

L. F. Manufacturing, Inc.

FIBERGLASS MANHOLE LINER SPECIFICATION

Specification # MHL001

A.1 GENERAL: Fiberglass reinforced polyester manhole liner shall be manufactured from commercial grade polyester resin or vinyl ester resin, with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems. The manhole liner shall be a one piece unit manufactured to meet or exceed all specifications of A.S.T.M. D-3753 latest edition as manufactured by L.F. Manufacturing, Inc., Giddings, Texas, 1-800-237-5791 or an approved equal.

A.2 MATERIALS:

Resin: The resins used shall be a commercial grade unsaturated polyester resin or other suitable polyester or vinyl ester resin.

Reinforcing Materials: The reinforcing materials shall be commercial Grade "E" type glass in the form of continuous roving and chop roving, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.

Interior Surfacing Material: The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inch thick. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5 inch (13 mm) to maximum length of 2.0 inch (50.8 mm) and shall be applied uniformly to an equivalent weight of 3 oz/ft. Each pass of chopped roving shall be well rolled prior to the application of additional reinforcement. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inch (2.5 mm)

Wall Construction Procedure: After inner layer has been applied the manhole liner wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one piece unit. Seams shall be fiberglassed on the inside and the outside using the same glass-resin jointing procedure. Field joints shall not be acceptable by anyone except the manufacturer.

Exterior Surface: For a UV inhibitor the resin on the exterior surface of the manhole liner shall have gray pigment added for a minimum thickness .125 inches.

Fillers and Additives: Fillers, when used, shall be inert to the environment and manhole construction. Sand shall not be accepted as an approved filler. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. The resulting reinforced-plastic material must meet the requirements of this specification.

A.3 MANHOLE LINER DESIGN:

Interior Access: All manhole liners shall be designed so that a ladder or step system can be supported by the installed manhole liner.

Manway Reducer: Manway reducers will be concentric with respect to the larger portion of the manhole liner diameters through 60 inches. Larger manhole liners may have concentric or eccentric manway reducer openings.

Cover and Ring Support: The manhole liner shall provide an area for which grade rings or brick can be installed to accept a typical metal ring and cover and have the strength to support a traffic load without damage to the manhole liner.

A.4 REQUIREMENTS:

Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 0.5 inch in diameter, delamination or fiber show.

Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 0.5 inch in diameter and wrinkles of 0.125 inch or greater in depth. Surface pits shall be permitted if they are less than 0.75 inch in diameter and less than 0.0625 inch deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 0.5 inch in diameter and less than 0.0625 inch thick.

Repairs: Any manhole liner repairs are subject to meet all requirements of this specification.

Manhole Lengths: Manhole liner lengths shall be in 6-inch increments +/- 2 inches.

Diameter Tolerance: Tolerance of inside diameter shall be +/- 1% of required manhole diameter.

Load Rating: The complete manhole liner shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with A.S.T.M. 3753 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lbs.

Stiffness: The manhole cylinder shall have the minimum pipe-stiffness values shown in the table below when tested in accordance with A.S.T.M. 3753 8.5 (note 1).

TABLE #1 STIFFNESS REQUIREMENTS

| LENGTH - FT. | F/AY - PSI |
|---------------------|-------------------|
| 3 - 6.5 | 0.75 |
| 7 - 12.5 | 1.26 |
| 13 - 20.5 | 2.01 |
| 21 - 25.5 | 3.02 |
| 26 - 35 | 5.24 |

Soundness: In order to determine soundness, apply an air or water pressure test to the manhole test sample. Test pressure shall not be less than 3 psig or greater than 5 psig. While holding at the established pressure, inspect the entire manhole for leaks. Any leakage through the laminate is cause for failure of the test. Refer to A.S.T.M. 3753 8.6.

Chemical Resistance: The fiberglass manhole and all related components shall be fabricated from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems.

A.5 PHYSICAL PROPERTIES:

| | Hoop Direction | Axial Direction |
|----------------------------|---------------------------|----------------------------|
| a. Tensile Strength (psi) | 18,000 | 5,000 |
| b. Tensile Modules (psi) | 0.6×10^6 | 0.7×10^6 |
| c. Flexural Strength (psi) | 26,000 | 4,500 |
| d. Flexural Modules (psi) | 1.4×10^6 | 0.7×10^6 |
| e. Compressive (psi) | 18,000 | 10,000 |

A.6 TEST METHODS: All tests shall be performed as specified in A.S.T.M. 3753 latest edition, section 8. Test method D-790 (see note 5) and test method D-695.

A.7 QUALITY CONTROL: Each completed manhole liner shall be examined for dimensional requirements, hardness, and workmanship. All required A.S.T.M. 3753 testing shall be completed and records of all testing shall be kept and copies of test records shall be presented to customer upon formal written request within a reasonable time period.

A.8 CERTIFICATION: As a basis of acceptance the manufacturer shall provide an independent certification which consists of a copy of the manufacturer's test report and accompanied by a copy of the test results stating that the manufacturer's fiberglass manhole has been sampled, tested, and inspected in accordance with the provisions of this specification and meets all requirements.

A.9 SHIPPING and HANDLING: Do not drop or impact the fiberglass manhole liner. Fiberglass manhole liner may be lifted by inserting a 4"x 4"x 30" timber into the top of manhole with cable attached or by a sling or "choker" connection around center of manhole, lift as required. Use of chains or cables in contact with the manhole surface is prohibited.

A.10 BACKFILL:

Backfill Material: Unless shown otherwise on drawings and approved by the engineer, concrete grout shall be used for backfill between the old manhole and the new fiberglass manhole liner. The backfill around the excavated reducer section shall be stabilized sand or crushed stone. The material chosen shall be free of large lumps or clods which will not readily break down under compaction. This material will be subject to approval by the engineer.

Backfill Procedure: The concrete grout backfill shall be poured in layers of not more than 12 inches in even lifts. The reducer section to be backfilled in 12 inch lifts evenly and compacted to 95% Standard Proctor Density.

A.12 MARKING and IDENTIFICATION: Each manhole liner shall be marked on the inside and outside with the following information:

1. Manufacturer's name or trademark
2. Manufacturer's factory location
3. Manufacturer's serial number
4. Total length