wall of the existing structure to within one inch of the interior form and be tied to this wall by the installation of rebar pins into the perimeter of the rough opening fastened with epoxy suitable for the environment.
 - c. Before the duct bank is poured the interior perimeter of the rough opening shall be treated with water stop Rx to provide a watertight joint.
 - d. The "window' fill shall be formed to provide a 3" recess from the manhole interior wall.
 - e. Conduit bell ends shall be used where the PVC meets the interior form and shall be installed flush to the interior wall.
 - f. See detail "E" on 'Dartmouth College Electric Vault and Ductbank Details.dwg' CAD drawing.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLES

- A. Shea
- B. Pheonix

2.2 RACKS

A. Provided by Dartmouth FO&M, installed by contractor.

2.3 **GROUNDING MATERIALS – See MV Cables**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Every effort shall be made to minimize the number of bends in all duct bank systems.
 - 1. Field bends shall be made using a "hot box" designed for the size of PVC used.
 - 2. Care shall be given to duct bank routing so that very large radius sweeping turns are designed into the route as opposed to factory-made 45-and 90-degree bends.
 - 3. When factory 90-degree bends are used they shall be a minimum of 36-inch radius for four inch and 48-inch radius for 5-inch.
 - 4. Factory 90-degree bends used in duct bank construction shall be rigid metal conduit (ferrous) only.
 - 5. These factory-made bends shall be protected by corrosion tape such as 3M Scotchwrap 50 or approved equal prior to the concrete pour.

- B. Duct banks used in the medium voltage electric system shall have red dye applied to the surface at the time the concrete is poured. A red "Danger High Voltage" tape shall be installed during backfill to identify the location to future excavators.
- C. Duct banks shall have "tracer tape" provided, installed 12" above underground ductbank.
 - 1. Telecommunications duct banks shall have a utility locating tracer wire installed according to manufacturer's requirements.
- D. The duct bank support "chairs" shall be spaced up from the bottom of the trench using cement brick to ensure that the proper amount of concrete is poured under the conduits.
 - Sides of the trench may be used as the form if the width does not exceed 1 1/2 times the recommended dimension of the duct bank (width) per the details in Appendix A of this document.
- E. The electrician shall vacuum, swab and install pull strings in every conduit of the completed duct bank. The pull string shall be permanently marked in one-foot increments to aid in wire estimation on future projects.
 - 1. Use Greenlee #435 pull string or approved equal.
- F. PVC conduits (flush bell-ends) shall be recessed 3" from inside wall into ductbank window openings.
- G. Manhole Grounding
 - 1. Provide one (1) ground rod exterior to the manhole.
 - 2. Provide #4/0 bare copper grounding conductor. The grounding conductor shall be connected to and be inclusive of:
 - a. ring around exterior of manhole,
 - b. connected to ground rod
 - c. ring around interior of manhole

3.2 AS-BUILTS, RECORD DOCUMENTATION

- A. All underground ductbanks, raceways and manhole and handhole structures shall be surveyed during installation.
- B. Locations and elevations of all underground ductbanks, raceways and manhole and handhole structures shall be provided to Dartmouth project manager and FOM-Engineering via a Cad/REVIT/pdf drawing file.

END OF SECTION