

**GENERAL:**

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The scope of this document is to provide instruction for the installation of concrete electric manholes.

**DESIGN GUIDELINES:**

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1. Materials for Manhole

- 1.1. Cast-in-Place or Pre-Cast concrete may be used.
- 1.2. The minimum 28 day concrete compressive strength for concrete shall be 4,000 psi.
- 1.3. The minimum inside dimensions for a manhole is 12' x 7' wide, and 6'6" high.
- 1.4. Only ready mixed concrete shall be used. Ready mixed concrete shall be mixed and transported to the job site in accordance with ASTM C94 "Specifications for Ready Mixed Concrete".
- 1.5. Manholes shall be designed in compliance with ASTM C857-87, "Standard Practice for Minimum Structural Design Loading for Underground Pre-cast Concrete Utility Structures". Wheel loading shall be HS-20.
- 1.6. Manholes shall be manufactured in accordance with ASTM C858-83, "Standard Specifications for Underground Pre-cast Concrete Utility Structures".
- 1.7. Shall be designed per ACI 318-02 "Building Code Requirements for Structural Concrete."
- 1.8. Design loads shall consist of dead load, live load, impact, surcharge load, and any other loads which may be imposed upon the structure
- 1.9. Sump
  - 1.9.1. The sump shall have a concrete bottom and shall be 18 inches as shown on Manhole Detail Drawing.
  - 1.9.2. The manhole floor is to be sloped to the sump pit.
  - 1.9.3. Sump pit is to be located in the middle of the floor below the entry hole.
  - 1.9.4. There is to be no grating over the sump pit.
- 1.10 Reinforcement
  - 1.10.1 All concrete used in the construction of the manholes shall contain steel reinforcing bars to conform to all applicable building codes. All reinforcing steel shall conform to ASTM 432 and ASTM A305 Specifications.
- 1.11 Accessories
  - 1.11.1 Cable pulling-in irons shall be Cooper Power Systems Catalog No. DU1T1; MacLean Power Systems Catalog No. J8120; Hubbell/Chance Catalog No. 8120; or approved equal.
  - 1.11.2 Manhole Covers and Frames
    - 1.11.2.1 Manhole access is to be in the middle of the manhole ceiling, with the sump pit located directly underneath (see Electric Manhole Detail.dwg for reference).

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- 1.11.2.2 Manhole covers shall consist of a solid circular gravity lid and frame. The lid and frame shall be heavy duty type, fabricated from gray cast iron.
  - 1.11.2.3 Manhole lids shall have a checkered design with the word ELECTRIC cast into the top surface.
  - 1.11.2.4 Manhole lid frames shall provide a 36-inch diameter opening. The opening through the concrete roof of each manhole shall be 40.5 inches in diameter.
  - 1.11.2.5 Manhole frames and covers shall be Neenah Foundry Company Catalog No. R-1640-D, or approved equal. The cover shall have two (2) 1" diameter pick holes located 180° apart.
- 1.11.3 Conduit End Bells
- 1.11.3.1 Conduit end bells for PVC conduit shall be polyvinyl chloride (PVC) type glued to the end of each PVC conduit. Conduit end bells shall be Carlon Electrical Products Catalog No. E297\_, or approved equal by Condux International, Inc., Certainteed Products Corp. or Can-Tex Industries.
  - 1.11.3.2 Conduit end bells for rigid galvanized steel conduit shall be hot-dipped galvanized malleable iron or steel, threaded to the end of the rigid galvanized steel conduit and cast in place in the concrete wall of the manhole and shall be O-Z/Gedney Company Type TNS or approved equal by Appleton Electric or Crouse-Hinds.
- 1.11.4 Cable Racks
- 1.11.4.1 Cable racks shall be heavy duty type fabricated from 50% glass-reinforced nylon or a non-metallic material having equal mechanical strength, thermal resistance, chemical resistance, dielectric strength and physical properties.
  - 1.11.4.2 Stanchions
    - 1.11.4.2.1 Size of stanchions shall be coordinated with Energy Management Electric Distribution Engineer.
    - 1.11.4.2.2 Stanchions shall incorporate multiple arm mounting holes that are 4 inches apart and recessed attachment bolt mounting holes.
    - 1.11.4.2.3 Stanchions shall be Model CR\_\_-B as manufactured by Underground Devices, Inc. or approved equal.
  - 1.11.4.3 Cable Support Arms
    - 1.11.4.3.1 Cable support arms shall be heavy duty type fabricated from 50% glass-reinforced nylon or a non-metallic material having equal mechanical strength, thermal resistance, chemical resistance, dielectric strength and physical properties. Cable support arms shall be 14 inches in length, with 5 slots for cable wire ties.
    - 1.11.4.3.2 Provide a positive locking clip for each and every cable support arm supplied to prevent disengagement of the cable support arm from the cable rack due to upward force on the support arm.
    - 1.11.4.3.3 Cable support arms shall be Model RA14 with Model HDL lock as manufactured by Underground Devices, Inc. or approved equal.

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## 1.11.5 Cable Support Insulators

1.11.5.1 Cable support insulators shall be fabricated from high-grade electrical porcelain and shall have rounded corners and edges to prevent cable sheath damage.

1.11.5.2 Cable support insulators shall be Model DE11U1 as manufactured by Cooper Power Systems, or approved equal.

## 1.11.6 Cable Ties

1.11.6.1 Cable ties shall be weather resistant self-locking high strength UV-resistant black nylon, having a minimum length of 15 inches and a minimum loop tensile strength of 120 lbs, meeting Military Specifications MS 3367-3-0. Cable ties shall be Ty-Rap Catalog No. TY5275MX; 3M Catalog No. 06277; W.H. Brady Company Series CTUN-400HBK; or approved equal.

## 1.11.7 Grounding

1.11.7.1 Grounding rods shall be ¾-inch diameter, 10 feet long, high strength solid steel rod with a bonded copper jacket, and UL listed.

1.11.7.2 Grounding rods shall be manufactured by Copperweld Steel Company, ITT Weaver; Thomas & Betts; Blackburn; Joslyn Mfg. and Supply Co.; or approved equal.

## 2. Installation for Manholes

## 2.1. Cast-in-Place Concrete Manholes

2.1.1. Concrete work excavations shall not be backfilled until the concrete has cured, or a minimum of seven (7) days after concrete placement.

2.1.2. All concrete work for the manholes shall be formed, using proper concrete forms.

2.1.3. The inside surfaces of manhole walls and ceilings shall have a smooth finish. Manhole floors shall have a non-slip broom finish.

2.1.4. Furnish and install all required appurtenances for each manhole, such as cast iron cable pulling-in irons, cast iron frame and cover, conduit end bells, cable racks, grounding rods, etc. Set them into position in forms before pouring concrete.

2.1.5. Cable rack stanchions shall be installed on each wall of every manhole. Maximum spacing of stanchions shall be 3'0" on center. Stanchions shall be bolted to manhole walls using stainless steel expansion anchors in accordance with the cable rack manufacturer's recommendations.

2.1.6. Provide a minimum of three (3) cable support arms for every stanchion supplied.

## 2.1.7. Cable Support Insulators

2.1.7.1. Each insulator with cables shall be tied to the cable support arm when installing the cables by wrapping two cable ties, in opposite directions, completely around the cables, the insulator, and the cable support arm. Cable ties shall be long enough to accomplish this.

## 2.1.8. Pulling-in Irons

2.1.8.1. Furnish and install the pulling-irons opposite each duct-bank entry.

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- 2.1.9. Duct bank entries shall be coordinated with owner and shall enter near corners where practical.
  - 2.2. Pre-cast Concrete Manholes
    - 2.2.1. Pre-cast concrete manholes shall be installed in accordance with the manhole manufacturer's instructions.
  - 2.3. Grounding
    - 2.3.1. Manhole shall have two grounding rods in each electric manhole. Grounding rods shall be driven into the soil beneath the manhole and cast in place with the installation of the concrete floor of the manhole. Grounding rods shall be located in diagonally opposite corners of the manhole, located 5 inches out from each wall, and projecting 6 inches above the finished floor level.
    - 2.3.2. Manhole shall have a size 4/0 bare stranded copper conductor around the inside perimeter of each electric manhole. The conductor shall be fastened to the manhole concrete wall every 4 linear feet at a height of 6 inches above the finished floor using two-hole copper tubing straps.
    - 2.3.3. The copper grounding conductor shall be connected to each grounding rod by means of exothermic welding.
  - 2.4. Sump
    - 2.4.1. Provide a concrete sump in the center of the floor of each manhole for the collection of any water which might enter the manhole. The manhole floor shall slope towards the sump with a minimum slope of 1/8 inch per foot. A sump pump is not required.
  - 2.5. Cables shall be routed around the interior walls of the manhole.
3. Commissioning
    - 3.1. Manhole
      - 3.1.1. All soil and debris shall be removed from manholes.
      - 3.1.2. Verify all pull strings and caps are installed.
    - 3.2. Electric Underground Ducts
      - 3.2.1. All soil and debris shall be removed from manholes and equipment pads where ductbanks terminate.
      - 3.2.2. Verify all pull strings and caps are installed.

**REFERENCES**