POL TANKLORRY DESIGN & SAFETY

OISD RECOMMENDED PRACTICE 167

Oil Industry Safety Directorate
Government of India
Ministry of Petroleum & Natural Gas
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NO.

POL TANKLORRY DESIGN & SAFETY

Prepared by:
FUNCTIONAL COMMITTEE ‘POL TANKLORRY DESIGN & SAFETY’

OIL INDUSTRY SAFETY DIRECTORATE
8th Floor, OIDB Bhavan,
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Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director

Oil Industry Safety Directorate
FORWORD

The Oil Industry in India is 100 years old. Due to various collaboration agreements, a variety of international codes, standards and practices are in vogue. Standardisation in design, philosophies and operating and maintenance at a national level was hardly in existence. This coupled with feed back from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas installations.

With this in view, the then Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by Oil Industry Safety Directorate (OISD), staffed from within the industry, in formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safer operations. Accordingly, OISD constituted a number of Functional Committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The present standard on: “POL Tanklorry Design & Safety” was prepared by the Functional Committee. This document is based on the accumulated knowledge and experience of industry members and the various national and international codes and practices. This document is meant to be used as a supplement and not as replacement for existing codes and practices. It is hoped that the provision of this standard, if implemented objectively may go a long way to improve the safety and reduce accidents in Oil and Gas Industry. Users are cautioned that no standard can be a substitute for the judgment of a responsible and experienced engineer.

This document will be reviewed periodically for improvements based on the new experiences and better understanding. Suggestions are invited from industry members may be addressed to The Coordinator, Committee on POL Tanklorry Design & Safety

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Though every effort has been made to assure the accuracy and reliability of data contained in these documents, OISD hereby expressly disclaims any liability or responsibility for loss of damage resulting from their use.

These documents are intended only to supplement and not replace the prevailing statutory requirements.
### Functional Committee on Pol Tanklorry Design & Safety

#### List of Members

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<th>Name</th>
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<th>Position in Committee</th>
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</thead>
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<tr>
<td>Mr. S.K. Jain</td>
<td>Executive Chairman PII.</td>
<td>Leader</td>
</tr>
<tr>
<td>Mr. R.H. Bhalekar</td>
<td>Jt. Chief Controller of Explosives, Nagpur.</td>
<td>Member</td>
</tr>
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<td>Mr. Barath Balan</td>
<td>Principal- NIGDI HPCL (M).</td>
<td>Member</td>
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<td>Member</td>
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<td>Member- Coordinator</td>
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SECTION No. 1

INTRODUCTION

In the wake of NGL tanklorry overturning and subsequent fire which occurred near Mendhwan Village in Thane District in November 1991 claiming a number of lives, a technical committee comprising of senior executives from Oil Companies, Oil Industry Safety Directorate and Chief Controller of Explosives (CCOE) was constituted to investigate into the cause of the incident and recommend the measures for avoidance of such incidents. The committee recommended several measures based on the directly attributable causes of the incident as well as with regard to deficiencies in tanklorry design and inspection practices of the fabricators. The recommendations include development of engineering standard covering all facets of design, minimum inspection and tests for soundness of the tank, protection of tank against lateral & longitudinal impact during overturning of a tanklorry, colour scheme of tanklorries carrying POL products, etc.

This Standard has been prepared keeping in view the above recommendations and to standardise the tanklorries carrying POL products in India.

SECTION NO. 2

SCOPE

This Standard lays down minimum requirements of design, inspection and quality assurance for tanklorry used for transportation of POL products other than Excluded Petroleum (such as LSHS, bitumen (asphalt), wax, etc., as defined under Petroleum Act, 1934, and Petroleum Rules, 1976. The scope of this Standard includes tanklorries of capacities up to 18 kl on rigid chassis.

SECTION NO. 3

SALIENT FEATURES

Salient features of a tanklorry constructed as per this Standard vis-a-vis existing tanklorries are as under:

a) Tank sheet material having higher tensile strength, yield strength and impact resistance has been recommended.

b) Roll over design is adopted giving protection to top fittings vulnerable to damage during overturning of a tanklorry.

c) Bottom loading provision has been included.

d) Colour scheme to identify tanklorries carrying POL products.

e) Protection for tank body against lateral and longitudinal impact during overturning.

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SECTION NO. 4

ENGINE

LOCATION

The engine shall be in front of the rear line of the cab or be otherwise protected so that any spillage or leakage of flammable liquid cannot impinge on the heated surfaces of the engine.

TYPE

Engine shall be an internal combustion engine (diesel driven). Engine power shall be adequate for the intended terrain operation.

AIR INDUCTION SYSTEM

The air induction system shall be located and/or protected so as to minimise the possibility of induction of flammable vapour from any spillage of flammable liquid or from any release from a safety relief device on the cargo tank. The air intake shall be fitted with an effective flame arrester capable of preventing emission of flame from the side of the engine in the event of backfiring.

EXHAUST SYSTEM

The exhaust system shall be located in such a way that any spillage or leakage of the flammable tank contents cannot normally impinge on the heated surfaces of the system. The exhaust pipe shall be fitted with Spark Arrester procured from CCOE approved manufacturer. The muffler or silencer shall not be cut off from the exhaust system. The Spark Arrester shall be firmly attached to the exhaust pipe by a proper bolting system.

Fuel system

The vehicle fuel tank shall be positioned so that leaking or spilled fuel can drain directly to the ground without impinging on the engine or its exhaust system. Additionally, it shall be located on the side opposite to the tanklorry discharge faucets. The fuel tank shall be protected by stout steel guards, and shall have provision for locking.

Alteration/addition to the originally designed fuel tank (supplied by the vehicle manufacturer) shall not be carried out.

SECTION NO. 5

TANK MATERIAL SPECIFICATIONS

Tank shall be fabricated out of carbon steel material meeting the following minimum requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>3.15mm (10 BWG)</td>
</tr>
<tr>
<td>Yield strength</td>
<td>30kg/mm2(300 Mpa)</td>
</tr>
<tr>
<td>Ultimate tensile strength</td>
<td>44-56 kg/mm2 (440-560 MPa)</td>
</tr>
<tr>
<td>Minimum elongation</td>
<td>21%</td>
</tr>
</tbody>
</table>

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### Impact strength (Charpy V-notch)
- 40 Joules at 0 deg. C.

### Bend test (Mandrel Dia)
- 3 times thickness

SAILMA 300 HI of Steel Authority of India meets the above requirements. However, steel sheet from any other reputed manufacturer with equivalent or better characteristics may also be used after testing.

## SECTION No. 6

### TANK DESIGN

1. Tanklorry shall be designed and constructed ensuring correct structural relationship between the cargo tank, the propulsion equipment and supporting members, its ruggedness, safe road performance and braking power.

2. Tanklorry shall comply with the Motor Vehicles Act, 1988, and the rules framed thereunder.

3. Tanklorry shall comply with the Petroleum Act, 1934, and the rules framed thereunder. The maximum net carrying capacity of a tank shall be 97 percent of its gross carrying capacity in the case of petroleum Class A and B and 98 percent in the case of petroleum Class C. In case the tank is likely to be used for all Classes, then the provision required for Class A shall apply.

4. Registered laden weight (RLW) of the vehicle shall not exceed the authorised registered weight of the vehicle by concerned transport authority or manufacturer, whichever is less. The weight product filled plus the unladen weight shall not exceed RLW or the licensed capacity as permitted by statutory authority.

5. Each tank or compartment of the tank shall be constructed with a manhole on the top to provide access to enable the interior to be examined. The manhole shall be not less than 450 mm in diameter.

6. Maximum width of the tank shall be less than the overall width of the cabin of the vehicle on which it is mounted, and also less than the overall width of the outer edges of the vehicle tyres.

7. A tank having a net capacity exceeding 5000 litres shall be divided into compartments by oil-tight partitions. No compartment shall have net capacity exceeding 5000 litres.

8. Tank ends and the partitions shall be dished. The depth of dish excluding the flange shall not be less than 8% of the minor axis of the tank cross-section subject to a minimum of 100 mm.

9. The distance between two partitions, and any adjacent tank end and a partition, shall not exceed 2500 mm.

10. Baffles shall be continuously welded to the shell.

11. All joints shall be welded conforming to IS 814. This shall include attention to the following:

   i. Weld joint preparation.

   ii. Welding procedure.

   iii. Weld thickness.

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iv. Acceptable limits of welding defects considering the fact that the welds are to be accepted without radiographic test.

v. Proper fabrication plan shall be prepared indicating the actual positions of weld joints. It shall be ensured that three plate joints do not occur at intervals closer than 500 mm.

vi. Welding electrodes shall be of reputed make and conform to E - 6013 grade.

All weld inside and outside the tank shall be ground smooth prior to painting.

12. Every compartment shall be tested by hydrostatic pressure of minimum 0.316 kg/sq.cm. g. gauged at the top of the compartment. This can be achieved by means of a 3160 mm high pipe fitted on top of the tank and filled up to the brim with water. The pressure shall be maintained for a period of not less than one hour. During testing, all the closures shall be in place and the operating relief devices shall be clamped, plugged, or otherwise rendered inoperative. The compartment under test shall not show any leakage or drop of pressure during the test. Two adjoining compartments shall not be tested or filled with water simultaneously. Tanks failing to pass this test shall be suitably repaired and the above test shall be continued until no leak is detected.

13. Center of gravity of fully loaded tanklorry shall not be higher than that recommended by the chassis manufacturer. Sample Design and Stability Calculations are given as Annexure I.

SECTION NO. 7

TANK BOTTOM FITTINGS

Bottom draw-off/loading systems shall conform to the following requirements:

1. Tank shall be designed to ensure the complete drainage of the contents of each compartment via an internal stop valve (Emergency Valve) and an external discharge faucet.

2. The Emergency Valve shall be of the type fitted with a suitable means for preventing development of dangerous static charge inside the tank during bottom loading. This can be achieved either by the design of the valve or by fitting a suitable deflector plate.

3. The operating mechanism (Termed Bottom Operator) for the Emergency Valves shall be provided with a secondary control (Emergency Release) in an easily accessible position remote from all fill openings and the discharge faucets.

4. The Bottom Operator shall incorporate a fusible link which will permit automatic closing of all the Emergency Valves in the event of fire. One end of the fusible link shall be anchored to the body of the Bottom Operator and the other end attached to the Bottom Operator spring release mechanism in such a way that all open Emergency Valves are closed at the same time. The link shall be capable of withstanding a minimum load of 35 kgs and the two halves shall not separate during normal handling of the valve but shall separate only when the fusible alloy melts at 93 degrees C. in the event of a fire. Fusible link shall be procured from CCOE approved manufacturer.

5. The Emergency Valve shall incorporate a shear section designed to break when subjected to excessive strain. This shall be located on the discharge side of the valve seat as close as possible to the valve seal.

6. All tank valves, fittings, pipework and ancillary fittings shall be so fitted and protected as to minimise the risk of damage and leakage of contents in the event of the vehicle being involved in an accident.

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7. Tank valves, sealing caps and other fittings, including joint seals and sealants, shall be manufactured from materials which are suitable for handling refined petroleum products including presently known additives.

8. Provision shall be made to prevent damage to pipework due to vibration by the incorporation of Flexible Bellow connections within pipework runs.

**SECTION NO. 8**

**TANK TOP FITTINGS**

The manhole mentioned in Section No. 6 shall be closed off with a mild steel (minimum 5 mm thick) base plate assembly fitted with a 24 bolt airtight fixing all around and a 3 mm thick compressed nitrile cork gasket.

The Manhole shall be enclosed in a dome cover having a hinge joint at one end and a spring loaded sealing arrangement at the other end. (Refer to Diagram in Annexure II). The dome cover shall not restrict the emergency venting capability of the vapour or liquid emergency vent.

Following fittings shall be provided within each manhole plate:

**FILL PIPE:**

1. Fill pipe shall be of Mild Steel of size 100 mm nominal bore and flange mounted to the manhole base plate. Internally the pipe shall be extended till almost bottom of the compartment leaving a clearance of 25 mm. The fill pipe should not be slotted, however, it should have an opening in the wall not greater than 13mm in diameter which should be above the maximum level of the tank contents in order to provide a pressure balance.

2. The inner end of the fill pipe shall be provided with a splash deflector arrangement (45 degree angular cut).

3. Top open end of the fill pipe shall be externally threaded and fitted with an oil-tight locker cap. The cap shall be fine finished from the inside and provided with a compressed nitrile cork gasket.

4. The top of the internal pipe is to have a gauzed opening of 140 Sq. mm minimum located above the maximum level of the contents to provide pressure balance. The stainless steel gauze shall be manufactured from wire with a diameter not less than 0.3 mm forming apertures of not more than 0.5 mm x 0.5 mm.

**DIP PIPE :**

1. Dip pipe of nominal bore of 75 mm shall be of mild steel with a longitudinal opening along its full internal length covered by gauze. The Dip Pipe shall be flange-mounted to the manhole base plate at the geometrical center of the compartment. It shall be extended to the bottom of the tank and shall be supported against vibration. The bottom end of the pipe shall be sealed. The pipe shall be truly vertical when the bottom of the tank is horizontal.

2. Internally, the pipe shall be provided with 5mm dia holes throughout its length and circumference, including at a level above the maximum level of the contents, the number of holes being minimum 5 nos. in minimum 5 rows. The openings shall be covered with 2 layers of wire gauze having not less than 11 meshes per centimeter.

3. The Dip pipe shall be projected from the manhole plate and it shall be at least 15 mm below the tank shell in case of Alternative I mentioned in Section 11.

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4. Top open end of dip pipe shall be externally threaded and fitted with an oil-tight locker cap. The cap shall be fine finished from the inside and provided with compressed nitrile cork gasket.

5. A datum plate of size 100 x 100 mm and thickness not exceeding 5 mm shall be provided exactly below the dip pipe.

PRESSURE-VACUUM VALVE:

1. Pressure Vacuum valve procured from CCOE approved manufacturer shall be mounted on the manhole cover base plate. Specimen drawing is enclosed as Annexure III.

2. P/V valve shall be of the double spring type, one for pressure and one for vacuum and shall incorporate an anti-roll over device which will not allow leakage of contents in the event of vehicle upset.

3. The settings of the P/V valve shall be:
   Pressure : 210 cm of water gauge
   Vacuum : 5 cm of water gauge

4. P/V valve shall provide a minimum flow venting area of 300 sq.mm., the opening being covered with 2 layers of wire gauze having not less than 11 meshes per centimeter.

EMERGENCY VENT:

1. An emergency vent procured from CCOE approved manufacturer shall be mounted on the manhole cover base plate. Specimen drawing is enclosed as Annexure IV.

2. The emergency vent shall be of fusible type to melt at 93 degrees Centigrade.

3. The vent shall provide a minimum opening having a net area in sq. cms. equal to 8 plus 4.3 times the gross capacity of the compartment in kilolitres.

SECTION NO. 9

TANK MOUNTINGS

Tank (including its supports and attachments) shall be so fitted that if under the maximum permissible load it is subjected to an acceleration of 2 g in the direction of travel, 1 g at right angles to the direction of travel, 1 g vertically upwards or 2 g vertically downwards, the maximum stress in any part thereof shall not exceed 75% of the yield proof stress of the material of construction. Where it is foreseeable that the tanker may be subjected to higher loading conditions, e.g. where it may be used over rough terrain, appropriate loads shall be established.

The tank shall be securely attached to the vehicle in accordance with the following conditions:

a) Mounting structures shall be designed to prevent excessive movement of the tank in relation to the chassis. This would include the use of flexible mountings as well.

b) The design of mounting structures shall take into account the loadings referred above.

c) Where the mounting structures are designed as an integral attachment to the shell, each attachment shall be designed to meet the requirements of the maximum stress referred above.

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d) Anchors shall not allow any movement between the tank and the vehicle during starting, stopping and turning.

e) All anchors shall be installed in a manner so as to be easily accessible for inspection and maintenance.

f) Special care shall be taken on the location of bolting of the tank to the chassis frame. It shall be as per recommendation of chassis manufacturer.

g) Packing shall be provided between saddle plate and the chassis as per recommendation of chassis manufacturer.

h) U-bolts for securing the tank shall be tightened to the specified torque level, and number of bolts shall not exceed the number recommended by the chassis manufacturer.

SECTION NO. 10
CATWALK

a) Catwalks shall be minimum 600 mm wide and provided on both sides of the manholes throughout the length of the tank and between the manholes. (Refer Annexure V).

b) Catwalk shall be made of chequered plates or gratings.

c) Catwalk supports shall not be welded directly to the tank shell but welded with a padding of 5mm thick plate of size 100x100 mm.

d) In case of Alternative II mentioned in Section No. 11, catwalk shall be above the level of the fittings and capable of withstanding the weight of the loaded tanklorry.

e) 1 No. ladder shall be provided at the rear of the tank.

SECTION NO. 11
TANK OVERTURN PROTECTION

a) All top fittings shall be protected against damage from roll over accidents. This can be achieved by any of the two alternatives below:

<table>
<thead>
<tr>
<th>Alternative I</th>
<th>Manholes shall be recessed within the contour of the tank shell and all fittings protruding above the manhole base plate shall be at least 15 mm below the top of the tank shell. (Refer Annexure VI.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative II</td>
<td>Manholes shall be flushed with the top of the tank shell and all fittings on the manhole base plate shall project above the shell only to the minimum extent necessary. Catwalk shall be as mentioned in item 4 of Section No. 10.</td>
</tr>
</tbody>
</table>

b) All the fittings shall be provided within the manhole cover base plate.

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c) Manhole cover lids as specified in Section No. 8 shall be provided.

d) The gross volume of the tank compartment shall be calculated as the net liquid load volume plus 2 to 3% of the volume and the level shall be never less than 75 mm below the top of the tank shell.

e) The center of gravity of the fully loaded vehicle shall not be higher than that recommended by the chassis manufacturer.

f) Saddle plates shall be extended on both the sides up to at least half the height of the tank, for bearing the impact in the event of vehicle overturn.

SECTION NO. 12

REAR-END PROTECTION

The vehicle shall be provided with a rear robust steel bumper so that collision stresses will be transmitted to the frame of the vehicle and thus protect the tank and its fittings in the event of a rear-end collision. The bumper shall be so located that its inside face is never less than 100 mm from the rear of the tank shell or its fittings. The bumper shall be extended on each side of the tank to at least the maximum width of the vehicle.

SECTION NO. 13

ELECTRICAL SYSTEM

The electrical system shall be designed, installed and adequately protected so as to minimise mechanical damage and the risk of electrical fires. In particular, the system shall conform to the following requirements:

a) The nominal circuit voltage on the vehicle shall not exceed 24 volts.

b) Batteries shall be effectively protected against contact with any spillage of flammable liquid, and be fitted with an insulator cover to protect against inadvertent contact by objects which could cause a spark.

c) All cables shall be secured on the vehicle so that they are protected against mechanical damage and heat.

d) All control switches shall be in the feed side of the circuit.

e) All cables shall be armoured and protected from mechanical/chemical damages.

f) Except for cables to the starter motor, the current rating of any cable shall be chosen so that the conductor temperature will not exceed 70 deg. C when it is carrying full load continuously.

g) Junction boxes, connectors and all electrical equipment shall be adequately protected and shielded from the ingress of moisture or flammable liquid.

h) Either an insulated return circuit shall be used or every item of electrical apparatus on the vehicle shall be individually bonded by cable either to the chassis or structural members attached to the chassis.

i) To enable electrical circuits to be isolated (including any open circuit of alternator field windings), a multipole master switch shall be fitted as close to the battery as possible and shall comply with the following provisions:

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i. Master switch shall include double pole switching to isolate outgoing circuits from both poles of the battery;

ii. Master switch control shall be readily accessible to persons outside the vehicle and its location shall be indicated by a clearly visible, legible and durable notice.

iii. Visual means shall be provided to indicate clearly when the master switch is in the "ON" or "OFF" position.

iv. Means shall be provided for the driver to put off the master switch without leaving the driver's seat.

VEHICLE ELECTRICAL CIRCUIT PROTECTION

The following steps shall be taken to ensure protection of the electrical circuits:

a) All circuits, with the exception of the main battery supply and the starter and alternator circuits, shall be protected with fuses or circuit breakers.

b) All circuit protective devices, with the exception of any barrier device for a tachograph or other intrinsically safe device, shall be mounted forward of the rear of the cab.

c) Fuses or circuit breakers shall be fitted within an enclosed unit. Fuse holders shall be permanently marked with the maximum fuse rating.

d) Number of circuits connected to any protective device shall not exceed four, and the rating of the device shall be compatible with the smallest conductor in any of these circuits.

e) Grouping of circuits shall be so arranged that the failure of any minor circuit does not render a major or obligatory circuit inoperative.

PROTECTION AGAINST STATIC ELECTRICITY

The vehicle shall be provided with a connector for connecting an external earthing lead during loading/unloading. The tank, its associated pipework and fittings, both internal and external, and the metal structure of the carrying vehicle shall all be in good electrical contact with each other and the external earth lead connector. The maximum electrical resistance of all such connections shall not exceed 10 ohms. All discharge hoses shall be electrically conducting. The electrical resistance from the external earth lead connector of the vehicle to the ground through the tyres shall not exceed 10 ohms.

SECTION NO. 14

DRIVER'S CABIN

a) The height of the vehicle cabin shall be more than that of the tank.

b) Cabin shall be fabricated out of steel plate material.

c) Its rear window, if provided, shall be fully covered with toughened glass.

d) 1 kg ISI approved DCP/CO2 fire extinguisher and a fully equipped first aid box shall be provided inside the cabin.

e) A 10 kg. ISI approved DCP fire extinguisher shall carried on the vehicle in an easily accessible position and away from the discharge faucets.

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SECTION NO. 15

SPARK ARRESTOR

a) Spark Arrestor procured from CCOE approved manufacturer shall be fitted at outlet of exhaust pipe of the vehicle to avoid emission of sparks. (Specimen drawing enclosed as Annexure VII).

b) Its inlet end with swirling blade assembly shall be fitted with the outlet end of the vehicle exhaust pipe by a proper bolting system.

c) The carbon of engine exhaust comes out through swirling blade and is deposited in the soot box of the spark arrestor assembly.

d) The carbon deposits shall be cleared regularly.

SECTION NO. 16

THIRD PARTY INSPECTION

Inspection at every stage of fabrication of a POL Tanklorry is necessary to ensure that right materials as per the specification are used and fabrication is carried out exactly as per the drawings and other technical details.

INSPECTION AGENCY

Inspection shall be carried out by a competent party approved by CCOE.

ROLE OF INSPECTION AGENCY

a) To check the design, drawings and technical specifications.

b) Inspection/verification/checking of all the materials to ensure that correct material is used.

c) Inspection of MS plates/sheets for thickness and any surface defects.

d) Testing of welders for welder’s qualification as per relevant IS code.

e) Welding procedures as per codes and as per the fabrication drawings.

f) To ensure that welding is being done as per predetermined welding sequence using approved electrodes.

g) Inspection of workmanship

h) Final pre-commissioning tests (Hydrotesting, etc.) after completion of fabrication work.

i) Review and certification of records and test certificates pertaining to welding material, MS plates, P.V. Vent, Master Valve etc.

VARIOUS STAGES OF INSPECTION

1st stage:

a) Verification of all the Manufacturer’s test certificates ensuring material to be of the correct specification.

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b) Check for thickness and its uniformity: Mechanical/ Ultrasonic test.

c) Visual inspection for any surface defects, cracks or lamination.

d) Approval of welding procedures, welding equipment and welder's qualification in accordance with relevant IS code.

2nd stage:

a) Ensuring that welding is being carried out as per predetermined sequence and procedures, by approved welders with specified electrodes.

b) Inspection of weld joints:

c) Dye penetration test of external weld joints not subjected to hydrotesting.

d) Ensuring repairs of the defective welds, if any, before giving clearance for hydrostatic testing.

e) Inspection during fabrication shall be carried out as per the requirement of applicable codes, specifications, approved drawings etc.

f) To ensure installation of all the fittings as per drawing.

3rd stage:

(Shall be carried out as pre-commissioning checks after completion of the entire fabrication work).

a) Check for physical dimensions (as per drawings).

b) Visual inspection for workmanship and quality of work.

c) To ensure that quality of welding meets the requirement of 2nd stage Inspection.

d) Hydrotesting of the tank as specified in tank design.

e) Check for installation and working of all the safety and other fittings.

f) Tank capacity to be checked physically using IS approved water meter.

g) To ensure proper surface preparation and painting.

h) Check for external and internal painting.

i) Issue of Inspection certificate after the final inspection.

4th stage:

(Shall be carried out every 5 years from the date of commissioning).

a) Check for physical dimensions as per drawings.

b) Visible signs of tank damage.

c) Check for external painting.

d) Condition of all fittings.

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e) Hydrotesting of the tank as specified in tank design.

f) Condition of fire extinguisher and first aid box.

g) Issue of fitness certificate.

SECTION No. 17

COLOUR SCHEME

a) POL tank lorries shall be painted as per RTO and other applicable regulations.

b) Emblem of the oil company shall be painted only on tank lorries owned by them. Transport contractors shall not paint oil companies’ emblems on their tank lorries.

c) Every tank lorry shall have an Emergency Information Panel painted on the three sides of the tank and two hazard class labels, one in front of the engine and one on top of the cabin, as laid down in the Motor Vehicles Act, 1988 and Motor Vehicle Rules, 1989.

d) “ML” and “Highly Inflammable” shall be indicated as laid down in Petroleum Rules, 1976.

SECTION No. 18

REFERENCES


c) Approved Code of Practice (1992 edition) for Design And Construction of Vented, Non-pressure Road Tankers Used For The Carriage Of Flammable Liquids, issued by Health And Safety Commission, U.K.

d) Code No. API 650 for fabrication of tanks.

e) IS Code No. 814 - Covered Electrodes For Manual Metal Arc Welding Of Carbon Steel And Carbon Manganese Steel.

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## ANEXURE I

### TANK LORRY DESIGN SAMPLE CALCULATIONS

---

**MODEL : ALCO COMET 3/1**

**CAPACITY : 12 KL**

<table>
<thead>
<tr>
<th>TANK DIMENSIONS:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MAJOR AXIS (a)</td>
<td>230.00 cm</td>
</tr>
<tr>
<td>MINOR AXIS (b)</td>
<td>145.00 cm</td>
</tr>
<tr>
<td>SHELL LENGTH (l)</td>
<td>466.00 cm</td>
</tr>
<tr>
<td>DISHEDED END DEPTH (d)</td>
<td>13.00 cm</td>
</tr>
<tr>
<td>TOTAL TANK LENGTH</td>
<td>492.00 cm</td>
</tr>
<tr>
<td>TANK SUPPORT HEIGHT</td>
<td>22.00 cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHASSIS DIMENSIONS:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FRAME HEIGHT</td>
<td>1015.00 cm</td>
</tr>
<tr>
<td>WHEEL BASE</td>
<td>447.00 cm</td>
</tr>
<tr>
<td>FRONT OVERHANG</td>
<td>111.80 cm</td>
</tr>
<tr>
<td>REAR OVERHANG</td>
<td>167.80 cm</td>
</tr>
<tr>
<td>OVERALL LENGTH</td>
<td>726.40 cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESIGN CALCULATIONS:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CABIN LENGTH</td>
<td>180.00 cm</td>
</tr>
<tr>
<td>PLATE THICKNESS (t)</td>
<td>0.32 cm</td>
</tr>
<tr>
<td>SHELL VOLUME 1.06<em>3.14</em>a<em>b</em>l/4000000</td>
<td>12938.31 lts</td>
</tr>
<tr>
<td>DISH END VOLUME 4<em>3.14</em>a<em>b</em>d/12000</td>
<td>454.01 lts</td>
</tr>
<tr>
<td>TOTAL TANK VOLUME</td>
<td>13392.32 lts</td>
</tr>
<tr>
<td>FILLING RATIO (MAXM. PERMISSIBLE=0.97)</td>
<td>0.90</td>
</tr>
<tr>
<td>PRODUCT VOLUME</td>
<td>12000.00 lts</td>
</tr>
<tr>
<td>PRODUCT DENSITY</td>
<td>0.85 gm/cu/cm</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th><strong>PRODUCT WEIGHT</strong></th>
<th>10200.00 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEEL DENSITY (G)</strong></td>
<td>7.85 gm/cu.cm</td>
</tr>
<tr>
<td><strong>TANK SHELL WEIGHT</strong></td>
<td>22/7<em>SQRT(a</em>a+b<em>b/2)<em>l</em>G</em> t</td>
</tr>
<tr>
<td><strong>DISH END WEIGHT</strong></td>
<td>1.4<em>22/7</em>a<em>b</em>2<em>g</em>t</td>
</tr>
<tr>
<td><strong>PARTITION NOS.</strong></td>
<td>3.00</td>
</tr>
<tr>
<td><strong>NO. OF PARTITION PLATES</strong></td>
<td>2.00</td>
</tr>
<tr>
<td><strong>WEIGHT OF EACH PARTITION PLATE</strong></td>
<td>65.80 kg</td>
</tr>
<tr>
<td><strong>TOTAL WEIGHT OF PARTITION PLATES</strong></td>
<td>131.60 kg</td>
</tr>
<tr>
<td><strong>TOTAL TANK WEIGHT</strong></td>
<td>1022.85 kg</td>
</tr>
<tr>
<td><strong>MOUNTING WEIGHT</strong></td>
<td>350.00 kg</td>
</tr>
<tr>
<td><strong>WEIGHT OF GUARD AT TOP</strong></td>
<td>60.00 kg</td>
</tr>
<tr>
<td><strong>TANK + MOUNTING WEIGHT</strong></td>
<td>1432.85 kg</td>
</tr>
<tr>
<td><strong>PRODUCT + TANK + MOUNTING WEIGHT</strong></td>
<td>11632.85 kg</td>
</tr>
<tr>
<td><strong>REACTION AT REAR AXLE = Rr</strong></td>
<td></td>
</tr>
<tr>
<td><strong>GAP BETWEEN CABIN AND TANK SHELL</strong> (e)</td>
<td>15.00 cm</td>
</tr>
<tr>
<td><strong>GAP AT REAR END</strong> (f)</td>
<td>39.40 cm</td>
</tr>
<tr>
<td><strong>TANK C.G. DISTANCE FROM FRONT AXLE</strong></td>
<td>329.20 cm</td>
</tr>
<tr>
<td><strong>Rr (FULL)</strong></td>
<td>8567.19 kg</td>
</tr>
<tr>
<td><strong>Rr (EMPTY)</strong></td>
<td>3065.66 kg</td>
</tr>
</tbody>
</table>

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ANK LORRY STABILITY CALCULATIONS (SAMPLE)

WEIGHT DISTRIBUTION

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>FRONT AXLE (KG)</th>
<th>REAR AXLE (KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AXLE+SUSPENSION WEIGHT</td>
<td>400.00</td>
<td>900.00</td>
</tr>
<tr>
<td>ENGINE+TRANSN+CHASSIS</td>
<td>1395.00</td>
<td>665.00</td>
</tr>
<tr>
<td>CABIN WEIGHT</td>
<td>400.00</td>
<td></td>
</tr>
<tr>
<td>CREW WEIGHT</td>
<td>130.00</td>
<td></td>
</tr>
<tr>
<td>PRODUCT+TANK+MOUNT WEIGHT</td>
<td>3065.66</td>
<td>8567.19</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5390.66</td>
<td>10132.19</td>
</tr>
<tr>
<td>AXLE RATING</td>
<td>5675.00</td>
<td>10200.00</td>
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</table>

STABILITY CALCULATIONS

C.G TABLE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>LOAD ON</th>
<th>C.G. HEIGHT FROM GROUND LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FRONT AXLE KG.</td>
<td>REAR AXLE KG.</td>
</tr>
<tr>
<td>CHASIS FRAME</td>
<td>300.00</td>
<td>500.00</td>
</tr>
<tr>
<td>ENGINE &amp; TRANS.</td>
<td>1095.00</td>
<td>165.00</td>
</tr>
<tr>
<td>CREW WEIGHT</td>
<td>130.00</td>
<td></td>
</tr>
<tr>
<td>CABIN WEIGHT</td>
<td>400.00</td>
<td></td>
</tr>
<tr>
<td>F.A.+ SUSPENSION WT.</td>
<td>400.00</td>
<td></td>
</tr>
<tr>
<td>R.A. + SUSPENSION WT.</td>
<td></td>
<td>900.00</td>
</tr>
<tr>
<td>PRODUCT WEIGHT</td>
<td>2688.05</td>
<td>7511.95</td>
</tr>
<tr>
<td>TANK + MOUNTING WT.</td>
<td>377.61</td>
<td>1055.25</td>
</tr>
<tr>
<td>TOTAL WEIGHT</td>
<td>5390.66</td>
<td>10132.19</td>
</tr>
</tbody>
</table>

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**STABILITY RATIO**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>UNLADEN WEIGHT</td>
<td>WU</td>
</tr>
<tr>
<td>LADEN WEIGHT</td>
<td>WL</td>
</tr>
<tr>
<td>DISTANCE BETWEEN REAR END TYRES</td>
<td>X</td>
</tr>
<tr>
<td>HEIGHT OF C.G. (UNLADEN)</td>
<td>YU</td>
</tr>
<tr>
<td>STABILITY RATIO</td>
<td>YU/X</td>
</tr>
<tr>
<td>HEIGHT OF C.G. (LADEN)</td>
<td>YL</td>
</tr>
<tr>
<td>STABILITY RATIO</td>
<td>YL/X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>5322.85</td>
</tr>
<tr>
<td>15522.85</td>
</tr>
<tr>
<td>2105.00</td>
</tr>
<tr>
<td>1279.86</td>
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<tr>
<td>0.61</td>
</tr>
<tr>
<td>1629.13</td>
</tr>
<tr>
<td>0.77</td>
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</table>
ANNEXURE II

DIAGRAM SHOWING THE DOME COVER ON A TANK LORRY
(PLAN WITH OPEN COVER)

1. Locking arrangements brazed to aluminium dome cover

2. Braze

3. Sealing bolts wired/sealed together

4. Spindle bolt to be welded or rivetted at both ends

5. Dome cover bracket held to the manhole plate by two bolts

6. Manhole cover plate

7. Base plate of clamp held down to the manhole plate by two bolts

8. Welding

9. Locking bolt which requires to be welded on the underside (see detail section 'A')

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ANNEXURE III

PRESSURE VACUUM VALVE (SPECIMEN)

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ANNEXURE IV

EMERGENCY VENT (SPECIMEN)
ANNEXURE V

CATWALK DETAILS

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ANNEXURE VIA

GENERAL ARRANGEMENT OF MANHOLE COVER FITTINGS

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ANNEXURE VII

END REMOVABLE FOR CLEANING

FIXED CENTRIFUGAL SPARK ARRESTED

INLET

MODIFIED CONE ADDED IN PLACE OF SILENCER MUFFLER

PACKING

OUTLET

PERFORATED FLOOR

REMovable END PLATE

LID FOR SOOT BOX FOR CLEANING

EXHAUST FLAME TRAP/SPARK ARRESTED
(NO SILENCER MUFFLER)

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