

# Specifications for High Density Polyethylene Manholes

## 1. GENERAL

This specification shall govern the materials and fabrication of high-density polyethylene manholes.

## 2. SCOPE OF WORK

This contract covers the purchase and fabrication of high-density polyethylene manholes.

## 3. MATERIALS

The pipe for the manholes shall be made from high-density polyethylene (HDPE) resins meeting the following requirements:

### 3.1. HDPE MATERIAL SPECIFICATIONS

- 3.1.1. HDPE Material – The HDPE material supplied under this specification shall be high density, high molecular weight as supplied by ISCO INDUSTRIES, LLC. Louisville, KY. The HDPE material shall conform to ASTM D 3350 with a minimum cell classification value of 345464C. Earlier versions of this specification will not be accepted.
- 3.1.2. PHYSICAL PROPERTIES OF HDPE COMPOUND
  - 3.1.2.1. Density- the density shall be no less than 0.955 gms/ccm as referenced in ASTM D 1505.
  - 3.1.2.2. Melt Index- the melt index shall be no greater than 0.15 gms/10 minutes when tested in accordance with ASTM D 1238-Condition 3.2.3.
  - 3.1.2.3. Flex Modulus-flexural modulus shall be 110,000 to less than 160,000 psi as referenced in ASTM D 790.
  - 3.1.2.4. Tensile Strength at Yield – tensile strength shall be 3,200 to less than 3500 psi in accordance with ASTM D 638.
  - 3.1.2.5. Slow Crack Growth Resistance shall be per ASTM F 1473 (PENT Test). The results shall be greater than 100 hours.
  - 3.1.2.6. Hydrostatic Design Basis shall be 1,600 psi at 23 degrees C when tested in accordance with ASTM D 2837.

## 4. SUBMITTALS AND QUALITY ASSURANCE

### 4.1. QA/QC CERTIFICATION-

- 4.1.1. The manhole supplier shall submit certification that the HDPE material meets the specifications.
- 4.1.2. The fabricator of the manholes shall submit drawings showing the position of the inlets, outlets and the overall dimensions along with any other special features such as manways, ladders, etc.
- 4.1.3. The fabricator shall submit data indicating that the manholes meet the requirements of ASTM F 1759, "Design of High Density Polyethylene (HDPE) Manholes for Subsurface Applications". The manhole should be proven to have acceptable design for the following areas:
  - 4.1.3.1. Ring Compressive Strain
  - 4.1.3.2. Combined Ring Compressive and Ring Bending Strain
  - 4.1.3.3. Ring Buckling
  - 4.1.3.4. Axial Stain
  - 4.1.3.5. Axial Buckling

- 4.1.3.6. Thickness of the bottom based on depth and groundwater. Thickness should be based on acceptable stress and deflection amounts.
- 4.1.4. Calculations supporting these requirements will be part of the submittal package.
- 4.1.5. The fabrication technician shall perform work in accordance to butt fusion of high-density polyethylene per ASTM F 2620 and for extrusion and hot air welding per ASTM C 1147. The fabricator shall submit the written quality assurance program used during fabrication of the manholes. The fabricator may be required to submit their overall QA/QC program for fabricating thermoplastic structures, the welding certification program for the fabrication technician, and the facility safety program.
- 4.1.6. The manholes and pipe shall be tested with water or air when required. A written certification shall be sent to the engineer certifying the manholes are leak free. The test results shall become part of the submittals. An identification plate indicating, the job number, testing data, and when built and by whom, shall be attached to the manhole.
- 4.2. Approval or Rejection
  - 4.2.1. Written approval or rejection of substitution given by the ENGINEER.
  - 4.2.2. ENGINEER reserves he right to require proposed product to comply with any or all requirements of specified product.
  - 4.2.3. In the event substitution results in a change of Contract Price or time, provisions in the Agreement will be applied for adjustment.
  - 4.2.4. Substitutions will be rejected if:
    - 4.2.4.1. Submittal is not through the CONTRACTOR with his stamp or approval.
    - 4.2.4.2. Requests are not made in accordance with this Section.
    - 4.2.4.3. In the ENGINEERS opinion, acceptance will require substantial revision of the original design.
    - 4.2.4.4. In the ENGINEERS opinion, substitution is not equal to original product specified or will not perform adequately the function for which it is intended.
- 4.3. THIRD PARTY TESTING-The owner or the specifying engineer may request certified lab data to verify the physical properties of materials not meeting the requirements of this specification.
  - 4.3.1.
- 4.4. DEVIATIONS- Procedure for requesting substitute
  - 4.4.1. Consider after award of Contract.
  - 4.4.2. A letter defining the deviation and justification must be sent to the engineer. The letter must identify:
    - 4.4.2.1. The Product
    - 4.4.2.2. Manufacturer's Name
    - 4.4.2.3. Representative Contact Name and Telephone Number
    - 4.4.2.4. Specification Section or drawing reference of originally specified product
    - 4.4.2.5. Discrete name or tag number assigned to original product in the Contract Document.
  - 4.4.3. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Document.
  - 4.4.4. Itemize comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
    - 4.4.4.1. Size
    - 4.4.4.2. Composition or material of construction
    - 4.4.4.3. Weight
    - 4.4.4.4. Electrical or mechanical requirements
    - 4.4.4.5. Product Experience:
      - 4.4.4.5.1. Location of past projects utilizing product
      - 4.4.4.5.2. Name and telephone numbers of persons associated with referenced projects knowledgeable concerning proposed product.
      - 4.4.4.5.3. Available field data and reports associated with proposed products
    - 4.4.4.6. Data relating to changes in construction schedule
    - 4.4.4.7. Data relating to changes in cost.
    - 4.4.4.8. Samples: At request of the Engineer, a full size sample may be required. This sample maybe held by the Engineer until completion of the project.

- 4.5. REJECTION – The high-density polyethylene manholes may be rejected for failure to meet any of the requirements of this specification.

## 5. HDPE MANHOLE CONSTRUCTION

- 5.1. The HDPE manholes shall be constructed of HDPE pipe with a nominal OD of \_\_\_\_\_ (or nominal ID of \_\_\_\_\_) and a wall thickness(or DR/RSC) of \_\_\_\_\_. The service conditions will determine the wall thickness, Pipe DR, and/or RSC of pipe. Calculations must be provided to verify the wall thickness is adequate for burial and loading.
- 5.2. The bottom thickness of the manholes will be determined in accordance with ASTM F 1759. Calculations must be provided to justify the thickness of the bottom.
- 5.3. The inlets and outlets shall be extrusion welded on the inside and outside of the structure using good welding practice. Gussets shall be attached at 90 degrees, 180 degrees, 270 degrees, and 360 degrees around the inlets and outlets unless impractical.
- 5.4. All manhole connections larger than 4" nominal OD pipe shall be butt fusion welded, electrofusion welded, or flanged connections. For 4" OD pipe and smaller threaded transition fittings can also be used as well as the acceptable connections listed.
- 5.5. All butt fusion welds shall be made as described in ASTM F 2620 and all butt fusion welds using hydraulically operated butt fusion equipment shall be recorded using a McElroy Manufacturing DataLogger. The fabricator shall maintain records of the temperature, pressure, and graph of the fusion cycle.
- 5.6. Manholes shall be factory tested with water or with air. The hydrostatic test shall be conducted by filling the structure with water and checking for leaks. Minimum test duration will be one hour. If air is used, a minimum of 1 PSI shall be used for 30 minutes. Structures with a 72" inside diameter or smaller may be tested to 2 PSI. Data showing the structure to be leak-free will be supplied. The owner or his representative may request to observe the test.
- 5.7. The ladders in the manholes, if specified, shall conform to OSHA requirements.
- 5.8. Top of the manhole shall be built to the requirements of the drawings. If testing is required, flanged tops or manways will be required, and additional bolts may be needed to withstand test conditions. Reinforced concrete pads spanning the HDPE manhole will be required when HDPE manholes are used in traffic areas. A traffic rated frame and cover will be required. A professional engineer shall approve the design of the concrete pad. Those calculations must be included in the submittal.
- 5.9. Where large changes in temperature are expected, restraints shall be designed as an integral part of the manhole by the fabricator/manufacturer to prevent strain at the inlets or outlets. These restraints shall be cast into a concrete collar around the pipe. Anti-flotation and/or anti-settling anchor collars, if required, shall be designed as an integral part of the manhole by the fabricator/manufacturer of the manhole. Shop drawings, approved by the specifying engineer, shall be required for restraints, anchors, collars, etc... that are designed by the manhole fabricator/manufacturer prior to acceptance of the HDPE structures.

## 6. CONSTRUCTION PRACTICES

- 6.1. Handling of Manholes. HDPE manholes shall be stored on clean, level, and dry ground to prevent undue scratching or gouging of the pipe. The handling of HDPE manholes shall be done in such a manner that there is no damage. Nylon slings are often used.
- 6.2. Flanged Connections. Flange adapters (where shown in the drawings) shall be attached to HDPE manhole inlets and outlet stubs during fabrication by butt fusion welding per ASTM F 2620. A ductile iron back up ring will be used with each flanged connection. The rings will use a standard ANSI 150# bolt pattern. Check the drawings for materials required for corrosive conditions.
- 6.2.1. Bolts shall be tightened in a "star pattern" to recommended torque values.
- 6.2.2. Bolts must be tightened a second time after 24 hours to insure a positive seal.
- 6.2.3. Gaskets are not required on HDPE to HDPE connections.
- 6.3. Pipe Joining. HDPE pipe shall be joined using butt fusion. All butt fusion welds shall be made as described in ASTM F 2620. Electrofusion welding can be used for making pipe welds. Hot air and extrusion welding are not

permitted for pipe joining. All connections to the structure made butt fusion welds using hydraulically operated butt fusion equipment shall be recorded using a McElroy Manufacturing DataLogger. The contractor shall maintain records of the temperature, pressure, and graph of the fusion cycle.

- 6.4. Handling of Fused Pipe- Fused segments of pipe shall be handled so as to avoid damage to the pipe. Limit bending of the pipe welded to fittings or manholes. Nylon slings are preferred.
- 6.5. Equipment Mounting- Special provisions must be made when mounting pumps in an HDPE manhole. Bolting directly to the wall of the HDPE structure is never recommended.

## 7. DIRECT BURIAL INSTALLATION

- 7.1. Trench Construction- The trench and trench bottom shall be constructed in accordance with ASTM D 2321- Section 6, Trench Excavation, and Section 7, Installation. The HDPE manhole shall be installed on a stable base consisting of 12" of Class I materials compacted to 95% proctor density per ASTM F 1759, Section 4.2. All required safety precautions for manhole installation are the responsibility of the contractor.
- 7.2. Embedment materials- Embedment materials shall be Class I or Class II materials as defined by ASTM D 2321- Section 5, Materials. Class I materials are preferred. Backfill and bedding materials shall be free of debris.
- 7.3. Bedding of the manhole shall be performed in accordance with ASTM D 2321- Section 7.2. Compaction shall conform to Section 7.5 and 7.51.
- 7.4. Backfilling shall be done to conform to the ASTM F 1759, Section 4.2, "Design Assumptions". This Specification indicates that backfill shall extend at least 3.5 feet beyond the edge of the manhole for the full height of the manhole and extend laterally to undisturbed soils. Compaction shall be to 90% proctor density.
- 7.5. H-20 Highway Loads- Reinforced concrete pads spanning the HDPE manhole will be required when HDPE manholes are used in traffic areas. A traffic rated frame and cover will be required. A drawing showing key design features must be submitted as indicated in Section 5.7 of this specification.

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