

260540 UNDERGROUND DUCT BANKS

Part 1 – GENERAL

1.1 Description

A. This section details the guidelines and expectations for the design and installation of underground duct banks on Johns Hopkins University Homewood Campus. Project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification and approval from the JHFRE Engineering and Energy Department, it is expected that these guidelines will govern the design and specifications.

1.2 Submittals

N/A

1.3 Quality Assurance

A. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

Part 2 – PRODUCTS

2.1 Duct banks shall utilize NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer, complying with NEMA TC 3 and UL 651, listed for underground use, concrete encased. Utilize rigid PVC interlocking spaces sized for type and sizes of ducts used and selected to provide minimum duct spacing of 3" between ducts while supporting ducts during concreting. Manufactured bell ends of appropriate sizes shall be used at the end of each conduit with conduit seals. All conduit seals shall be mechanical interlocking assembly seal of modular synthetic rubber links properly sized to fit the pipe and tightened in place. Provide underground polyethylene tape with continuous metallic strip warning tape over the center of each duct bank.

2.2 All manholes shall be precast concrete structures with a minimum interior width of 6' wide, 8' long and 6' high. Each manhole wall shall have precast openings to match dimensions and elevations of approaching ducts with an additional 12" vertically and horizontally to accommodate alignment variations. Provide weatherproof, gray cast iron Class 30B frame and cover with a minimum diameter of 29". Cover shall have a nonskid finish and be labeled to match the contents of the manhole. All manholes shall have a fixed, nonconductive ladder and cable rack assemblies.

A. Provide ground loop covering all four (4) walls. Install 3/4" x 10' copper ground rod in corner holes (not center drain).

B. Provide a minimum of one (1) Heavy-duty, Glass-reinforced Nylon Stanchion per wall (minimum 4' in height) and a minimum of (1) 8", (1) 14" and (1) 20" Glass/Nylon Arms per stanchion. For any walls without knockouts, provide two (2) stanchions per wall and fitted as described above.

2.3 For all medium voltage distribution, conductors shall be installed in concrete encased duct banks with a minimum of one spare duct per feeder.

Part 3 – EXECUTION

3.1 Duct Installation

A. Slope: Pitch ducts a minimum slope of 6":100' down toward manholes and handholes and away from buildings and equipment. All ducts shall slope from a high point in runs between two manholes to drain in both directions. All manholes shall be installed with gravity drains.

B. Curves and Bends: Use 5° angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 12.5', both horizontally and vertically, at other locations, unless otherwise indicated. Contractor may use field fabricating techniques per conduit manufacturer written instructions to achieve binds/curves as necessary.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Existing Manholes: Use end bells, spaced approximately 10" on center for 5" ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10' from the end bell without reducing duct line slope and without forming a trap in the line.

2. Direct Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15psig hydrostatic pressure.

1. Provide waterproof sealing collar around all conduit terminations at building foundations.

F. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with no less than 4 spacers per 20' of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6" between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.

b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4" reinforcing rod dowels extending 18" into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

4. Reinforcement: Reinforce concrete-encased duct banks where they cross sidewalks, roads, paved areas and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. Forms: Use trench walls to form sides of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

6. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

7. Warning Tape: Align tape parallel to and within 3" of the centerline of duct bank. Provide an additional warning tape for each 12" increment of duct bank width over a nominal 18". Space additional tapes 12" apart, horizontally.

3.2 Pull aluminum or wooden test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80% fill of duct. If obstructions are indicated, remove obstructions and retest.

3.3 Within every manhole, provide identification for each feeder and duct bank. For each feeder, identify the feeder number and substation that it is served from. For each duct bank, identify the next manhole or building that the duct bank serves.

3.4 All duct banks shall have at least one spare conduit.

3.5 Tagging and labeling

A. All medium voltage cabling to be tagged at least twice in each manhole, upon entering switchgear and in any pull boxes using plastic labels.

B. All cable circuit labels shall be 1-1/2" high, polyethylene, with black characters on white background, in a polyethylene holder, attached to the cable by two nylon self-locking ties.

3.6 Underground Duct bank Construction in Congested Areas

- A. Route all electrical and communications duct bank underneath all water and steam utilities.
- B. Vacuum Truck required when working in congested areas with fragile utilities (backhoe prohibited).
- C. For highly congested areas in the public right-of-way, contractor shall search City database for abandoned gas and water pipes to free-up space for new duct banks.