

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products [CED 7: Structural Engineering and structural sections]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक

पैट्रोलियम उत्पादों के लिए भूमिगत और भूमि पर क्षैतिज
बेलसाकार भंडार टैंकों के डिजाईसंविचरन, परीक्षण और
संस्थापन रीति संहिता

(पहला पुनरीक्षण)

Indian Standard

CODE OF PRACTICE FOR DESIGN,
FABRICATION, TESTING AND INSTALLATION
OF UNDER-GROUND/ABOVE-GROUND
HORIZONTAL CYLINDRICAL STEEL STORAGE
TANKS FOR PETROLEUM PRODUCTS

(*First Revision*)

UDC 621.642.37/39-005 : 665.6/7 : 006.76

© BIS 1992

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 1992

Price Group 5

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Structural Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

This code has been prepared to provide the petroleum industry with tanks of adequate safety and reasonable economy which can be built in any size required to meet the needs of the industry subject to the limitations given in this code and to establish uniformity in designing, fabricating, testing and installing the horizontal storage tanks.

This code is not intended to establish a fixed series of allowable tank sizes but to assist the purchaser in the selection of the size of the tank that may be required to meet his particular need.

This code was first published in 1984. In the first revision, based on the experience gained in the use of this code, following major modifications have been effected:

- a) Minimum shell plate thickness both for underground and above-ground tanks has been modified as 5.00 mm for tanks up to 20 kilolitre capacity.
- b) A clause relating to earthing connection to safeguard the tanks from the accumulation of static charge has been included.

In this code numerical values are given in SI units only.

In the preparation of this standard assistance has been derived from BS 2594 : 1975 'Specification for carbon steel welded horizontal cylindrical storage tanks' issued by the British Standards Institution.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CODE OF PRACTICE FOR DESIGN, FABRICATION, TESTING AND INSTALLATION OF UNDER-GROUND/ABOVE-GROUND HORIZONTAL CYLINDRICAL STEEL STORAGE TANKS FOR PETROLEUM PRODUCTS

(*First Revision*)

1 SCOPE

1.1 This code is intended to provide purchasers and manufacturers with guidelines in design, fabrication, testing and installation of under-ground as well as above-ground horizontal cylindrical steel tanks with flat ends for storage of petroleum products.

1.1.1 Provisions of this code may also be applied to design and construct tanks for storage of various chemicals having specific gravity less than one. In such cases, special considerations regarding lining and corrosion allowance shall be made while designing the tanks for intended use.

1.1.2 Provisions of this code are applicable for storage of products under ambient temperature and atmospheric pressure conditions.

1.2 This standard is complementary to IS 800 : 1984 and IS 816 : 1969.

1.2.1 Provisions regarding permissible stresses, design, fabrication and erection as included in IS 800 : 1984 shall apply unless specified otherwise in this code.

1.2.2 For provisions regarding analysis for saddle support and associated local loads, reference shall be made to IS 2825 : 1969.

1.3 The above-ground storage tanks covered in this standard are not intended for mobile application.

1.4 Unless otherwise stated specifically, provisions, covered in this standard apply to both above-ground and underground tanks.

2 REFERENCES

The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 STATUTORY PROVISIONS

Compliance with this code does not absolve anyone from the responsibility of observing any statutory provisions as may have been promulgated by the statutory bodies, such as Department of Explosives, Nagpur.

4 DEFINITION AND SYMBOLS

4.1 Underground Tank

A tank placed in earth, masonry or concrete pit and packed around with sand, earth or clay leaving no air space between the tank and the pit. No part of the tank is visible.

4.2 Welding Terms and Symbols

4.2.1 Welding Terms

Shall be according to IS 812 : 1957.

4.2.2 Symbols for Welding Used on Plans and Drawings

Shall be in accordance with IS 813 : 1986.

5 NOTATIONS

For the purpose of this standard, the following notations shall have the meaning indicated against each (*see* Fig. 1).

B = Steel saddle width

B_1 = Width of wear plate of saddle support
($B_1 \geq B + 10 t_m$)

C = Steel saddle breadth

D = Shell outside diameter

E = Spacing between saddle supports

H = Height of the stiffener

L = Overall length

b = Width of saddle support

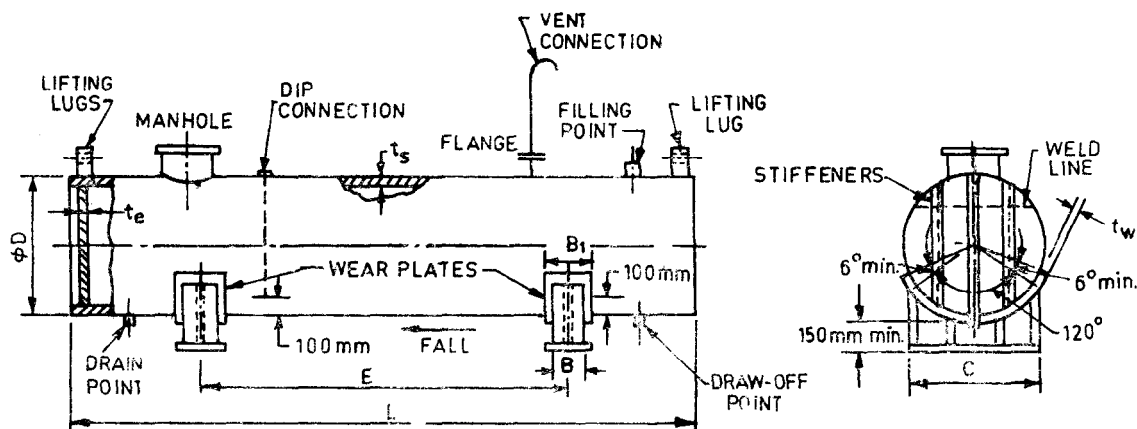


FIG. 1 TYPICAL ARRANGEMENT OF ABOVE-GROUND HORIZONTAL TANK

t_{in} = End plate thickness

t_s = Shell plate thickness, *Min*

t_w = Wear plate thickness

NOTE — The plate material specified in 7.1.1 may be used without impact testing for tank shells and its reinforcements for design metal temperature up to -10°C .

6 GENERAL

6.1 The tank may be manufactured from suitable size plates covered in IS 1730 : 1989.

6.2 Table 1 covers recommended sizes, plate thickness for tanks of various nominal capacities up to 90 kl. The shell and end plate thicknesses include a corrosion allowance of 1.5 mm.

6.3 General arrangements for above-ground and underground tanks are shown in Fig. 1 and 2, respectively.

6.4 Enquiries or Order Form

With a view to facilitating the manufacturing and supply of welded oil storage tanks, certain detailed information is to be supplied to the manufacturer. The information so required is listed in Annex B.

7 MATERIALS

7.0 General

Unless agreed otherwise, the material for the construction of oil storage tanks shall conform to Indian Standards, where applicable.

7.1 Structural Steels

7.1.1 Steel plates and sections used in the tank construction shall conform to any one of the following specifications:

IS 226 : 1975, IS 961 : 1975, IS 2002 : 1982, IS 2041 : 1982, IS 2062 : 1984 or IS 8500 : 1977.

7.1.2 The dimension of structural steel sections and plates used in tank construction shall conform to IS 808 : 1989 and IS 1730 : 1989, respectively.

7.2 Cast Steel Mountings

The mountings shall be suitable for welding and shall conform to Grade 3 of IS 1030 : 1982.

7.3 Electrodes

The electrodes for metal arc welding shall conform to IS 814 : 1991.

7.4 Piping

Unless specified otherwise the pipe and pipe couplings shall conform to IS 1978 : 1982. If so specified in the contract or order, couplings for threaded connections may be supplied without recesses; when so supplied the coupling in all other respects shall conform to IS 1978 : 1982. Pipes used for structural purposes shall conform to IS 1978 : 1982 or IS 1979 : 1985 with respect to physical properties of the material. Pipes of heavy class conforming to IS 1239 (Part 1) : 1990 may be used for nozzles on tank and internal piping, if so specified in the contract or order.

7.5 Flanges

Plate ring flanges shall be made from any of the plate material listed in 7.1.1. Requirements of slip on welding and welding neck flanges are covered in IS 6392 : 1971.

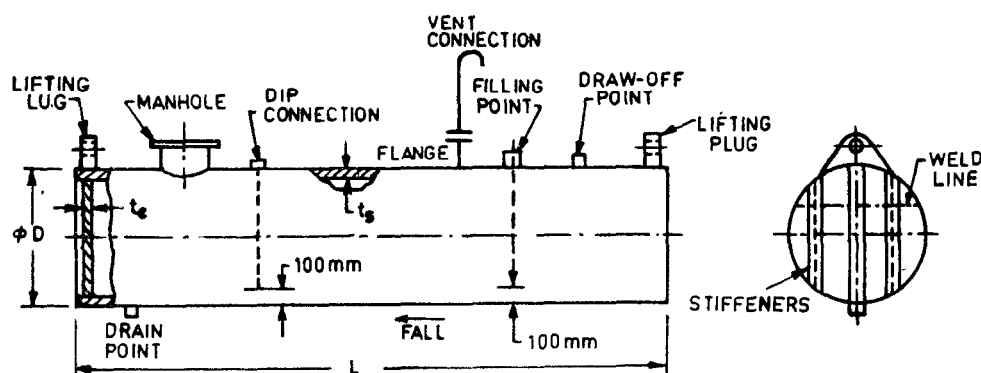


FIG. 2 TYPICAL ARRANGEMENT OF UNDER-GROUND HORIZONTAL TANK

7.6 Bolts and Nuts

Bolts shall conform to property class 4.6 or 4.8 and other requirements specified in IS 1367 (Part 3) : 1979. Nuts shall conform to property class 4 of IS 1367 (Part 6) : 1980.

7.7 Other materials used in association with steel work shall, where appropriate Indian Standard specifications for materials exist, conform to such specifications.

8 PERMISSIBLE STRESSES

8.1 Maximum permissible stresses in shell and other structural members shall not exceed values stipulated in 8.1.1, 8.1.2 and 8.1.3.

8.1.1 In the design of tank shells, the maximum permissible tensile stress before applying the factor of joint efficiency of 0.7 shall not exceed 165 MPa in case of steels conforming to IS 226 : 1975 and IS 2062 : 1984. For other steels this shall be taken as 0.70 of the minimum yield stress or 0.4 of the minimum tensile stress specified, whichever is less.

8.1.2 The permissible stresses in compression, buckling, shear, bearing, etc (not covered in 8.1.1), shall not exceed those specified in IS 800 : 1984. For this purpose steel conforming to IS 2002 : 1982 and IS 2041 : 1982 shall be treated as equivalent to IS 226 : 1975 or IS 2062 : 1984 whereas Type 2 steel conforming to IS 2041 : 1982 shall be treated as equivalent to IS 961 : 1975.

8.1.3 The stresses specified in 8.1.1 and 8.1.2 are applicable for design temperatures of -10°C to $+200^{\circ}\text{C}$.

8.2 The permissible stresses for welds and welded connections shall conform to the values given IS 816 : 1969.

9 DESIGN

9.1 Tanks manufactured to provisions of this code, shall be designed for a pressure of 0.05 MPa when full of water. Thicknesses chosen shall not be less than the thicknesses given in Table 1.

9.2 Tanks to be installed underground shall also be designed for external earth pressure acting on the tank when it is empty.

9.3 Corrosion Allowance

Minimum corrosion allowance of 1.5 mm shall be considered in design of tanks. To safeguard against corrosion caused by the environment and the product stored 1.1.1 and 10 should be followed.

9.4 Design Temperature

The design temperature shall be the lowest one day mean temperature where the tank is to be installed, as available from relevant IS codes, meteorological department or local authorities.

9.5 Foundation

9.5.1 Tanks shall be built on good foundations. Above-ground tanks shall be provided with steel wear plates for installing them on concrete pedestals or steel cradles as specified by the purchaser.

9.5.2 Typical arrangement for above-ground tank is given in Fig. 1. Concrete pedestals shall be designed to support the tank full with water.

9.5.3 As tank diameter or shell thickness ratio increases, the shell shall be analysed for buckling resistance to reaction loads at the concrete pedestals and associated local loads as per IS 2825 : 1969.

Table 1 Dimensions and Capacities of Horizontal Underground and Above-Ground Storage Tanks With Flat Ends

(Clauses 6.2, 9.1, 13.4 and 14.3)

Nominal Capacity	Shell Outside Diameter	Overall Length	Spacing Between Saddle Supports	Thickness				Size of Stiffners (angle Sections)	Minimum Width of Saddle Support B	Minimum Breadth of Saddle Support C	Approximate Ullage (Above Nominal Capacity
				Wear Plate	Shell Plate		End Plate with Stiffners				
	D	L	E		Under-ground tank	Above-ground tank					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Kl	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	percent
5	1 600	2 750	2 110	6.0	5.0	5.0	6.0	65×65×6	150	1 385	7.8
7.5	1 600	4 000	3 610	6.0	5.0	5.0	6.0	65×65×6	150	1 385	4.9
10	1 800	4 250	3 530	6.0	5.0	5.0	8.0	65×65×8	250	1 560	5.9
15	1 950	5 500	4 720	6.0	5.0	5.0	8.0	70×70×8	250	1 690	7.5
20	2 250	5 500	4 600	8.0	6.0	5.0	8.0	90×90×8	250	1 950	7.5
25	2 500	5 500	4 500	8.0	6.0	6.0	10.0	90×90×10	250	2 295	6.3
30	2 650	6 000	4 910	8.0	6.0	8.0	10.0	100×100×10	250	2 340	8.3
35	2 700	6 750	5 670	8.0	6.0	8.0	10.0	100×100×10	250	2 330	8.4
40	2 750	7 500	6 400	8.0	6.0	8.0	10.0	100×100×10	250	2 380	9.5
45	2 750	8 250	7 100	8.0	6.0	8.0	10.0	100×100×10	250	2 380	7.2
50	2 750	9 000	7 900	8.0	6.0	8.0	10.0	100×100×10	250	2 380	5.2
55	2 750	10 000	8 900	8.0	6.0	8.0	10.0	100×100×10	550	2 380	6.4
60	2 750	11 000	9 900	8.0	6.0	8.0	10.0	100×100×10	250	2 380	7.3
70	2 750	13 000	11 900	8.0	6.0	8.0	10.0	100×100×10	250	2 380	8.7
80	2 750	14 750	13 650	8.0	6.0	10.0	10.0	100×100×10	250	2 380	7.7
90	2 750	16 500	15 400	8.0	6.0	10.0	10.0	100×100×10	250	2 380	7.1

NOTES

1 The thickness specified above are the minimum requirement only (including internal and external corrosion allowance), pertaining to yield value of steel as 250 MPa.

2 The actual thickness required shall be checked taking into the consideration soil pressure, fluid pressure and external loading.

3 End plates in col 8 of the flat ends shall be provided with stiffners given in col 9 and agreed as per Fig. 3E.

4 End plates of the flat ends shall preferably be without joints. Where the end plate is made by welding of two or more plates, the weld joint shall be made horizontal. Full width of plate(s) should be utilized at the bottom.

10 CORROSION PROTECTION

Tanks to be installed underground shall be suitably protected against corrosion caused by the soil strata and/or sub-soil water. The purchaser shall specify type of such protection that he considers desirable. Suggested good practices for asphalt doping are given in Annex C.

11 TANK ANCHORAGE

11.1 Tank to be installed underground shall be anchored to resist the buoyancy force induced by high water tables that may occur seasonally. The anchorage could be either provided by means of steel flat of round bars having adequate cross section to resist the uplift at a stress level of 140 MPa maximum.

11.2 The anchors should be embedded in RCC draft having necessary dead weight, bonding and shear strength to resist the uplift force.

12 APPURTENANCES AND MOUNTINGS

12.1 General

12.1.1 Appurtenances or mountings installed on tanks shall conform to this code. Alternative designs of appurtenances which provide equivalent strength, tightness and utility are permissible, if so agreed to by the purchaser.

12.1.2 Manhole necks, nozzle necks, reinforcing plates and shell-plate openings which have either sheared or oxygen-cut surfaces, shall have such surface made uniform and smooth, with the corners rounded, except where such surfaces are fully covered by attachment welds.

12.1.3 The opening in tank larger than 65 mm in diameter shall be reinforced. The minimum thickness of the reinforcing pad shall be the same as the shell thickness and diameter shall be twice the diameter of the hole cut subject to maximum diameter of the opening plus 200 mm.

12.2 Manhole

12.2.1 Each tank shall have a minimum of one manhole of not less than 500 mm size (diameter).

12.2.2 The manhole cover may be hinged with single or multiple bolt fixing, as required by the purchaser.

12.3 Nozzles

The nozzle sizes shall be selected to meet individual operating conditions of filling and emptying rates.

12.4 Lifting Lugs

The lifting lugs shall be provided in the tank at appropriate position to lift the empty tanks only. Typical details of lugs and positions are shown in Fig. 1 to 3.

12.5 Accessories

The tank shall be provided with a fill connection, a draw-off connection, a dip-connection a vent connection and a drain connection.

12.5.1 Fill Connection

When the tank is filled from the top, an internal fill pipe running down to within 100 mm of the tank bottom shall be provided to avoid splashing of product and generation of static electricity. End of the fill pipe shall be chamfered at 45°.

12.5.2 Dip Connection

The dip connection shall be provided with a galvanized iron, aluminium or brass screwed cover and be fitted with an internal perforated pipe running down to within 100 mm of the tank bottom. Appropriate perforation shall be provided for various products. Alternatively, in case of above-ground tank a float arrangement for continuous gauging of liquid level inside the tank may be used.

12.5.2.1 The calibrated dip rod shall be of non-sparking material (12 mm square brass rod is recommended).

12.5.3 Vent Connection

The vent pipe shall be securely supported and shall not be less than 4 m in height and at 4 m distance from any adjoining land or property or any other source of fire. Vent pipe of any tank shall not be interconnected with that of another. The open end of every vent pipe shall be covered with two layers of non-corrodible metal wire gauge having not less than 11 meshes per linear centimetre and shall be further protected from rain by a hood or by suitably bending it downward.

12.5.4 Earthing Connection

The horizontal storage tank, whether above-ground or underground, shall invariably be provided with earthing connection to eliminate the possibility of accumulation of static charge on the surface of the tank either due to atmospheric electricity or due to flow of product into the tank.

For this purpose, two earthing bosses of appropriate sizes shall be welded to the saddle support in case of above-ground tanks and to the end plate in case of underground tanks. Guidelines for making earthing connection for tanks are also given in Annex D.

13 FABRICATION AND SHOP PAINTING

13.1 The workmanship and finish shall be first class in every respect subject to closest inspection by the manufacturer's inspector, whether or not the purchaser, waives any part of the inspection.

13.1.1 The tanks shall be fabricated by welding. Welding procedure in general and the qualification of welders shall be as specified in IS 9595 : 1980 and IS 817 : 1966.

13.2 The cylindrical shell shall be of full penetration double butt-welded construction.

13.2.1 The end plates and penetration shall be attached to the cylindrical shell by means of double fillet welds.

13.3 Shell Plate Arrangement

13.3.1 When the shell length is produced from more than one single plate the longitudinal seams shall break joint at intermediate circumferential seams. It is recommended that whenever possible a longitudinal seam should be situated in the upper third of a tank or on the top centre line.

13.4 The end plates shall be adequately stiffened. The recommended size of angle stiffeners as

given in Table 1 shall be arranged as per Fig. 3 C.

13.5 Typical weld joint details are shown in Fig. 3.

13.6 Shop Painting

All the external surfaces of the tank shall be thoroughly cleaned and freed from rust and scale and painted with one coat of an approved primer paint. All the interior surfaces of the tank shall be cleaned to remove all rust and foreign matters like grease, dirt, etc, before despatch.

14 TOLERANCES

14.1 Tolerance on Shell Diameter

The tolerance on diameter at any point on the length of the tank shell shall be within ± 0.35 percent of the specified diameter (*Max*) when calculated from an external circumferential measurement.

14.2 Tolerance on Circularity

The tolerance on circularity at any point on the length of the shell that is the difference between maximum and minimum internal shell diameter, shall not exceed one percent of the nominal internal diameter.

14.3 Tolerance on Overall Length

The overall length of the tank shall not differ by more than 0.5 percent of the overall length given in Table 1.

15 INSPECTION AND TESTING

15.1 Examination of welds shall be done by visual means. However, non-destructive testing such as spot radiography may be carried out at the option of the purchaser.

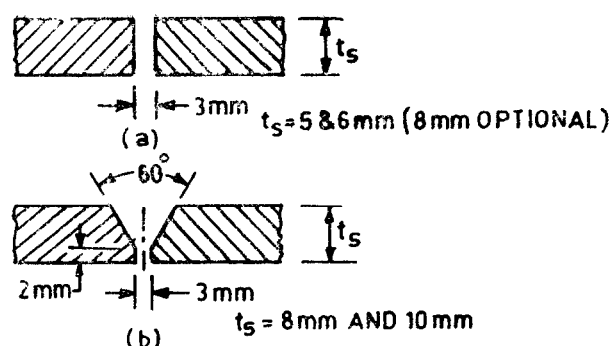
15.2 All gauges and templates necessary for inspection, to the satisfaction of the inspector shall be supplied by the manufacturer.

15.3 All tanks shall be subjected to hydraulic test at a pressure of 0.05 MPa and checked for leaks.

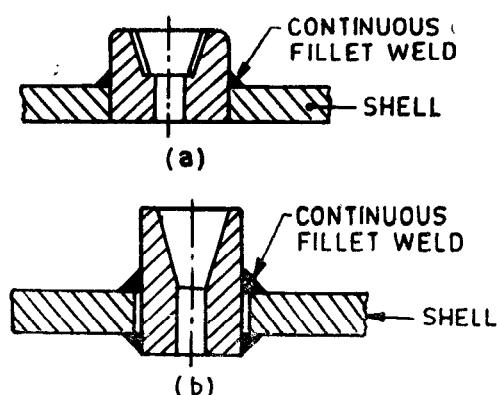
16 CALIBRATION

16.1 Tanks may be calibrated mathematically unless otherwise specified by the purchaser. Where physical calibrations are specified by the purchaser, tanks shall be calibrated in accordance with IS 2009 : 1975 using a certified water. Calibration tables shall show volume of product for every 0.5 cm of filling height of the tank.

16.2 Calibration may be certified by an independent authority, if so required by the purchaser.

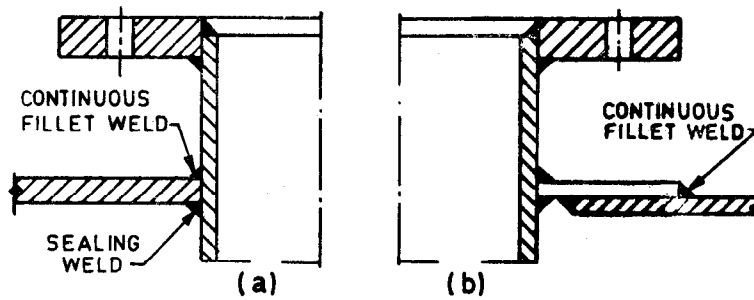


3A TYPICAL LONGITUDINAL AND CIRCUMFERENTIAL JOINTS OF SHELL

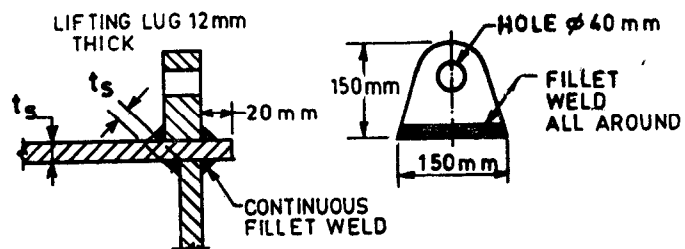


3B TYPICAL SHELL TO COUPLING JOINT DETAILS

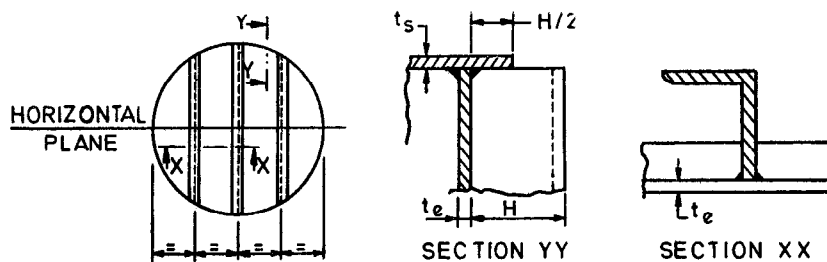
FIG. 3 TYPICAL WELD JOINT DETAILS — (continued)



3C TYPICAL JOINT FOR MANHOLE AND NOZZLE NECK TO SHELL



3D WELD JOINT FOR FLAT ENDS AND LIFTING LUG



3E STIFFENING DETAILS OF END PLATE

FIG. 3 TYPICAL WELD JOINT DETAILS

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
226 : 1975	Structural steel (standard quality) (<i>fifth revision</i>)		studs with full loadability (<i>second revision</i>)
800 : 1984	Code of practice for general construction in steel (<i>second revision</i>)	1367 (Part 6) : 1980	Technical supply conditions for threaded steel fastners: Part 6 Mechanical properties and test methods for nuts with specified proof loads (<i>second revision</i>)
808 : 1989	Dimensions for hot rolled steel beam, column channel and angle sections (<i>revised</i>)	1730 : 1989	Dimensions for steel plate, sheet, strip and flats for general engineering purposes (<i>second revision</i>)
812 : 1957	Glossary of terms relating to welding and cutting of metals		
813 : 1986	Scheme of symbols for welding	1978 : 1982	Line pipe (<i>second revision</i>)
814 : 1991	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel (<i>fifth revision</i>)	1979 : 1985	High test line pipe (<i>first revision</i>)
		2002 : 1982	Steel plates for pressure vessels for intermediate and high temperature services including boilers (<i>first revision</i>)
816 : 1969	Code of practice for use of metal arc welding for general construction in mild steel (<i>first revision</i>)	2009 : 1975	Method for calibration of horizontal and tilted oil storage tanks (<i>first revision</i>)
817 : 1966	Code of practice for training and testing of metal arc welders (<i>revised</i>)	2041 : 1982	Steel plates for pressure vessels used at moderate and low temperature (<i>first revision</i>)
961 : 1975	Structural steel (high tensile) (<i>second revision</i>)	2062 : 1984	Weldable structural steel (<i>third revision</i>)
1030 : 1982	Carbon steel castings for general engineering purposes (<i>second revision</i>)	2825 : 1969	Code for unfired pressure vessels
1239 (Part 1) : 1990	Mild steel tubes, tubulars and other wrought steel fittings: Part 1 Mild steel tubes (<i>fifth revision</i>)	6392 : 1971	Steel pipe flanges
		8500 : 1977	Weldable structural steel (medium and high strength qualities)
1367 (Part 3) : 1979	Technical supply conditions for threaded steel fastners: Part 3 Mechanical properties and test methods for bolts, screws and	9595 : 1980	Recommendations for metal arc welding for carbon and carbon manganese steels

ANNEX B

(Clause 6.4)

INFORMATION TO BE FURNISHED BY THE PURCHASER

B-1 The following information shall be supplied by the purchaser in his enquiry:

- a) Location of tank;
- b) Nominal capacity of tank;
- c) Tank diameter and/or length restrictions;
- d) Internal tank pressure and/or vacuum;
- e) Rate of filling and emptying tank;
- f) Product to be stored and its design and specific gravity;
- g) Minimum ambient temperature where tank is located or design metal temperature;
- h) Corrosion allowance for shell, end plates and other parts both — internal and external;
- j) Maximum wind speeds;
- k) Earthquake factor;
- m) Any additional loads to be considered for tank design;
- n) Type of foundation and bearing capacity of the soil;
- p) List of mountings required and their location on the tank;
- q) Type of construction, lap or butt-welded;
- r) Extent of painting required and surface preparation; and
- s) Scope of supply of tank manufactured.

ANNEX C

(Clause 10.1)

ASPHALT DOPING**C-1 ASPHALT DOPING**

Asphalt doping should be adopted to provide satisfactory protection to steel against soil attack.

C-1.2 Doping of tank should not be taken in hand until the tank is finally tested inside the pit and all water emptied out. However, on the portion of the outside surface of tank which come in contact with cement concrete or foundation, doping can be carried out (as per the laid down procedure/specifications) before testing, excluding the welding joints portions which shall be completed after testing.

C-1.3 Recommended practices for carrying out asphalt doping are as follows:

- a) *Surface Preparation* — The outside surface of the tank, turn buckle, anchor bolts, burried portion of manholes, nozzles, saddles, etc, should be thoroughly cleaned by scraping with wire brushes and sand papers to bare metal. All mill scales dirt should be completely removed before starting the doping work.

- b) *Primer Coat* — The surface thus prepared should be treated with two coats of 'Tankmastic' or equivalent primer. Each coat is applied uniformly after the previous is completely dried. The approximate coating capacity of 'Tankmastic' or equivalent is about 11 to 13 m²/l coat.

- c) *Doping* — After the application of primer coats, two coats of hot 30/40 Grade bitumen shall be applied as per manufacturer's recommendations, resulting in an overall coating thickness of 3.2 mm.

The 30/40 Grade bitumen shall be heated to the required temperature as recommended by the manufacturer for easy and uniform application of bitumen.

The application of bitumen shall be done in such a way as to give the appearance of a rough cast plaster and this can be obtained by dabbing only and not painting.

ANNEX D

(Clause 12.5.4)

EARTHING CONNECTION

D-1 GUIDELINES FOR MAKING EARTHING CONNECTIONS

D-1.1 Every tank shall be electrically connected with the earth in an efficient manner by not less than 2 separate and distinct connections placed at the opposite extremities of such tank. The

connections and contacts shall have as few joints as possible. All joints shall be riveted, welded or bolted and also soldered to ensure both mechanical and electrical soundness. The resistance to earth shall not exceed 70 and the resistance to earth plate or to any part of fitting shall not exceed 20.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standard

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No. CED 1 (4728)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones ; 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	6 32 92 95
Branches : AHMADABAD, BANGALORE, BHOPAL, BHUBANESHWAR, COIMBATORE, FARIDABAD, GHAZIABAD, GUWAHATI, HYDERABAD, JAIPUR, KANPUR, LUCKNOW, PATNA, THIRUVANANTHAPURAM.	