

11.02.02 TECHNICAL SPECIFICATION FOR UNDERGROUND HORIZONTAL TANKS

1. SCOPE OF WORK

The scope of work will include but not limited to the following:-

- 1.1 Foundation/Shop/ site fabrication, erection, welding, inspection & testing, repairs or replacement of substandard tankage work including all appurtenances for under ground tank .
- 1.2 Supplying and transporting to construction site all steel structural and other consumable such as welding electrodes, filler rods, gases, greases, oil for cleaning etc. of quality approved by Site-in-Charge. Transportation of steel plate meant for tank fabrication from BPCL store/yard to workplace.
- 1.3 Providing personnel of various grades i.e. supervisors, skilled, semi skilled and unskilled labour. Experienced/ qualified welders employed by contractor will have to be approved by the Site-in-Charge . If necessary, contractor must make arrangements at his cost for testing welders, which shall be witnessed by Site-in-Charge.
- 1.4 Providing water and power, arc/gas/welding/gas cutting equipment, DG sets, compressors, testing pumps, dewatering pumps, all types of construction tools and appliances, lifting jacks/tackles, cranes, gin poles, plate rolling machinery, transportation equipment, jigs and fixtures etc. Number and quantity shall be sufficient for speedy and efficient execution of the project.
- 1.5 Development of general and detailed drawings for shop/site fabrication/erection, if not provided by the corporation, or as may become necessary for execution of the work. Drawings prepared shall be in metric system and must be submitted for approval of the Site-in-Charge or other competent authority of the corporation.
- 1.6 Preparation of plate cutting diagrams, welding sequence diagrams and if necessary , design/strength adequacy calculations. These will have to be approved by the Site-in-Charge/competent authority.
- 1.7 Lifting and transportation to work site of all "Free Issue" materials from Corporations supply point (within the site premises).

2.0 PREPARATION OF FABRICATION DRAWING

Before commencing fabrication work at site, Contractor shall be required to prepare a good for fabrication drawing of the tank in line with our standard drawing no. S/CE /001(100 KL Tank) and S/CE/104 (45 KL Tank)

Following points should be kept in mind while finalising the drawing:

It should be ensured that plate size is selected in such a manner so as to generate minimum scrap.

While deciding position of stiffening Rings, following parameters should be kept in mind:

At least one ring should be provided on a plate.

The minimum distance from the ring to the welded joint should be 450mm

At this stage it should be checked, if the number of good plates available at site are sufficient for completing the work. If not, Site-in-Charge is to be informed for arranging the balance requirement.

3.0 FABRICATION OF UNDER GROUND TANKS

Before starting working on any plate, it should be ensured that the plate has been checked for laminations and conforms to relevant IS codes.

3.1 CUTTING AND PLATES/EDGE PREPARATION

Each and every plate is checked for rectangularity using right angles.

In case the plate is required to be cut either for making it a true rectangle or for reducing the size, it should preferably be done by a pug cutting machine, using oxy-acetylene flame only.

Edges of the plates are prepared for single-vee butt jointing, using pug cutting machine.

3.2 PRESSING OF PLATES

Shell plates and dished end plates are rolled using a rolling machine (consisting of 3 Cylindrical rollers).

The curvature of the plates can be controlled by vertical movement of the adjustable roller. It should be noted that while rolling the plates for dish

end, the pressure of adjustable roller shall not be uniform over the plate; however, it shall be made different by tightening one side of the roller more than the other side. During and after rolling of plates, curvature should be constantly checked using templates. The template should at least be 1 meter long.

3.3 ASSEMBLY AND WELDING OF UNDER GROUND TANK

Following sequence shall be followed:

A steel platform is laid on an even ground for assembling of petals. Alternate cleats are tacked on this platform for holding a ring of shell plates.

Shell rings are assembled one by one. For assembling a shell ring, rolled plates are placed length-wise on the platform, held between the cleats and tack-welded. Tack welds should be 50mm wide and are done at 0.3 M pitch throughout the axial joints.

Immediately after assembling a ring, an angle iron stiffening ring is tack-welded on the outside surface of the ring as per the fabrication drawing. Rolling of the ring to the desired curvature is done using groove rollers.

The two conical ends each with one ring of shell plates are assembled separately as per the fabrication drawing. Full welding of ends both internally and externally is done at this stage.

One conical end of the tank already assembled should now be lifted by a derrick and placed on rollers on its horizontal position and the first ring of shell plates is connected to it. The ring is so placed for joining that axial joints on the 2 adjacent rings are at least 5 t apart (t: Thickness of plates). The edges are matched together using cleats and wedges. Tack welds, 50mm wide and at 0.3m pitch shall be made throughout the circumferential joint. Remaining rings of shell plates are also be assembled in a similar manner. Each ring of plates must be properly tack-welded before the next ring is fitted. If it becomes difficult to draw the rings of shell plates together, angle cleats should be welded near joints and joints are drawn together by means of bolts. Rollers on which tank can be revolved shall be placed at every 3M under the tank .

External welding of shell butt joints is now carried out continuously; opposite lengths of joints should be welded alternately until the entire circumferential joints are completely welded.

It should be ensured before welding, that all the tack-welds are removed using grinding machine. After completing welding of external side, the

internal welding of the tank is carried out in the same way after removal of slag etc. by back-gouging.

The remaining conical end of the tank shall be now joined . The internal welding of the last circumferential joint can be done only after cutting both the man-holes on the shell

The nozzles of manholes, fabricated out of plates (8mm thick) are now welded on the shell. The flanges as per our standard drawing are tacked on to the nozzles. The level of flanges must be checked using right angle, before commencing welding of fillet joints.

3.4 ELECTRODE SELECTION

The welding electrode brought by contractor shall confirm to AWS E-6013, IS:814. Recommended electrodes for UG tanks are given below:

- | | | | |
|----|----------------|---|---|
| a) | Advani Orlikon | - | Overcord-S |
| b) | IOL | - | Vordian |
| c) | Philips | - | Philips -28 |
| d) | D & H | - | Medio |
| e) | L & T | - | Xuper -660 NH- All position all steels. |

3.5 WELDERS' QUALIFICATION TEST

Welder shall be tested in accordance with IS: 817 or Section IX of the ASME code before being assigned to welding work. Refer to chapter on piping for more details.

3.5 WELDING PROCEDURE

The welding should be carried out in multi-layers. Each layer of weld metal shall be thoroughly cleaned of slag and other deposit before the next layer is applied. All completed welds shall be freed from slag, brushed and thoroughly cleaned before final inspection and painting.

There shall be no under - cutting in base metal.

The weld metal on both sides of all but joints shall be built up in form of an overlay so that all the finished face on the area of fusion shall extend

above the surface of the adjoining plate to a height of preferably not more than 1.5 mm.

The edges of all welds shall merge with the surface of adjoining plates without sharp angle.

Penning of welds shall not be carried out and the final layer of weld shall never be penne. All welding joints shall be subjected to close visual inspection to ensure good workmanship. All joints shall be thoroughly deslagged by chipping and brushing and examined between each run of weld metal for faults such as lack of fusion, surface cracks, slag inclusion and undercutting, etc.

3.6 WELDING SEQUENCE FOR UG TANKS

All the short seams of shell course shall be welded on the outside first. The reverse side of the joint shall then be gauged to sound metal removing all slag and impurities and area of incomplete fusion and then the welding will commence. All the shell courses will be prepared in this manner. The welding of shell ring to shell ring joints will be done with staggering of weld joints, as discussed above.

3.7 TOLERANCES

Tolerances on various dimensions will be as follows:

In overall length: Overall length of a tank shall not differ by more than 0.5% of nominal length.

Shell diameter: Tolerance on diameter at any point on length of the tank shell shall be +0.35 percent of the specified diameter (max) when calculated from external circumferential measurement.

Circularity : Tolerance on circularity at any point on the length of the shell i.e, the difference between maximum & minimum internal shell diameter, shall not exceed 1% of nominal internal diameter.

4.0 HYDROTESTING

Before commencing hydrotesting, the tank is blinded completely and a 12 feet long pipe is welded to the manhole cover. Now, water is filled from this pipe into the tank such that water level is upto the top of this pipe. This way tank gets subjected to 5 psi. pressure (hydrotest pressure). Tank should be observed for any leakage's after 4 hours of water-filling. Entire water is removed from the tank after completing hydrotesting.

5.0 PAINTING

Tank to be installed under ground, shall be protected against corrosion caused by soil and /or sub soil water by painting as described below:

I) SURFACE PREPARATION:

The outside surface of the tank should be thoroughly cleaned by scraping with wire brushes and sand papers to bare metal to St2 finish of Swedish standard SIS 05 5900.

II) PRIMER COAT:

The surface thus prepared should be treated with two coats of bituminous paint, PF-4 or equivalent primer. Each coat is applied uniformly after the previous coat is completely dried. The approximate coating capacity of bituminous paint (PF-H or its equivalent) is about 10 to 12 m²/litre/coat

III) PROTECTIVE COATING

After the application of primer coat and when the same is dry, apply 2.5 mm thick layer of plastic asphalt (cold application).

After the coat has dried completely apply another layer of 2.5mm thickness of plastic asphalt and allow it to harden before handling tank. It should be noted that plastic asphalt contracts on hardening and that it is necessary to apply a total thickness of 5mm to obtain a final Dry Film Thickness of 3.2 mm.

In applying the plastic asphalt it is usually convenient to place the tank on two pieces of timber placed at right angles to its axis near the ends of the tank so as to raise it about 150 mm from the ground. Care must be taken to keep all the welding joints exposed before lowering the tank in the pit for retesting of tank.

6.0 CIVIL WORKS FOR FOUNDATION OF U/G TANKS

PBM & TBM (a permanent structure) are to be established and formation level is decided as per the drawing.

The area where UG tank has to be erected is demarcated at site in line with plan and distances checked as per CCOE' s rules. This area is checked for any UG pipeline /UG cable from local authorities or existing plans.

In an operational area, necessary excavation permit is to be issued before starting the excavation work

The excavated earth is to be thrown at a place where no second handling is required and also it does not block the normal operation/future construction work. Ensure proper shoring is done. The final level of excavation is to be checked with standard drawing.

All mandatory tests (as recommended in chapter on mandatory test) are to be carried out before starting any civil work and records of test to be maintained as described in chapter on documentation.

RCC beams and Holding down arrangement has to be designed and provided to prevent upliftment of tank against buoyancy. Holding down bolts/turn buckles are to be provided as per drawing no F 16.1

Before pouring concrete contractor has to ensure that the threads of anchor bolts are properly greased and protected with plastic bags.

All the distances are to be checked as per drawing.

After providing RCC beam, provide a layers of 150 mm sand at the bottom of trench and final level of sand is to be checked as per drg.

Earth work excavation Filling, RCC and other Civil Engineering jobs shall be as per BPCL's specifications and standards.

7.0

ERECTION/LOWERING OF TANK

Tank can be lowered into the pit by either of the methods described here below:

- i) For lowering the tank, two mobile cranes of identical capacity and lift are to be used .The combined safe lifting capacity of cranes should be more than the weight of the tank to be lifted and lowered.
- ii) The other way of lowering the tank in case cranes are not available is by rolling. It is done by rolling it on a slope cut on one side of pit. Stay posts are dug into the ground behind the tank and one end of the rope, is fixed to these posts, the rope being passed round the tank, and the other end fixed, with the assistance of such ropes, the tank is rolled gently down the slope.

Before starting the rolling, the manholes are so adjusted so that they will be vertical when the tank is in position in the pit. Channels are dug in the sloped side to prevent obstruction from manholes while rolling.

Where space does not permit rolling, a slope should be cut on one end of the pit and tank lowered in endwise on pipe rollers or on old steel rails.

When lowering a tank along side an existing tank, a temporary sand bag buffer should be built to protect the latter, incase the new tank breaks loose from the holding tackles and ropes.

Care should be taken while lowering, that the tank is not damaged by holding down bolts which are already grouted in the rafts. As a precaution, sand bags should be placed between the rafts so that the tank keeps sufficient clearance from the top of the bolts.

8.0 HYDROTESTING/ CALIBRATION

After lowering the tank in the pit, tank has to be hydrotested again at 5 psi. All the weld joints are to be inspected at this stage once again.

After hydrotesting all the weld joints are to be painted, also the external paint damaged during lowering is to be touched up. Holding down straps are to be as per standard drawing. All the holding down straps are to be tightened and properly aligned at this stage.

Great care must be taken while backfilling to prevent stones from coming into contact with asphalt coating. In order to avoid damage or penetration of the coating, the tank is to be surrounded to a thickness of about 300 mm with fine sweet sand.

The U.G. tank is to be calibrated physically with water meter which has been checked for accuracy.

9.0 TANK FITTINGS

Pad connection have to be provided on manhole covers for inlet, outlet, vent, dip and water draw off as per BPCL's standard drawing.

On the manhole cover which is away from the sump, provide dip pipe and outlet pipe.

The other 2 connections, for inlet and vent pipe, which are provided on manhole which is just over the sump.

The vent pipe for MS U.G. tanks is to be provided with a 3" tyros valve at top, set at 250mm W.C. for pressure and 25mm W.C. on vacuum. The vent pipe will also have connections for manometer 'U' type for noting the setting of tyros valves. For other U.G. tanks containing class 'B' products brass vent cap (11 mesh size) is fixed on the vent pipe.

The dip pipe for M.S. tank has G.M. valve along with dip cap and nipple with dip slot. The dip pipe going inside tank is slotted.

Brick masonry/random rubble masonry chamber with suitable cover are constructed over the manholes.

TYPICAL QUANTITY OF WORK FOR UNDERGROUND TANKS AT DEPOTS/INSTALLATIONS

DESCRIPTION			UNIT	TANK
CAPACITY			100 kl (std.Drg S/CE/104)	45 kl
1.	TANK			
1.1	Steel Plates*	tonne	12	5*
1.2	Transportation	tonne	12	5
1.3	Fabrication/Erection/welding	tonne	12	5
2.	UNDERGROUND INSTALLATION			
2.1	Excavation in soft Soil	(m3)	214	105
2.2	Excavation in Hard Soil	(m3)	214	105
2.3	Consolidation and levelling	(LS)	LS	LS
2.4	RCC rafts 2 Nos.	(m3)	36	16
2.5	Sand Filling	(m3)	48	21
2.6	Testing	(LS)	LS	LS
2.7	Lowering of Tank	(LS)	LS	LS
2.8	Holding Down Straps	(Nos)	6	3
2.9	Calibration	(LS)	LS	LS
2.10	Cleaning/Scraping	(m2)	346	84
2.11	Painting	(m2)	202	84
2.12	Backfilling	(m3)	54	36
2.13	Disposing Surplus Earth	(m3)	160	45
2.14	Brick Masnory Sump	(m3)	2	2
2.15	Earthing Connections	(Nos)	2	2

*** Quantities shown are indicative, actual quantity must be estimated case to case basis on availability of steel plate sizes and optimum plate cutting diagram.**