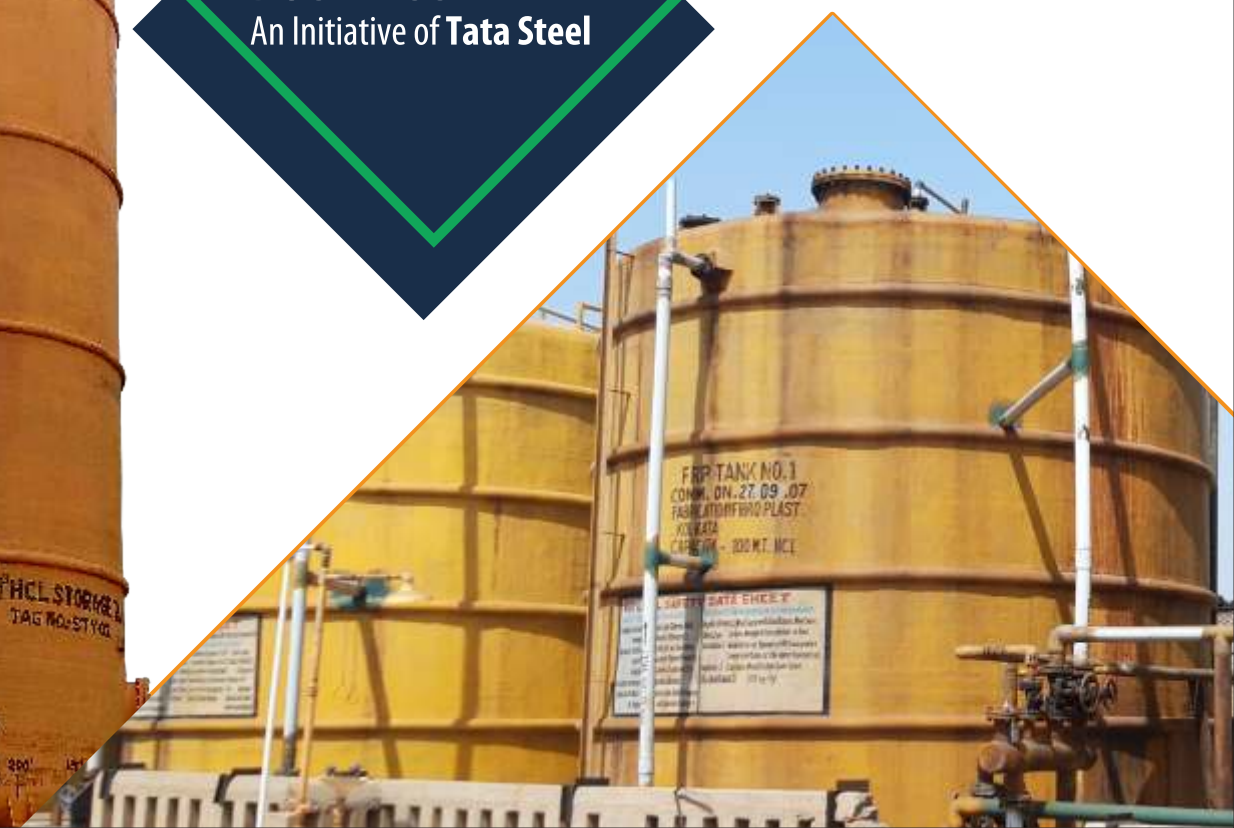
TATA STEEL
WeAlsoMakeTomorrow

TATA

FRP CHEMICAL TANKS

Corrosion handlers for every kind of industry

NEW MATERIALS BUSINESS
An Initiative of **Tata Steel**



Tata Steel's **New Materials Business** (NMB) offers a wide range of FRP (Fibre Reinforced Polymer) tanks for a range of industries. NMB offers the very best of design engineering, technology and raw materials in its products, backed by an unmatched technical expertise and long experience in offering FRP solutions. With deep understanding of demands of various applications, NMB designs and manufactures customised tanks. Aside tanks, NMB's products for the industrial sector include FRP scrubbers, hoods, chutes, valves, mist eliminators as well as a range of moulded and pultruded FRP products such as gratings, chequered plates, hand rails, conveyor guards, ladders and cross-overs.

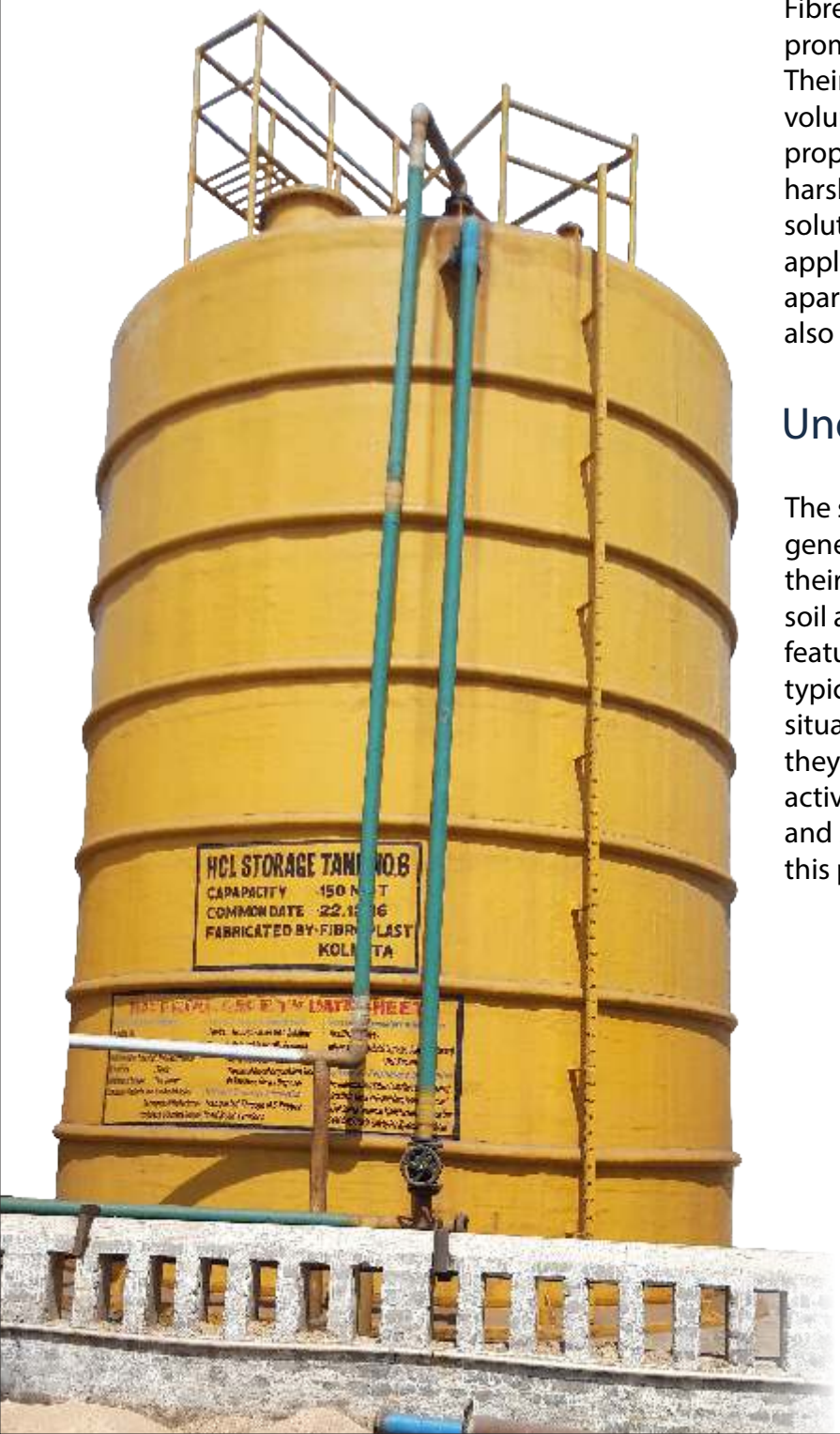
REASONS TO CHOOSE FRP

- **Lightweight**
- **High Strength-to-Weight Ratio**
- **Corrosion Resistance**
- **Long Maintenance-free Service Life**

Over the years, the global **Fibre Reinforced Polymer (FRP)** industry has become the best alternative for process industries that handle harsh chemicals during their day-to-day activities. The performance of FRP over other metal counterparts in handling such chemicals has improved substantially over the years. As a result, composites have seen rapid growth and usage in diversified industries such as Metal and Mining, Paper and Pulp, Desalination, Refining, Power, Fertiliser, Electroplating, Air Pollution Control Equipment Water and Wastewater Treatment industries.

OVER GROUND AND UNDERGROUND APPLICATIONS

FRP tanks can be used for both over ground and underground applications. As opposed to the regular vertical tanks, they can also be used as horizontal tanks.



Over ground Applications

These are light and unlikely to expand and contract due to a forceful thermal cycle. Fibreglass tanks and vessels find a place of prominence in chemical processing facilities. Their light weight form factor allows for higher volumes, and at the same time the material property is such that it will not react to the harsh chemical properties of the contained solution. Due to these properties, FRP tanks find application in the marine and shipping industry apart from their regular usages. These tanks are also resistant to corrosion or oxidation.

Underground Applications

The subterraneam metal pressure vessels are generally costly and do not always adapt to their conditions. Metallic tanks corrode when soil alkalinity strikes. More expensive design features like cathodic protection systems are typically used in metal tanks when such situations arise. FRP tanks do not rust when they come into contact with wet and chemically active ground soils. Subterranean potable water and sewage containment vessels benefit from this premium feature.

FEATURES THAT SCORE OVER METAL

FRP tanks are chosen above other metal tanks for their properties. These tanks broadly have the following features.

Physical and Chemical Performance: FRP tanks are meant to withstand high tensile forces and are corrosion resistant. They are also seepage proof and possess anti-ageing qualities.

Good Structural Performance: Tank walls resist most of the load and have sound structural qualities with strength in axial and longitudinal directions. Excellent vacuum resistance prevents rupturing.

Extensive Application and Long Service Life: The temperature handling capacity ranges from -50 ºC to 140 ºC and service life is generally greater than 20 years.

Light Weight: These are light weight and hence easy to transport and install.

Wide Industry Applications: They have wide applications in various sectors including petroleum, chemical, textile, transportation, metal, mining and water irrigation.

Applications of all mediums and water: Acids, alkalis, salt, organic solvent

TECHNICAL SPECIFICATIONS

Chemical tanks are designed with standard parameters. These can be changed depending on customer preferences.

Codes that are followed for manufacturing are

- **BS 4994 – 87** - British standards for hand layup process.
- **BSEN 13121-2016** - British and European standards for filament winding process.
- **ASME RTP-1** – American standards for over ground tanks and vessels
- **ASTM D- 3299** – This defines the product specifications and governs the filament winding process for tanks.

Design Standards

Working Capacity: Diameter from 0.5M to 6.5M, Height up to 15M

Technical Data Sheet	
Working Capacity	Dia from 0.5 metres to 6.5 metres. Height up to 15 metre
Maximum Application	300 m3
Manufacturing code	ASME RTP-1, ASTM D-3299, PS 15 – 69, BS 4994, BSEN 13121
Resin	Novolac Vinyl Ester, Epoxy Vinyl Ester, Isophthalic resin
Fiberglass	Polyester surface veil, chopped strand mat, woven roving, direct C- glass roving
Physical Properties	As per international standards

Design Considerations

The structural layer of the tank is designed following BSEN 13121-2016 and BS 4994-1987. The two key elements which are most important are Hoop and Helical Winding which give the tank its desired strength to sustain the liquid.

Hoop Winding:

- Hoop Winding - Is done to resist Hoop Stress
- Hoop Stress develops due to Hydrostatic pressure
- Winding is done perpendicular to the axis of the tank

Helical Winding:

- Strength along Axial & Longitudinal direction

Resistance to

- Vacuum
- Seismic
- Wind
- Liquid Vortex
- Flexure

EASIER, FASTER, MORE ADVANCED MANUFACTURING

NMB's manufacturing practices have advanced with times. Through the integration of automated systems and implementation of precision quality control practices, it has become easier, faster, and much more consistent.

Manufacturing considerations

- Complexity of geometric design
- Fibre orientation for determination of strength
- Avoid localised stress concentration
- Prone to leakage at vessel connection ports
- Low anisotropy is desired die to Hydrostatic pressure load
- Multi-axial fabrics can be used to avoid stress concentration due to high pressure applications

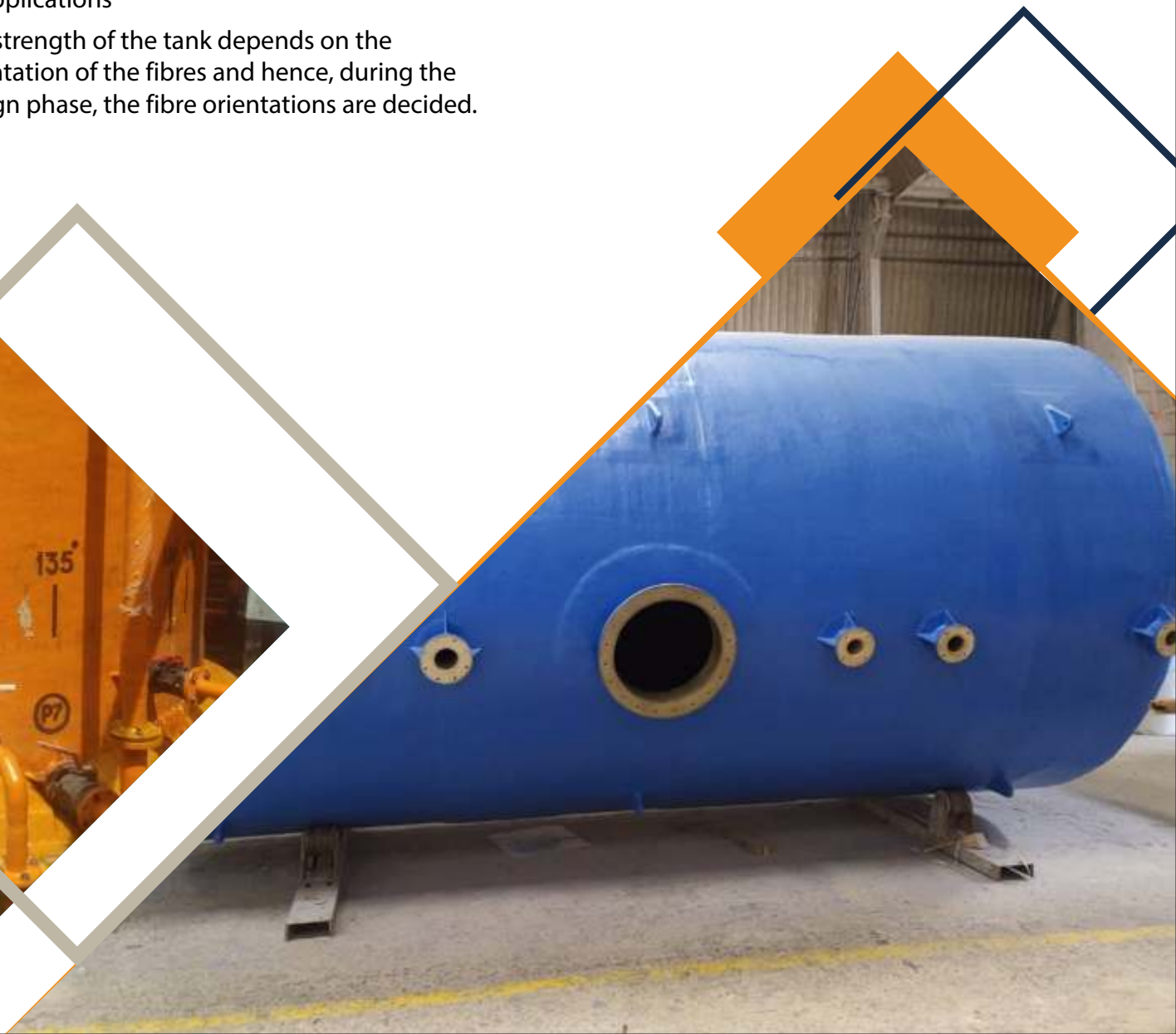
The strength of the tank depends on the orientation of the fibres and hence, during the design phase, the fibre orientations are decided.

Laminate Preparation

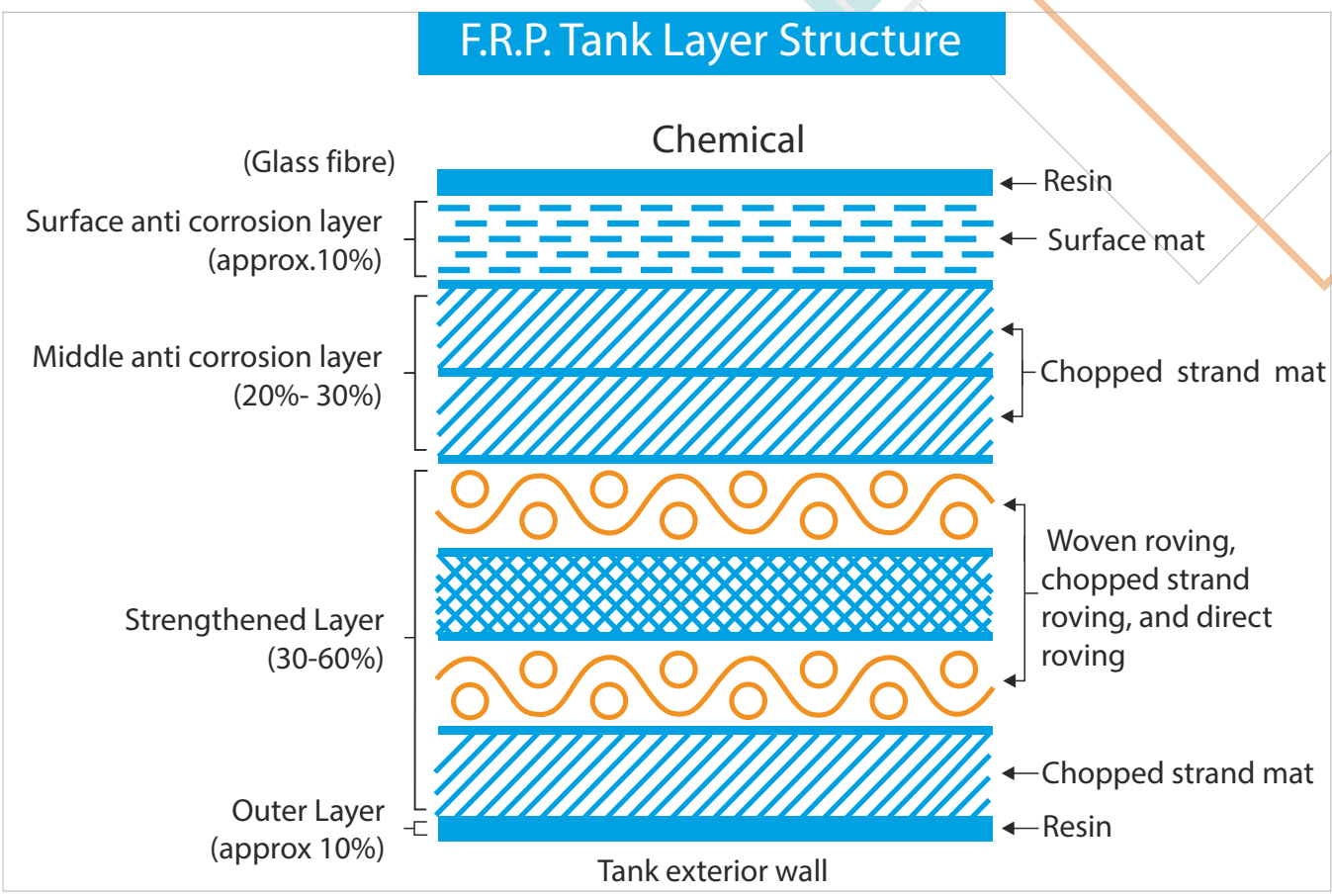
The tanks are manufactured in 3 layers to achieve the desired results of corrosion resistance, strength and protection from the external environment.

Corrosion Barrier

Corrosion barrier laminates are usually made with one or more plies of resin saturated C-glass or synthetic veil against the process surface.



STRUCTURAL WALL



The structural wall gains its strength from glass fibre, and therefore a maximum glass content in the structural wall is required. The structural layer is filament-wound wherein continuous roving is wound to provide specific strength and stiffness as required by the equipment specifications. The fibre content of structural wall laminates may range from 25% by weight for hand lay-up to 70% or more for filament winding. This high fibre content permits FRP structures to combine high strength, light weight and low cost. The thickness of the layer depends on various load factors, diameter, pressure, safety factors etc.

Surface Layer

This is the outermost layer and works as a protective layer. The thickness is about 0.5 mm. UV protection in this layer helps anti-ageing and delamination. Typically, the resin content in this layer is over 80% by weight in comparison to glass fibre.

GEOMETRY AND DIMENSION

Manholes

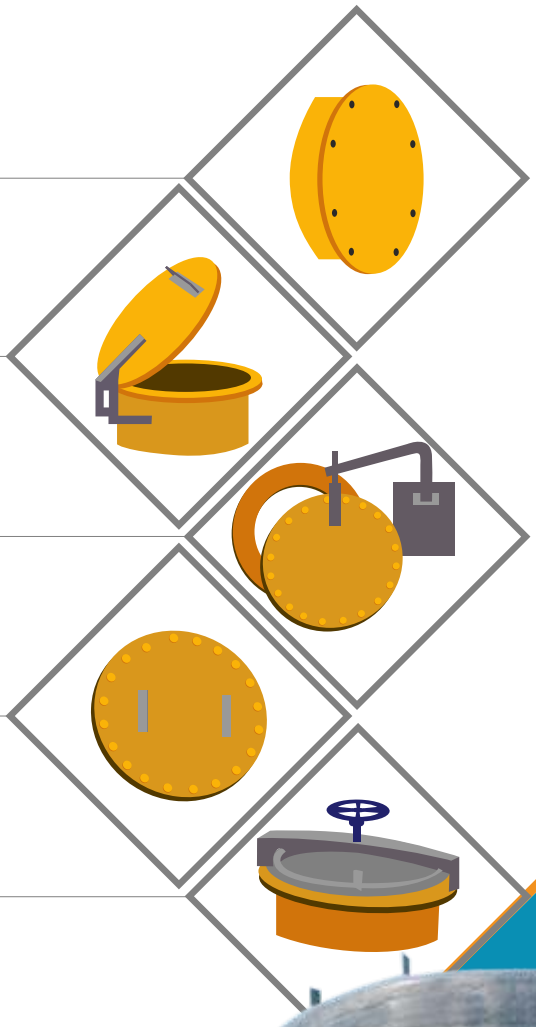
Flanged Manhole: on top or on side

Davit for top manhole

Davit for side Manhole

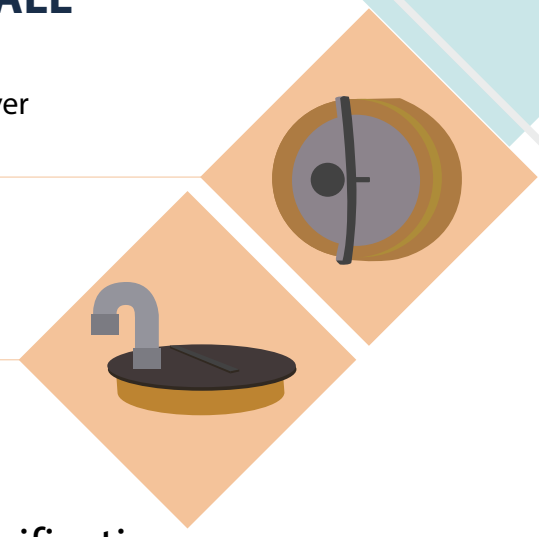
Handles for manhole

Top manhole with
cross-brace locking device



STRUCTURAL WALL

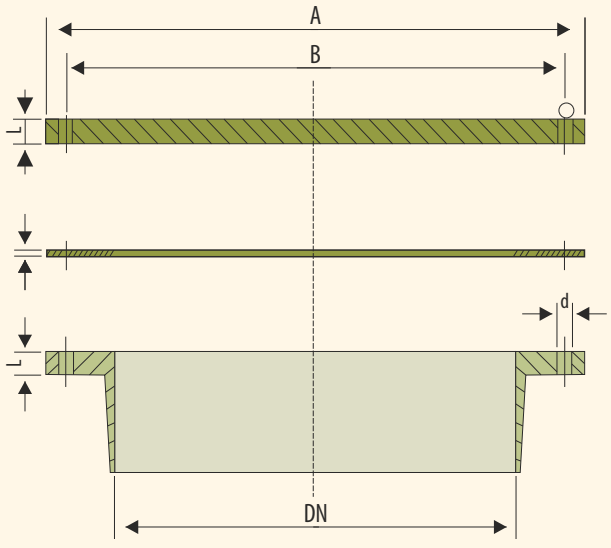
Side Oval Door GRP cover

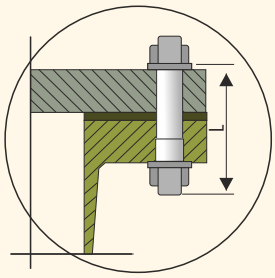


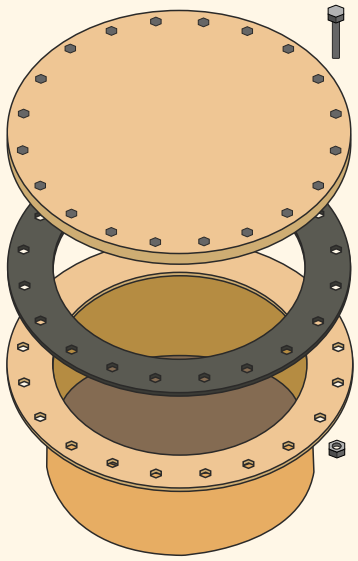
GRP

Product Specifications

Diameter (mm)	DN	400	500	600	800	400	500	600	800
	A	500	600	780	975	565	670	780	975
	B	470	570	725	920	515	620	725	920
Holes	N*	8	8	20	24	16	20	20	24
	d	12	12	18	18	18	18	18	22
Thickness (mm)	t	15	15	20	20	30	30	35	35
	s	3	3	3	3	3	3	3	3
Bolts		N*8 M10		N*20 M16	N*24 M16	N*16 M16	N*20 M16	N*20 M16	N*24 M16
	L	50		70	70	90	90	100	100
Bolt Torque (Nm)		50		100		120/150			150/200







1. The gasket must be flat and drilled.
2. The bolts are partially threaded

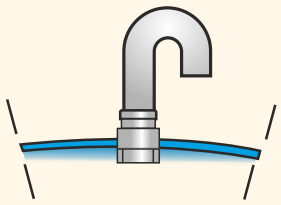
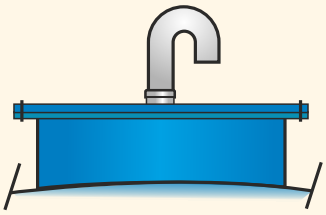
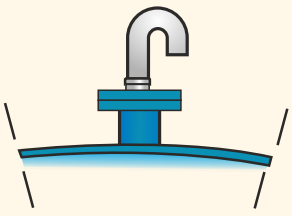
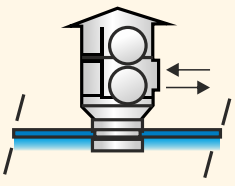
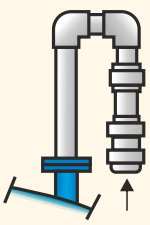
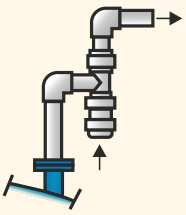
OTHER ACCESSORIES

Vent – To be connected to atmospheric tanks, they are made in PE, PVC or in FRP upon request.

Security Valves – These are connected to tanks that are under over pressure/under pressure

Hydraulic Guard – For abatement of hydrochloric acid (HCL) fumes.

Scrubber – For abatement of hydrochloric acid (HCL) fumes, it comes complete with ring type pall and pump.

Bended free vent on tank	
Bended free vent on manhole on tank	
Bended free vent on flanged nozzle	
Double effect vent for alimentary application	
Security valve. Valve opening at -3.5 mbar, flow rate max 80+100 m3/h.	
Security valve. Valve opening at -3.5 mbar, flow rate max 80+100 m3/h.	

OTHER ACCESSORIES

Nozzles: They are made in fibreglass – GRP with hand layup technology

Dimensions: Inside dimension from DN15 up to DN 600.

Execution: Flange nozzles can be fixed flange type FF in FRP, loose flange type in LJ in galvanised steel, loose flange type in LJ in FRP, loose flange type in PP with mandrel

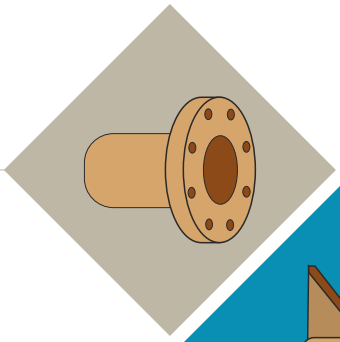
Rating: The following drilling standards are available: EN 1092 – 1 – PN6, PN10, PN 16

ANSI 150, ANSI 300, DIN – 16966

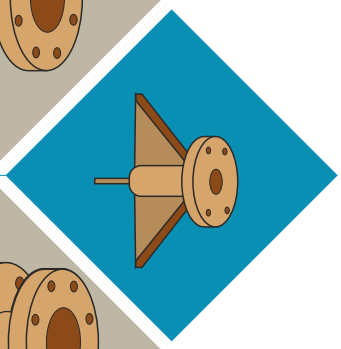
Flange Projection: Upto DN 400, max L = 100 mm, Over DN 400, max L = 150 mm

NOZZLES TYPES AND INSTALLATIONS

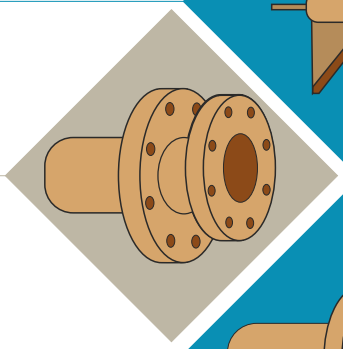
Nozzles in FRP Flat face type



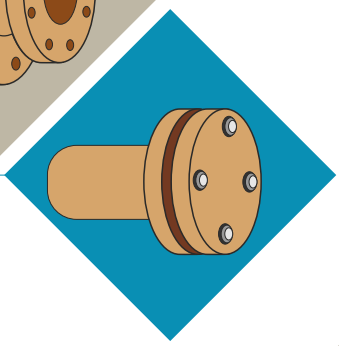
Nozzles with gussets



Lab joint nozzle with flange in PP/ FRP/ galvanized steel



Nozzle with blind flange



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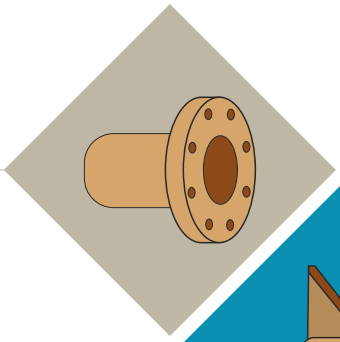
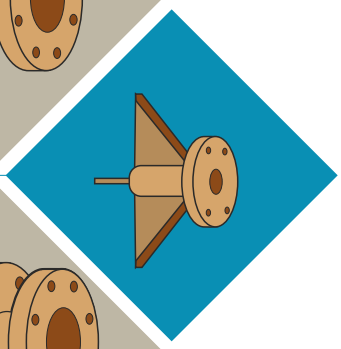
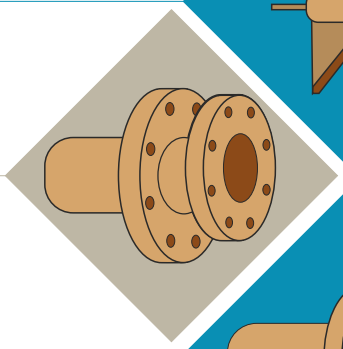


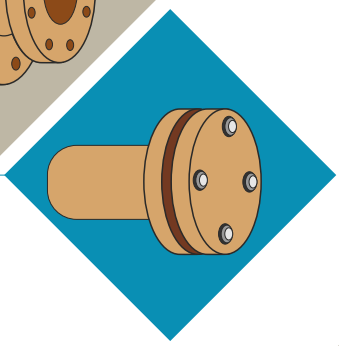
Nozzles with gussets



Lab joint nozzle with flange in PP/ FRP/ galvanized steel



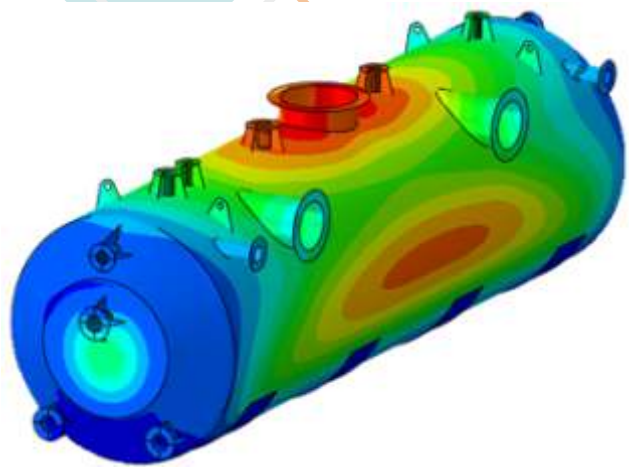
Nozzle with blind flange



DESIGN VALIDATION AND OPTIMIZATION USING ADVANCED ANALYTIC TOOLS

- **New Materials Business of Tata Steel delivers innovative, robust and optimized composite components that perfectly suit the requirements of our customers**.
- These composite components are designed and developed in-house. Computer Aided Engineering (CAE) based Finite Element tools such as Hypermesh, Abaqus, LS-Dyna etc. are used to optimise for the best performance.
- Use of CAE based advanced analyses approach allows TSL to offer its customer the most optimum design solution for complex Tanks ensuring overall structural Integrity and delivering a light weight and cost-effective design.

FE model of a 10 kL tank



Deflection in tank under load from FE analysis
*Red and blue regions represent high and low deflections respectively

NEW AGE CORROSION HANDLERS FOR TOMORROW

Lightweight and strong FRP tanks are the new age corrosion handlers. Guaranteed to give productivity a boost and prove an economical and long term solution for industry, these tanks are the start of a sustainable new future.

To find out more about what FRP can do for your business, please contact us.

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