



**FIBRE CRAFT INDUSTRIES**  
THE FIBRE GLASS PEOPLE

# Manhole

## & Manhole Cover



ISO 9001

**BUREAU VERITAS**  
Certification

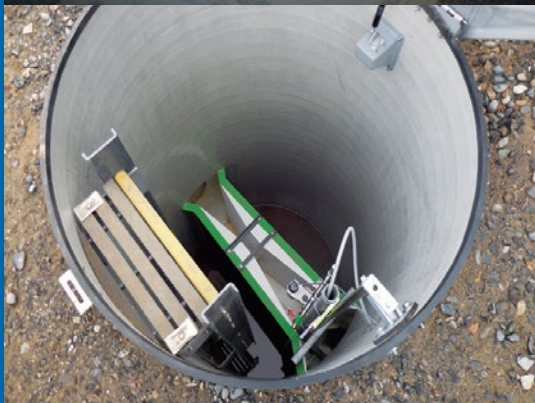


# INTRODUCTION

FCI has been building quality fiberglass products since more than last 30 years. Our expertise in the field of corrosion resistant solutions is an acknowledged fact throughout the industry in Pakistan. We have been associated with some of the prestigious organizations within the country and providing solutions related to their extreme corrosion problems. Keeping in view this FCI has taken the lead by starting the fabrication of fiberglass manholes as a replacement of conventional brick or concrete manholes and manhole covers as a replacement of concrete and cast iron covers. Use of fiberglass manholes and manhole covers is now a globally accepted phenomenon and the manholes are utilized for all kinds of applications including, sewer manholes, metering manholes and maintenance ports etc. However, at the moment we will be discussing about sewer manholes

which is an area of concern due to deterioration of conventional civil manholes.

Concrete manhole covers are quickly becoming less common in new installations due to the increasing popularity of fiberglass. Sanitary sewer lines create an incredibly corrosive environment which causes leaks in concrete manholes and even worse, infiltration. Infiltration allows ground water to enter the waste line overburdening the system and increasing costs. Municipalities across the nation are investing huge amount in the rehabilitation of failing concrete manholes. Fiberglass manholes from Fibre Craft Industries (FCI) are non-corrosive, watertight and come with an industry leading 10-year warranty. Fiberglass is simply the superior choice for Manholes and Manhole covers.



# FIBREGLASS MANHOLE COVERS

Fiberglass manhole covers are becoming very popular alternatives to cast iron manhole covers in wastewater collection systems, sewer systems, storm water systems, utilities, septic systems, grease traps and industrial applications.

Fibre Craft Industries offers quick turnaround times on all metallic or RCC manhole covers in terms of fiberglass composite covers that are proved to be as little as one-third the weight of a ductile-iron cover and as much as 80% lighter than a steel-and-concrete cover. The manhole covers are designed for carriageways of roads and parking areas. In addition they provide a superior anti-skid surface, are lockable and do not corrode!

There are various advantages of Fiberglass or FRP manhole covers over conventional materials;

## Advantages of FRP Manhole Covers

### 1.) ZERO Scrap Value

Today's reality is that traditional cast iron manholes are being stolen left and right to pay for habits, addictions, gas for cars, electric bills and even food. That is the sad state of the economy and society in many areas. Fiberglass manhole covers offer a quick and affordable way to deter further manhole theft. Standard or Hinged Fiberglass Manhole Covers (or composite manhole covers) have no scrap value so thieves just move on to the next source of scrap.

### 2.) Reduce Manhole Injuries Falls, Vehicle Damage

Every city, town, county or utility has real liabilities when it comes to manholes. Semi-trucks or other vehicles often flip up manhole covers – even during regular traffic. Thieves are stealing the cast iron manhole covers for scrap allowing vehicles, people or animals to drop in the hole.

### 3.) Reduce Worker Injuries

Fiberglass and Polymer Manhole Covers are lighter and easier for utility workers to move and place. Composite manhole covers reduce weight by 60-80%.

### 4.) Keep your manhole lids in place and where they should be

Utilities are often called out to deal with manhole lids

that have been popped off by truck tires, sewer backups, storms or vandals. Traditional cast iron manhole covers or lids are typically held in place by the weight of the lid. They can be fitted with locks but even those can be defeated allowing the crooks to swipe your lid. Once a manhole cover is off or missing, the sewer is now open to animals, sticks, debris, children or worse. Fiberglass manhole covers are locked down and secured with 1/4 turn theft resistant stainless steel hardware that ensures the lid stays in place.

Crew time spent maintaining covers are greatly reduced along with callouts and overtime fuel costs for extra trips. The greater benefit is the reduction of unwanted rainwater, sand, dirt, trash and sewer debris into the system. This decreases treatment and maintenance costs while increasing public safety.

## 5.) Reduce Inflow and Infiltration (I&I) in sewers and collection systems

A major source of inflow and infiltration in sewers or wastewater collection systems are manholes. Traditional cast iron manhole lids are meant to be loose-fitting and consequently allow more surface water in to our sewers and storm water collection systems. This excess water then has to be treated at a higher cost at the sewer plant or adds volume to an already overflowing storm sewer. Tight fitting manholes lids and fiberglass manhole covers are made to tighter tolerances and can greatly reduce inflow and infiltration (I&I).

► *Keeps excess water, spills and runoff out of our sewers and stormwater systems.*

► *Reduces the volume of water sent to lift stations and treatment plants.*

► *Keeps more oil and spills out of our sewers, stormwater systems, creeks, rivers, lakes and oceans*

## 6.) Fiberglass manholes and manhole covers are ideal for corrosive settings

Many sewer and wastewater systems are highly corrosive. Fiberglass manhole covers and frames are perfect for the most corrosive settings found throughout municipal and industrial settings. Sulfide rich effluents along with a warm, humid atmosphere and long retention times create ideal conditions for microbiologically induced corrosion (MIC).

MIC destroys typical sewer infrastructure but not fiberglass manholes. Fiberglass manhole covers are also ideal for industrial pretreatment applications, equalization tanks, holding tank and effluent manholes.

### **7.) Fiberglass manhole covers are better for non conductive applications**

Some electrical and telecom applications require manhole lids and rings to be non conductive. Fiberglass manholes are well suited for this and can also be fitted with non conductive fiberglass ladders.

### **8.) Fiberglass manholes covers can help control odor**

Sewer and collection systems can have significant problems with Hydrogen Sulfide (H<sub>2</sub>S) and other odors. Fiberglass manhole covers and frames are engineered and fabricated to seal better, resulting in better odor control. Fiberglass manhole covers are ideal for areas sensitive to sewer odors: high density neighbourhoods, parks, recreation areas, trailer parks, campgrounds, islands, beaches and resorts.

### **9.) Fiberglass manhole covers work better for radio signals, AMR and telemetry**

Cast iron manholes can interfere or block radio signal transmission. This normally requires different antennas, antenna extensions, special lids, adapters or drilling. Fiberglass manhole covers offer little interference with radio frequency signals. This makes fiberglass retrofit and replacement manhole lids an ideal fit for AMR systems, SCADA, telemetry, level monitoring, samplers, flow meters and other data acquisition devices.

### **10.) Reduce ongoing operation costs**

Utilities are looking for ways to do more with less. High diesel and gasoline costs demand that every manager look for ways to save on fuel and vehicles. If you can reduce manhole cover maintenance, you can reduce callouts, reduce fuel consumption and trips required to maintain the system. You could keep up to three lightweight fiberglass, plastic or polymer manholes covers in the place of one cast iron manhole.

The minimum lifespan of a quality fiberglass manhole is 30+ years. A typical cast iron manhole system may require significant maintenance or replacement costs over that same period of time. Fiberglass manhole covers help stop the theft cycle while also requiring less time, labor and equipment to install due to the lower weight and construction. Fiberglass manhole covers also cost less to ship and use less fuel per unit to deliver due to the lower weight per unit.



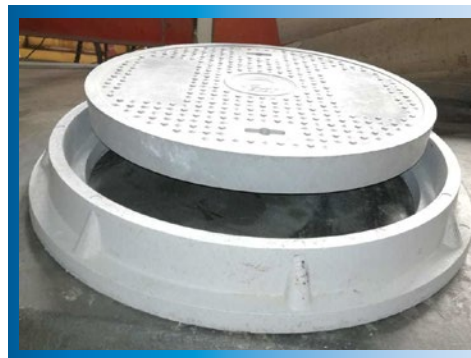
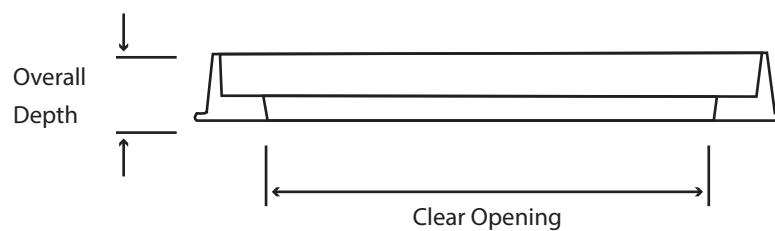
## AVAILABLE SIZE

Fiberglass Manhole cover is manufactured in various sizes. However, FCI is providing covers with a clear opening of 20 inch. Further sizes are being added and

will be available as well shortly. The technical specifications of offered system is provided as under;

| Clear Opening | Duty Rating | Class (CE EN 124) | Rated load (kN) | Color                     |
|---------------|-------------|-------------------|-----------------|---------------------------|
| 400 mm        | Heavy       | D                 | 400             | Grey, Black or Customized |
|               | Medium      | B                 | 200             | Grey, Black or Customized |
|               | Light       | A                 | 71              | Grey, Black or Customized |
| 506 mm        | Heavy       | D                 | 400             | Grey, Black or Customized |
|               | Medium      | B                 | 200             | Grey, Black or Customized |
|               | Light       | A                 | 71              | Grey, Black or Customized |
| 600 mm        | Heavy       | D                 | 400             | Grey, Black or Customized |
|               | Medium      | B                 | 200             | Grey, Black or Customized |
|               | Light       | A                 | 71              | Grey, Black or Customized |
| 700 mm        | Heavy       | D                 | 400             | Grey, Black or Customized |
|               | Medium      | B                 | 200             | Grey, Black or Customized |
|               | Light       | A                 | 71              | Grey, Black or Customized |

Square and rectangular manholes with customized sizes are also available. Please contact our technical team for your queries.



# MANHOLE

Fiberglass manholes are fabricated using high quality resin, glass, and engineered fillers specifically designed to improve corrosion resistance and overall performance. This laminate matrix is then fused through a computer automated process using rotating mandrels. This manufacturing process produces a frictionless high gloss inner surface that is maintenance free. Fiberglass manholes are approximately 10% of the weight of concrete manholes so they are easier and safer to handle. FCI manholes can withstand a 16,000 lb vertical dynamic wheel load. They comply with H-20 standards and will support 30% more weight than the legal limit on most highways. Fiberglass manholes also meet the requirements of ASTM D3753.

## Advantages of FRP Manhole

### Fiberglass manholes are:

- ▶ *Light weight (1/10th the weight of concrete)*
- ▶ *Corrosion-resistant*
- ▶ *Monolithic Design*
- ▶ *Watertight*
- ▶ *Able to integrate a wide variety of shapes and structures*
- ▶ *Extremely robust and possessing long service lives*
- ▶ *H20 Load Rated*
- ▶ *10 year corrosion and structural limited warranty*

## Reduce Infiltration / Exfiltration

In the corrosive environment of sanitary sewers, even well-sealed concrete manholes will fail over time. Manhole failures mean that fluids can enter or exit a system. If the manhole leaks out into a body of water the environmental liability can be catastrophic. On the other hand, if a manhole is allowing ground water to enter the sewer line, the additional volume flowing through the system has a ripple effect that causes structural instability and exponentially increases management costs. FCI manholes are built in a watertight monolithic design absent of field joints and potential leaks. With both open bottom and concrete base models, FCI's

manholes arrive to the site ready for installation saving significant time and money.



## Corrosion Resistant

Sanitary sewers create an environment high in concentration of hydrogen sulfide gas which causes MIC corrosion in concrete as hydrogen sulfide is converted into sulfuric acid by microbes, which then in turn converts the calcium hydroxide in concrete into calcium sulfate – destroying the polymeric nature of calcium hydroxide in concrete and introducing a large molecule into the matrix. Fiberglass manholes are not susceptible to MIC corrosion and thus have much longer service lives. The resin rich interior surface of a fiberglass manhole acts as another barrier to corrosion, in addition to what the manhole barrel itself already possesses.

While concrete and brick manholes were once believed to last 50 years, many actually fail within the first 5-10 years. Premature corrosion and leaking in concrete manholes created a market for rehabilitation manholes. FCI offers rehabilitation manholes that slide into existing concrete manholes and act as an independent manhole. This new manhole is non-corrosive, H-20 traffic load approved, and comes with a 10-year warranty so you will never have to repair or rehab again.



# TYPES OF FIBERGLASS MANHOLES

On the basis of construction & installation methodology there are two types of FRP Manholes.

1. *Closed Bottom Manholes*
2. *Open Bottom Manholes*

## Closed Bottom Manholes

Closed-bottom fiberglass manholes (also referred to as "watertight manholes") are lightweight, watertight and corrosion resistant. Their appearance is similar to a conventional manhole with a base, bench, flow channel, riser, reducer cone, and manway opening. Depending on design preference, the overall construction can be monolithic or modular, and have a straight sidewall profile or a transitional diameter profile. A wide variety of pipe connections are available, depending on the pipe material selected. Monolithic closed-bottom manholes arrive on the jobsite as a single structure from top to bottom. This type of construction provides a "jointless" structure where the only connection points are at the pipe and ring & cover interface.

The modular sections are joined with two styles of joints: alignment ring and tongue & groove, depending on preference. Each provides a permanently-bonded watertight joint when completed. The alignment ring method is constructed with an internal ring (or internal bell) so that the riser section can be placed upon the base section with the alignment ring overlapping. The sole purpose of the alignment ring is to prevent lateral movement prior to a sealing. The joint is sealed using a fiberglass laminate field kit (provided by FCI).

The tongue & groove epoxy joint incorporates a groove joint at the top of the base section. The groove joint is designed to perform as a reservoir to hold a predetermined quantity of epoxy adhesive (provided by FCI).

The epoxy adhesive is injected into the bottom of the groove joint in equal amounts around the joint. The riser section (plain end) is then lowered into the groove joint. As the riser section is pressed toward the bottom of the groove joint, the epoxy adhesive is displaced and rises along the sidewall of the riser section toward the upper edges of the joint. Once cured, the epoxy adhesive provides a structural bond between the base section and riser section. In cold weather, an external heat source may be required to either heat the manhole's interior or exterior surface to promote curing of the epoxy.

Due to the lightweight construction of fiberglass manholes, concrete ballast may be required to prevent

buoyancy or uplift where groundwater is present. The manhole includes an external base flange along the circumference and external C-channel reinforcement underneath the base that anchors into the concrete ballast. The quantity of concrete required to prevent buoyancy or uplift is dependent on a variety of factors. The base of a closed-bottom manhole consists of an integral fiberglass plate to prevent infiltration of ground water. Closed-bottom manholes may be constructed with or without a fiberglass bench and flow channel. If corrosion of the bench and invert is not a concern, brick and mortar or concrete flow channels may be formed in place after the manhole has been installed. Pre-fabricated fiberglass flow channels can be built as 1/2, 3/4 or full-depth flow channels. For optimal hydraulic performance, fiberglass flow channels offer a Mannings smoothness coefficient of 0.009 and directional changes include smooth-sweep elbows.



## Open Bottom Manholes

Open-bottom fiberglass manholes are lightweight, corrosion resistant, and typically the most economical fiberglass manhole design for small collection systems. Their construction consists of a riser section, a reducer cone, and a manway opening. However, open-bottom manholes arrive on the jobsite with an open-ended bottom. This manhole design requires a concrete base, bench, and flow channel to be formed-in-place on the jobsite. Usually, open-bottom manholes are installed using a "dog-house" installation method where U-shaped cut-outs are made at the manhole base to facilitate pipe penetrations. With few exceptions, open-bottom manholes arrive on the jobsite as monolithic structures from top to bottom.

Prior to pouring the concrete base, holes are drilled through the fiberglass manhole near the bottom to accommodate a grid pattern of steel reinforcement. This steel reinforcement not only provides a structural benefit to the concrete base, but also anchors the fiberglass manhole to the base. Typically, the manhole will be placed on cinder blocks at the proper elevation and concrete will be poured underneath and around the manhole and over the pipe penetrations. Care is taken to tightly pack the concrete against the manhole and pipe to prevent infiltration of groundwater.

The poured-in-place concrete bottom performs two functions, providing both a base and ballast for the manhole. Due to the lightweight construction of fiberglass manholes, concrete ballast is required to prevent buoyancy or uplift where groundwater is present.



The quantity of concrete required to prevent buoyancy or uplift is dependent on a variety of factors. As the typical construction method is a "dog house" configuration, pre-fabricated connections are rarely used and concrete or hydraulic cement is simply packed tightly around the pipe penetrations. Often, a water-stop gasket is placed at the pipe penetration to provide an additional sealing mechanism. If a pre-fabricated pipe connection is required, options include fiberglass laminated pipe stub-outs and flanges. Field-installed pipe connections are also an option. External drops are typically field-installed with an external PVC pipe stub fitted using a hub connection at the desired elevation. The external drop is then assembled and connected in the field by the installer. If required, FCI also provides the services for a pre-cast concrete base along with the manhole for easy and quick installation in the field. Then manhole has to be just picked from hoisting points already provided on the concrete slabs and then placed in the excavated pit.

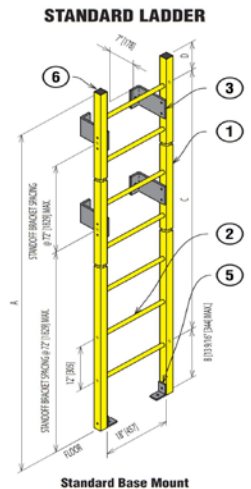
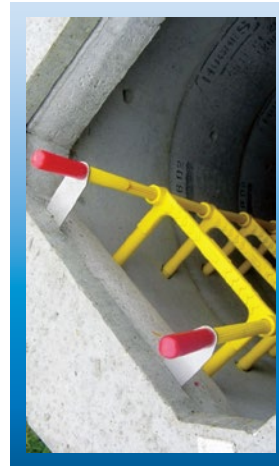
#### Available Diameters

FCI can build fiberglass manholes to your specified dimensions with diameters available from 36" through

14'. Depths are available by the half-foot from 2' through 40'. We manufacture several different wall thicknesses for different load, depth, and diameter specifications. Contact FCI Technical team to find which dimensions best suit your needs.

#### Manhole Access

All Fiberglass Manholes beyond 5 ft are fitted with a full fiberglass ladder to provide internal access to the personnel. The ladder is fabricated using the same corrosion resistant material as used in the manhole fabrication.



#### PART IDENTIFICATION

| NAME |                  | DESCRIPTION                          |
|------|------------------|--------------------------------------|
| 1    | Side Rail        | 2" x 0.156" (51mm x 4mm) square tube |
| 2    | Rung             | 1.25" (31.75mm) diameter fluted tube |
| 3    | Standoff Bracket | 5" (127mm) bracket plate             |
| 4    | Standoff Bracket | 10-1/2" (267mm) bracket plate        |
| 5    | Base Angle       | 3" (76mm) angle                      |
| 6    | End Plug         | Molded end cap                       |

#### Engineered for Your Site Requirements

The manway opening at the top of the manhole is available in a wide variety of sizes and shapes ranging from round openings between 22.5" and 36", to square and rectangular shapes that accommodate most hatch designs on the market. Where a bolt-down ring & cover casting is desired, threaded studs may be added during manufacturing or installed in the field. The manway opening typically incorporates a 3" tall neck to prevent lateral shifting of grade adjustment rings or the ring & cover casting after installation. The cone section is available as a concentric or eccentric design. A concentric cone is more popular and the most economical; however, an eccentric cone offers easier access to internal steps and provides for a tri-pod descent onto the bench area.



# MANHOLE LINERS

Manhole Liners (also referred to as Manhole Inserts) provide a structural repair to manholes that have experienced corrosion or deterioration due to aggressive environments. These liners are designed to fit inside deteriorated manholes. Diameters of the manhole liners are sized 6-inches smaller than the host manhole diameter. Prior to installing the manhole liner, the installer cuts the liner to the proper length and to accommodate all pipe penetrations, as required. Installations typically involve removing the cone section of the host manhole and lowering the manhole liner until it comes to rest on the bench of the host manhole. After insertion, the manhole liner is braced in position, then grouted into place. The portion of the manhole liner that extends above the host manhole riser is, then, backfilled with suitable granular material. The manhole is then brought to grade using grade adjustment rings and ring & cover. Manhole liners are designed to withstand all structural loads (i.e. soil, hydrostatic, H2O traffic) as with direct bury FRP manholes without the aid of the host manhole or annular grout.

## Available Diameters

FCI's fiberglass manhole liners are available in diameters

from 36" through 168" (14'). We recommend using a fiberglass manhole liner which is six inches smaller in diameter than the existing structure. Standard depths are available from 2' through 40'. Greater depths can be custom fabricated per engineer's specifications.

## Strong and Lasting Construction

Our fiberglass manhole liners meet or exceed all ASTM requirements for fiberglass manholes. FCI's fiberglass manhole liners are designed to withstand the rigid requirements of ASTM Specification D3753 for glass fiber-reinforced plastic (FRP) manholes. In addition to the ASTM standards, our fiberglass manhole liners meet H-20 load requirements. Our products are engineered to provide you with long and trouble-free service.

## One Piece Design

The one piece design of FCI's fiberglass manhole liners makes installation economical and easy. Our fiberglass liners are light-weight which eliminates the need for heavy equipment on the job site. Installation is less time consuming because there is only one piece to install. In a short time, an old decaying manhole can be easily transformed into a newly lined fiberglass manhole.



# SPECIFICATIONS

## Fiberglass Manhole

### A.1 General:

Fiberglass reinforced polyester manhole shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins with fiberglass reinforcements. Manhole shall be a one piece unit manufactured to meet or exceed all specifications of ASTM D-3753 latest edition as manufactured by Fibre Craft Industries – Lahore or 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 as per the type of application.

**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 0.25mm to 0.50mm thick. The inner surface layer exposed to the corrosive environment shall be followed with 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 900gm/Sq. meter, in minimum two passes. 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 2.5mm.

**Wall Construction Procedure:** After the inner layer has been applied the manhole wall shall be constructed with chop and continuous strand filament wound manufacturing process, which ensures 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 sealed with fiberglass lamination on the inside and the outside using the same glass-resin jointing procedure. Field joints shall not be acceptable by anyone other than FCI, Lahore or an approved equal.

**Exterior Surface:** For a UV inhibitor the resin on the exterior surface of the manhole shall have gray pigment added to a minimum thickness 3mm. Upon request stub-outs may be installed. Installation of SDR, PVC or

sewer pipe must be performed by sanding, priming and using resin fiber-reinforced hand lay-up.

The resin and fiberglass shall be the same type and grade as used in the fabrication of the fiberglass manhole. Customized fittings may be requested and installed per manufacturer's instructions.

**Manhole Bottom:** Fiberglass manholes will be required to have resin fiber-reinforced bottom. Deeper manholes may require a minimum of two fiberglass channel stiffening supports. All fiberglass manholes manufactured with a fiberglass bottom will have a minimum 75mm wide anti-flotation ring. The manhole bottom shall be a minimum of 12.5mm thick.

**Fiberglass enclosed invert and bench area:** A fiberglass enclosed invert and bench area shall be installed in the manhole by the manufacturer. The invert will be formed using a non-corrosive material and completely enclosed in a minimum 6mm layer of fiberglass chopped strand mat.

**Height Adjustment:** Fiberglass manholes must have the ability to be height adjustable in the field. Height adjustment can be made as a field operation by skilled staff by the use of uncured resins or fiberglass lay-ups. Fiberglass manholes must maintain all load and soundness characteristics required by ASTM D3753 after height adjustment has occurred. Height adjustment must only be done by FCI, Lahore or approved equal by the consent of manufacturer.

**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 the ASTM D-3753 standard. The resulting reinforced-plastic material must meet the requirements of this specification.

### A.3 Manufacture:

Manhole cylinders, manway reducers and connectors shall be produced from a fiberglass-reinforced polyester resin using a combination of chop and continuous filament wound process.

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

**Manway Reducer:** Manway reducers will be concentric with respect to the larger portion of the manhole diameters through 60 inches. Larger manholes may

have concentric or eccentric manway reducer openings.

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

**A.4 Requirements:**

**Exterior Surface:** The exterior surface shall be relatively smooth with no sharp projections. Handwork finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 12mm in diameter and de-lamination or fiber show.

**Interior Surface:** The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, de-lamination, blisters larger than 12mm in diameter and wrinkles of 3mm or greater in depth. Surface pits shall be permitted if they are less than 20mm in diameter and less than 1.5mm deep. Voids that cannot be broken with finger pressure and are entirely below the resin surface shall be permitted if they are less than 12mm in diameter and less than 1.5mm thick.

**Wall Thickness:** Fiberglass manholes 48" in diameter and up to 20 feet in depth will have a minimum wall thickness of 8mm. Fiberglass manholes 48" in diameter and 20 feet to 30 feet in depth will have a minimum wall thickness of 12.5mm.

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

**Manhole Length:** Manhole 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 shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM 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 inch 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 ASTM 3753 8.5 (note 1).

| 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, the manufacturer shall 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 ASTM 3753 Clause 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 system.

**A.5 Physical Properties:**

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

#### A.6 Test Methods:

All tests shall be performed as specified in ASTM 3753 latest edition, section 8. Test method D-790 (see note 5) and test method D-695.

#### A.7 Quality Control:

Each completed manhole shall be examined by the manufacturer for dimensional requirements, hardness, and workmanship. All required ASTM 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 Shipping and Handling:

Do not drop or impact the fiberglass manhole. Fiberglass manhole may be lifted by inserting a 4"x4"x30" timber into the top of manhole with cable attached or by a sling or "choker" connection around the center of manhole, lift as required. Use of chains or cables in contact with the manhole surface is prohibited.

#### A.9 Installation:

**Closed bottom manhole installation:** Bottom of excavation should be compacted to 95% Standard Proctor Density. Manholes with diameters less than 60 inches and depths less than 12 feet, require a base of 6 inches of crushed stone. Manholes with depths of 10 feet and greater, and diameters of at least 48 inches should have a poured reinforced concrete base at least one foot deep and at least two feet larger than fiberglass manhole outside diameter. The fiberglass manhole shall be lowered into the wet concrete and brought to plumb. Pour reinforced concrete over the anti-flotation flange. The concrete shall be a minimum of one foot deep and two feet from outside wall of the manhole. More concrete may be required in high water table areas. In high water table areas you should consult your Engineer for backfill requirements.

**Open bottom or concrete bottom manhole installation:** Lower manhole into wet concrete until it rests at the proper elevation, with a minimum of 4 inches of fiberglass manhole inserted into the wet concrete below flow line, then move manhole to plumb. The concrete shall extend a minimum of one

foot from the outside wall of the manhole and a minimum of 6 inches above incoming lines. On the inside concrete shall form the bench and invert area and rise a minimum of 4 inches above incoming lines. If required by engineer concrete may be used around reducer section for buoyancy.

#### A.10 Internal Bottom Channel Stiffening Supports:

Manholes with internal bottom FRP Channel stiffening supports will require that concrete be poured on the inside of the manhole to a depth equal to that of the stiffening support. This is typically 4 – 6 inches. This is NOT required on manholes that have a factory installed integral fiberglass bench and invert area.

#### A.11 Backfill:

**Backfill Material:** Unless shown otherwise on drawings and approved by the engineer, sand, crushed stone or pea gravel shall be used for backfill around the manhole for a minimum distance of one foot from the outside surface and extending from the bottom of the excavation to the top of the reducer section. Suitable material chosen from the excavation may be used for the remainder of the backfill. 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:** Backfill shall be placed in layers of not more than 12 loose measure inches and mechanically tamped to 95% Standard Proctor Density, unless otherwise approved by the engineer. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the fiberglass manhole structure.

#### A.12 Marking and Identification:

Each manhole 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 manhole depth*

# Other FRP Solutions for Industry

COOLING TOWER



PORTA CABINS



LADDER



TANKS



MARINE



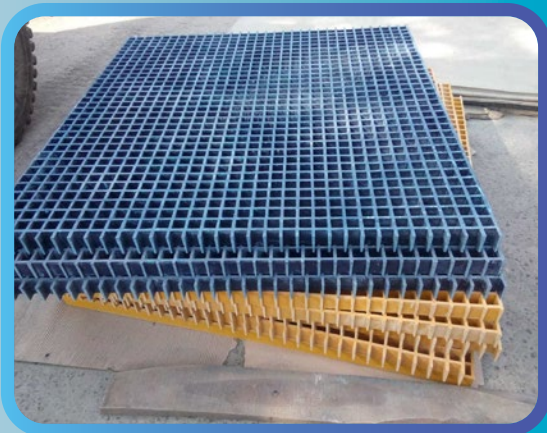
PIPES



PUMP



GRATING





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