The following information shall be included in specifications prepared for use on all University of Cincinnati construction and renovation projects. This information is supplemental and not intended to be a complete specification.

**GENERAL STANDARDS**

**General Criteria**

Minimum size manhole shall be 6 feet wide by 10 feet long by 6 feet, 6 inches high. Minimum size handhole shall be 4 feet long by 4 feet wide by 4 feet high.

Maximum spacing between manholes or handholes is 400 feet.

Minimum size pullbox shall be 18 inches long by 12 inches wide by 12 inches deep. Pullboxes shall be made from fiberglass reinforced epoxy/concrete product, similar to products made by Quazite.

Polyvinyl chloride (PVC) duct shall be schedule 40 and concrete-encased with a minimum of 3 inches of concrete.

Minimum size duct for primary electric shall be 5-inch trade size.

Minimum size duct for telephone shall be 4-inch trade size.

For 1½-inch and smaller ducts, PVC-coated, rigid galvanized steel conduit may be used and shall be concrete-encased unless the University Project Manager makes an exception.

**PRODUCT STANDARDS**

**Manhole Requirements**

Precast manholes meeting American Association of State Highway and Transportation Officials (AASHTO) H20 loading requirements are preferred. Cast-in-place manholes are acceptable where conditions warrant. Manholes shall be located and sized to allow workable pulling tension on cables and other consideration in planning.

Each manhole shall include, but not be limited to the following:

- Manhole cover and frame, minimum size 36 inches diameter
- Extendable hand holds
- Pulling irons
- Cable racks
- Support with locking clips
- Cable rack insulators
- Sump pit
- Solid bottom
- Grounding bus
- Ladder

A ¾-inch diameter by 10 feet, driven copper-clad steel ground rod bonded to grounding bus with approved ground lugs, or exothermic weld.
**Manhole Contents**

**Covers** - Covers shall be round, minimum 36 inches diameter, heavy duty with the word “ELECTRIC” or “TELEPHONE” cast in cover as applicable.

**Pulling Irons** - Pulling irons shall be hot-dipped galvanized forged steel and located opposite middle of each receptive entrance.

**Cable racks** - Cable racks shall be hot-dipped galvanized steel. Racks shall have support T-slots spaced on 1 1/2-inch centers.

**Supports** - Supports shall be hot-dipped galvanized steel. Supports shall be T-shaped to mate with insulators. Upturned end of supports shall restrain insulators. Locking clips shall keep supports from disengaging if bumped from below.

**Insulators** - Insulators shall be porcelain with rounded corners and edges. Insulators shall slide and lock onto supports and have locking-type grooves.

**Sump pit** - Each pit shall be a minimum of 12 inches in diameter and shall extend into granular subbase.

**Solid bottom** - Bottom of manhole shall be placed over base consisting of crushed nonporous rock base or gravel. Maximum size shall not exceed 1 1/2 inches any dimension and shall have a minimum dimension of 4 sieve size.

**Grounding bus** - A copper grounding bus shall be installed in each manhole for bonding all hardware cable sheaths and ground rod. Minimum size bus ¼ inch thick, 3 inches wide, 18 inches long.

**Access** - Access shall be minimum 36 inches round frame equipped with a movable steel galvanized ladder placed in each manhole.

**Ground Rod** - A manhole ground rod shall be placed close to each grounding bus, all located for easy access to test.

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**EXECUTION STANDARDS**

**Construction & Installation**

**Building Transition** - Where entering a building, PVC ducts shall be converted to PVC-coated, rigid galvanized steel, 5 feet from the building wall or foundation.

**Duct Bends** - Bends in PVC ducts may be made up to 10 degrees by the hot-forming method. Cold bends are not allowed. For bends exceeding 10 degrees, PVC-coated, rigid galvanized steel conduit shall be used. All 90 degree bends shall be made with PVC-coated, rigid galvanized steel conduit.

**Roadway Reinforcement** - Where PVC ducts cross below heavily traveled roads, concrete-encased schedule 80 ducts shall be used.

**Duct Runs** - Duct runs between manholes or other terminating points shall be as straight as possible, sloped to drain into the manhole. All bends shall be sweep-bends and shall have a minimum curvature radius of 25 feet except at risers. Duct joints shall be staggered by row and layered to provide maximum duct strength. Ducts shall enter manhole or terminating point perpendicular to the manhole or terminating point, and must be a minimum of 10 feet straight from the wall of the termination point. All ducts entering a building must be sloped away from the building.

**Support** - Duct banks shall be supported on a full bed of concrete and shall not be supported on bricks, blocks, or rocks. Support for ducts shall be on approved spacers of precast concrete, high-impact polystyrene, or high-density polyethylene (not less than .96 specific gravity); minimum spacing of spacers to be 5-foot intervals. Concrete shall encase the duct bank installation a minimum of 3 inches on all sides. Reinforcing rod tied to side stakes to ensure full concrete flow under ducts shall be specified. Concrete envelopes shall extend through foundation and manhole walls designed so that envelope becomes a structural member providing support for
bridging the area that has been excavated and backfilled for foundation or manhole walls. Concrete envelope for duct banks shall be reinforced as shown on the drawings.

**Testing & Commissioning**

**Final preparation** - Each duct shall be cleaned and proved clear by pulling a full-size test mandrel through the duct. Each duct shall have a 200-pound test nylon pull rope left in place and have duct plugs installed.

**Color additive** - The primary duct concrete envelopes shall have red concrete additive mixed in concrete for identification, unless otherwise directed by the University Project Manager, who may allow coloring to be distributed on top of wet duct bank concrete. Specify AC Horn Red “Colorundum” mix, approximately 3½ pounds per sack of cement to provide an identifiable red color as a warning to anyone digging into a high-voltage cable run.

**Caution Tape** - Provide a foil-backed plastic caution tape along the entire length of duct bank, installed 12 inches above the top of the concrete envelope. Use one tape for every 12 inches of width of concrete. Tape shall be worded “CAUTION: HV ELECTRIC” for electric, or “CAUTION: TELEPHONE” for telephone.

**Full Range Marker** - The Associate should specify that each of the following underground utilities shall have a **3M ball marker or full-range marker**, each having a distinct color and frequency, for locating underground utilities:

- The 1250 full-range orange marker for **communication and telephone**
- The 1254 full-range yellow marker for **gas**
- The 1407-XR black/orange ball marker for **street lighting**
- The 1251 full-range blue marker for **chilled water**
- The 1254 full-range yellow marker for **steam/condensate**
- The 1252 full-range blue marker for **water**
- The 1251 full-range red marker for **power — high voltage**

The marker shall be used only when the utility will be 8 feet or less below the future finished grade (except for street lighting; 5 feet below).

A marker shall be placed every 25 feet.

A marker shall be placed at every direction change.

There shall be a minimum of two markers for each utility trench.

--- END OF SECTION ---