1 References

- ASTM A48 – Gray Iron Castings
- ASTM C478 – Pre-cast Reinforced Concrete Manhole Sections
- ACI 318 – American Concrete Institute
- ASTM C891 – Installation of Underground Precast Utility Structures
- NEMA TC 8 – Extra-Strength PVC Plastic Utilities Duct for Underground Installation
- NEMA TC 9 – Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation
- NFPA 70 – National Electrical Code

2 Pre-Cast Manholes

2.1 The quality of components is to be that represented by:
- Manhole: Hartford Concrete Products, Inc. - Pre-Cast Vault
- Frame & Cover: Neenah Foundry - #R-1740-F
- Stanchion: Underground Devices Inc. - CR 36
- Cable Arms: Underground Devices Inc. - RA 14 & 20
- Cable Rack Assemblies: Underground Devices Inc.

2.2 Construction

2.2.1 Manhole will be constructed of steel reinforced concrete

2.2.2 Manhole will be complete with manhole cover and ring, 14” diameter sump indentation located adjacent the manhole opening, cable pulling rings, and other appurtenances as required.

2.2.3 Manhole will be waterproof construction

2.2.4 Mortised joint seals or PVC pre-molded water stops shall be installed at the junction of base and walls

2.2.5 Provided with a heavy-duty cast iron frame and cover with nominal 48” opening with a 22” smaller access cover centered in larger cover

2.2.6 Frame and cover shall have open pick holes

2.2.7 Label cast in lid shall read “ELECTRIC”

2.2.8 The Contractor shall permanently weld identification number/letter labels on the manhole lids

2.2.9 Provide cast concrete grade rings without steps as needed to elevate cover to approximately 1” above finish grade. Cast iron adjusting rings may be used to trim final elevation.

2.2.10 Precast manholes shall be provided with hot-dipped galvanized pull-in irons mounted on the ceiling and on each wall. One removable pulling eye shall be installed in the floor, centered under the manhole opening.

2.2.11 Contractor to provide stanchions and cable arms of a glass reinforced nylon material having a combination high mechanical strength, thermal resistance, corrosion resistance and dielectric strength.

2.2.11.1 The stanchions shall be 72” long (2-36”) and incorporate multiple cable arm mounting holes.

2.2.11.2 Cable arm length shall be a minimum of 14”.

2.2.11.3 Mounting hardware shall be 316 stainless steel.

2.2.12 Cable racks shall be mounted on each wall of the manhole to adequately support cables.

2.2.12.1 Additional racks shall be mounted not more than twelve (12) inches from corners at duct entrances.

2.2.12.2 Racks shall be spaced not more than forty (40) inches between racks on the walls.

2.3 Installation

2.3.1 Ensure that the soil materials and compaction criteria used for the manhole conforms to the specifications and that the proper elevation for installation has been determined and verified prior to setting manhole.

2.3.2 An eight-inch thick layer of washed pea gravel shall be placed in the excavation to set the new manhole on manholes shall be set level and plumb.

2.3.3 Contractor shall furnish, securely install and properly bond all reinforcing steel, metal hardware, and cast iron frame with #4 AWG solid soft drawn bare copper.

2.3.4 Manhole shall be grounded

2.3.5 Contractor shall properly backfill and compact soil around the manholes after they
have been inspected and approved.

2.4 Design Conditions: Manholes shall be specifically designed for the following conditions and specifications.

<table>
<thead>
<tr>
<th>Item</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground water level</td>
<td>3’-6” below surface</td>
</tr>
<tr>
<td>Dry earth density</td>
<td>100 lbs. / ft³</td>
</tr>
<tr>
<td>Saturated earth density</td>
<td>120 lbs. / ft³</td>
</tr>
<tr>
<td>Live load</td>
<td>AASHTO H-20-S16 truck</td>
</tr>
<tr>
<td>Live load impact</td>
<td>2’-0” I = 20%</td>
</tr>
<tr>
<td>Earth cover</td>
<td>Min. 2’-0” – Max. 5’-0” for Electrical Manholes</td>
</tr>
<tr>
<td>F’c</td>
<td>4,500 PSI with grade 60 reinforcing steel</td>
</tr>
<tr>
<td>Fy</td>
<td>60,000 PSI</td>
</tr>
<tr>
<td>Codes &amp; Standards</td>
<td>AASHTO Load factor design for manholes</td>
</tr>
<tr>
<td></td>
<td>ASTM C-857</td>
</tr>
<tr>
<td></td>
<td>ACI Code 318 (USD) where applicable for manholes</td>
</tr>
</tbody>
</table>

3 Cast-in-Place Duct Bank

3.1 Construction

3.1.1 Concrete and related work shall be mixed, placed, and cured in accordance with the “Building Code Requirements for Reinforced Concrete”, ACI-318.

3.1.2 Concrete shall develop an ultimate compressive strength of 4000 P.S.I. in 28 days with a maximum slump of 6 inches at time of placing. The top aggregate size shall be ½” to ensure good placement between embedded items.

3.1.3 Color top layer of concrete encasement red by heavily sprinkling with red oxide cement coloring while still wet (color to the satisfaction of the Owner).

3.1.4 The number, size and arrangement of conduits in the cast-in-place underground duct bank sections shall be as indicated in the Program.

3.1.4.1 Outer encasement of concrete shall be 3” minimum with 1½” between conduits.

3.1.4.2 Conduit spacers shall be PVC, sized to allow for the full separation of conduits as indicated on the drawings and spaced a maximum of eight (8) feet on centers. No conduits, wood stakes, etc. shall be used to separate conduits in the duct bank.

3.1.4.3 Conduit and fittings used in the construction of this cast-in-place underground duct bank shall conform to Section 2.4 of this specification. Make all joints and connections in conduit using fittings designed for the purpose bonded permanently and watertight using solvent cement.

3.2 Quality; the quality of components and construction is to be that represented by:

<table>
<thead>
<tr>
<th>Item</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lid and Frame</td>
<td>ASTM A48, Class 30B. Cast iron construction, machined flat bearing surface with removable lid</td>
</tr>
<tr>
<td>PVC Duct</td>
<td>NEMA TC-8 Type – DB Nominal size 5”</td>
</tr>
<tr>
<td>PVC Fittings</td>
<td>NEMA TC-9</td>
</tr>
<tr>
<td>Underground Warning Tape</td>
<td>3 inches wide plastic tape, colored red with suitable warning legend describing buried electrical lines</td>
</tr>
<tr>
<td>Reinforcing bars</td>
<td>ASTM A615 Grade 60, deformed type</td>
</tr>
<tr>
<td>Reinforcing bar concrete cover</td>
<td>ACI-318</td>
</tr>
<tr>
<td>Lap splices</td>
<td>Class B according to ACI-318 for the respective steel grade and concrete ultimate strength</td>
</tr>
</tbody>
</table>

3.3 Installation

3.3.1 Duct runs should slope from buildings to manholes and from manhole to manhole a minimum of three inches (3”) in one hundred feet (100’).

3.3.2 A three inch thick 4000 PSI concrete base shall be poured to form a solid surface to set new duct bank on. Within the base shall be #4 Rebar ties at intervals of not greater than eight feet (8’). Each tie shall be used to secure down the conduit spacers. The base shall be the full width and length of the duct bank and shall have
a minimum of 24 hours set up time prior to constructing duct bank. Grades shall be checked after pouring to assure proper slope and drainage.

3.3.3 A minimum distance between top of duct bank and final grade surface of 2 feet 6 inches is preferred, for all points of all duct runs, but some exceptions will be granted to avoid serious conflicts with existing utilities, and for obtaining correct grades, where necessary. Final depth must be approved by the owner if less than 2 feet 6 inches.

3.3.4 Where curves are necessary in duct run (both vertical curves and horizontal curves) design to the least curvature practical, and without any abrupt changes in the direction of the ducts.

3.3.5 Install 4-#4 continuous reinforcing bars (one in each corner of duct bank) throughout the length of duct bank runs. Provide crossties as required to form these bars in place. 3.3.6 The minimum-bending radius for underground conduits shall be 48” with no more than a combined total of 90 degrees of directional change per run without owner’s approval.

3.3.6 The entire length of excavation between manholes or between manholes and buildings must be excavated to its design depth before installing any duct, to determine all interferences and adjust elevations accordingly, if necessary.

3.3.7 Where the duct bank enters a manhole, provide reinforcement in the duct bank base. Provide extra reinforcement where duct bank crosses a roadway, an excavation, and unstable or compacted earth.