



## **OIL INDUSTRY SAFETY DIRECTORATE**

**पीओएल टैंक लॉरी डिज़ाइन एवं सुरक्षा  
ओ आई एस डी –आर पी- 167**

**POL TANK LORRY DESIGN & SAFETY**

**OISD-RP-167**

Inception	July 1997
Revised Edition	August 2019

**FOR RESTRICTED CIRCULATION ONLY**

**OIL INDUSTRY SAFETY DIRECTORATE**

Government of India

Ministry of Petroleum & Natural Gas

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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 by 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 three decades 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**

## FOREWORD

The Oil Industry in India is over 100 years old. As such, various practices have been in vogue because of collaboration/ association with different foreign companies and governments. Standardization in design philosophies, operating and maintenance practices remained a grey area. This coupled with feedback from some serious accidents that occurred in the past in India and abroad, emphasized the need for the industry to review the existing state-of-the-art in designing, operating and maintaining of Oil and Gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) staffed from within the industry in formulating and implementing a series of self-regulatory measures aimed at removing obsolescence, standardizing and upgrading the existing standards to ensure safe 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 earlier document on recommended practice RP-167 on "POL Tank truck Design & Safety" was prepared by the Functional Committee in year 1997. In view of the large number of Tank truck in transit accidents involving loss of life, product & environmental pollution, Incidences of fire during T/L unloading at retail outlets. Introduction of higher capacity tank Lorries, Tank Lorries with bottom loading facilities and changes in statutory regulations, the existing practices needed review. Accordingly, a team of Industry experts was constituted by OISD for revision of the existing RP-167.

The figures and photographs used in the document, if any, are representative in nature.

We, at OISD, are confident that the provisions of this standard, when implemented in totality, would go a long way in ensuring safe operation of the target group of locations.

Needless to mention, this standard, as always would be reviewed based on field level experience, incident analysis and environment scanning. Suggestions from all stake holders may be forwarded to OISD.

## NOTE

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These documents are intended only to supplement and not to replace the prevailing statutory requirements of PESO, DGMS, Factory Inspectorate or any other Government body which must be followed as applicable.

Wherever Acts/ Rules/ Regulation and National/ International Standards are mentioned in the standard, the same relates to in-vogue version of such documents.

Numaligarh Refinery Limited

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## 1.0 INTRODUCTION

The number of Tank lorry accidents involving loss of life, product & environmental pollution has increased in alarming proportions in recent past. Incidences of fire during Tank truck unloading at retail outlets have caused loss of lives and severe damage to property.

Higher Capacity tank Lorries have come in to the system in larger way. Bottom loading Tank Lorries are being used at many locations and the usage is expected to increase considerably in coming years. Additionally vapor recovery systems are also being provided in many locations to meet environmental requirements.

Existing OISD- RP-167 needed revision to take care of Tank truck safety by considering the above aspects. Accordingly, this document has been prepared to enhance integrity of POL Tank Lorries for ensuring safety in road transportation.

## 2.0 SCOPE

This Standard lays down minimum requirements of design, inspection and quality assurance for tank truck used for transportation of POL products other than Excluded Petroleum products such as LSHS, bitumen (asphalt), wax, etc., as defined under Petroleum Act, 1934, and Petroleum Rules, 2002 & its subsequent amendments.

## 3.0 SALIENT FEATURES

Salient features of a tank truck are as under

- a) Tank sheet material having higher tensile strength, yield strength and impact resistance has been recommended.
- b) Rollover design is adapted giving protection to top fittings vulnerable to damage during overturning of a tank truck.
- c) Anti-lock Braking System / under run protections / Speed governors / Retractable Seat belts to enhance Safety in road transportation.
- d) Fittings for Top and Bottom loading have been included.
- e) Protection for tank body against lateral and longitudinal impact during overturning.
- f) Colour scheme to identify tank Lorries carrying POL products.
- g) Inspection and maintenance of vehicle components.
- h) Adoption of new technologies to enhance road safety.



## 4.0 ENGINE

### 4.1 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.

### 4.2 TYPE

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

### 4.3 AIR INDUCTION SYSTEM

The air induction system shall be located and / or protected so as to minimize 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 arrestor or air cleaner having effective flame arrestor characteristics, installed and capable of preventing emission of flame from the side of the engine in the event of backfiring.

### 4.4 EXHAUST SYSTEM

The exhaust system shall be located in such a way that any spillage or leakage of the flammable liquid cannot normally impinge on the heated surfaces of the system.

The Exhaust System shall be so directed or protected to avoid any danger to the load through heating or ignition.

All present and future models of the vehicles, the engine exhaust system shall be clear of the chassis frame and it shall not be between the chassis and the load body. The exhaust tail pipe shall open at the right side of the chassis frame.

However for BSIV and higher models, the exhaust can be at the rear of the cabin as per PESO approval. Parts of the exhaust system, if situated directly below the fuel tank (diesel) or below the cargo tank, shall have a clearance of at least 100 mm or be protected by a thermal shield. As an additional safety, an additional protective shield shall be provided over the exhaust system, such that there is no spillage of petroleum product directly on bare exhaust system as approved by PESO.

The exhaust pipe shall be fitted with Spark Arrestor procured from PESO approved manufacturer and shall have embossing of PESO approval number. The Spark Arrestor shall be welded to the exhaust pipe. Cinder box (soot trap) shall be cleaned at regular intervals.

If the exhaust of the diesel engine is based on design having electronic fuel management with unit injectors and electronic control unit coupled with turbo charger and inter cooler arrangements, no separate spark arrester need to be provided. However such models shall have PESO approval.

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### 4.5 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 tank truck discharge faucets. Any exception shall be with additional safety measures as approved by PESO

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.

### 5.0 TANK MATERIAL SPECIFICATIONS

The tank shall be constructed of mild steel or High Strength Alloy Steel or Austenitic Stainless Steel or Aluminum Alloy having the following requirements approved by PESO.

#### 5.1 PHYSICAL REQUIREMENTS:-

Mild Steel or High Strength Alloy Steel or Austenitic Stainless Steel

Property	Mild Steel (MS)	High Strength Low Alloy Steel (HSLA)	Austenitic Stainless Steel (SS)
Yield Strength	1,700 Kg/ Cm <sup>2</sup>	3,100 Kg/ Cm <sup>2</sup>	1,700 Kg/ Cm <sup>2</sup>
Ultimate Strength	3,100 Kg/ Cm <sup>2</sup>	4,200 Kg/ Cm <sup>2</sup>	4,900 Kg/ Cm <sup>2</sup>
Elongation, 50mm samples	20%	25%	30%

Aluminum Alloys: Only aluminum alloy material suitable for fusion welding and in compliance with ASTM B-209 Alloy 5052, 5086, 5154, 5254, 5454, 5652 or equivalent specification for Aluminum and Aluminum Alloy sheet and plate, shall be used.

All heads, baffles, and ring stiffeners shall be permitted to use zero temper (annealed) or stronger tempers and all shells shall be made of materials with properties equivalent to H 32 or H 34 tempers, except that lower ultimate strength temper shall be permitted to be used if the minimum shell thickness are increased in inverse proportion to the lesser ultimate strength.

#### 5.2 THICKNESS OF METAL

Minimum thickness of the tank shall be related to the volume capacity of the tank expressed in



litres per centimeter and the distance between partitions or baffles or other stiffeners as well as to major radius of shell curvature as specified in the table below:-

	Volume Capacity in Liters per Centimeter									
		Up to 21			Over 21 to 27			Over 27		
Maximum Shell Radius	Distance between Heads, Baffles, or Ring Stiffeners	MS (mm)	HSLA, SS (mm)	AL (mm)	MS (mm)	HSLA, SS (mm)	AL (mm)	MS (mm)	HSLA, SS (mm)	AL (mm)
Less than 175 cm	90 cm or less	2	2	2.2	2	2	2.5	2.5	2	3
	Over 90 cm to 135 cm	2	2	2.5	2.5	2	3	3	2	3.5
	Over 135 cm	2	2	3	3	2	3.5	3.5	3	4
175 cm or more, less than 225 cm	90 cm or less	2	2	2.5	2.5	2	3	3	2	3.5
	Over 90 cm to 135 cm	2	2	3	3	2	3.5	3.25	3	4
	Over 135 cm	3	2	3.5	3	3	4	3.5	3	4.5
225 cm or more, less than 310 cm	90 cm or less	3	2	3	3	2	3.5	3.25	3	4
	Over 90 cm to 135 cm	3	2	3.5	3	3	4	3.5	3	4.5
	Over 135 cm	3	3	4	3.5	3	4.5	4.2	3	5
310 cm or more	90 cm or less	3	2	3.5	3.5	3	4	3.5	3	4.5
	Over 90 cm to 135 cm	3.5	3	4	3.5	3	4.5	4.2	3	5
	Over 135 cm	3.5	3	4.5	4.2	3.5	5	4.5	4.2	6

Note: If the tank has other than circular cross-section, the radius for the purpose of this table shall be the maximum for that portion of the cross-section under consideration.

## 6.0 TANK DESIGN

- 6.1** Tank truck shall be designed and constructed ensuring correct structural relationship between the cargo tanks, the propulsion equipment and supporting members, its ruggedness, safe road performance and braking power.
- 6.2** Tank truck shall comply with the Motor Vehicles Act, 1988, and the rules framed there under.
- 6.3** Tank truck 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.
- 6.4** Registered laden weight (RLW) of the vehicle shall not exceed the authorized registered weight of the vehicle by concerned transport authority or manufacturer, whichever is less. The weight of product filled plus the unladen weight shall not exceed RLW or the licensed capacity as permitted by statutory authority.



- 6.5** 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 at geometrically Centre of the compartment and not less than 450 mm in diameter. This shall be ensured during fabrication of tank truck.
- 6.6** 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.
- 6.7** The height of cabin shall be more than the height of the tank. The overall height of a motor vehicle (including cabin) measured from the surface on which the vehicle rests shall be as per CMV-Rules. Width of the cabin shall be more than the width of the tank body.
- 6.8** No modification/alterations shall be carried out on the chassis provided by Original Equipment Manufacturer (OEM).
- 6.9** Division of tank into compartment
- A tank having a net capacity exceeding 5 kilolitres but not exceeding 25 kilolitres. shall be divided into compartments by oil-tight partitions and no compartment shall have net capacity exceeding 5 kilolitres,
  - A tank having a net capacity exceeding 25 kilolitres shall be divided into compartments by oil-tight partitions and no compartment shall have net capacity exceeding 7 kilolitres.
  - The net carrying capacity of a tank truck or a tank semi-trailer shall not exceed 40 kilolitres of petroleum except in case of air-craft refueller in which case it shall not exceed 50 kiloliters.
  - The net carrying capacity of any tank trailer shall not exceed 5 kiloliters of petroleum.
- 6.10** Tank ends shall be dished. Every partition shall be either dished, corrugated, reinforced or rolled. Flat partitions without reinforcement shall not be allowed. 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.
- 6.11** The distance between two partitions, and any adjacent tank end and a partition, shall not exceed 2500 mm.
- 6.12** Baffles shall be continuously welded to the shell.
- 6.13** All joints shall be welded conforming to IS 814. This shall include attention to the following
- Weld joint preparation.
  - Welding procedure.
  - Weld thickness.
  - Acceptable limits of welding defects considering the fact that the welds are to be accepted without radiographic test.
  - 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.
  - 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.



- 6.14** Every compartment shall be tested by air or hydrostatic pressure of minimum 0.316 kg/sq.cm. gauged at the top of the compartment, at time of manufacturing of tank truck. Thereafter hydro testing or air pressure testing is to be carried out once in five years and after any repair of the tank, whichever is earlier.

The detailed process is as follows:-

- a. Hydro testing of each compartment can be done 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 ten minutes.
- b. Air Pressure if used shall be held for a period of at least five minutes during which the entire surface of all joints under pressure shall be coated with a solution of soap and water, heavy oil, or any material suitable for the purpose, foaming or bubbling of which indicated the presence of leaks.
- c. During testing, all the closures shall be in place and the operating relief devices shall be clamped, plugged or otherwise rendered inoperative.
- d. 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.

- 6.15** Centre of gravity of fully loaded tank truck shall not be higher than that recommended by the chassis manufacturer. Sample Design and Stability Calculations are given as **(Annexure I)**.

- 6.16** Every tank vehicle used for the transport of petroleum, in bulk on land shall be built, tested and maintained in accordance with the requirements laid down in the Third Schedule of Petroleum Rules and be of a type approved in writing by PESO.

- 6.17** Tank vehicle meant for the carriage of petroleum in bulk shall not be used for any other purpose except when so authorized by PESO in writing.

**6.18 TRAILER**

Trailers used for carrying petroleum products shall conform to the following in accordance with petroleum Rules-2002

- a. A tank trailer not exclusively used for transporting petroleum shall not be attached to any vehicle for transporting petroleum.
- b. A tank trailer transporting petroleum shall not be attached to any vehicle other than a vehicle used exclusively for transporting petroleum and not more than one trailer shall be so attached.
- c. A tank trailer shall not be attached to a tank semi-trailer or a trailer.
- d. A tank trailer or tank semi-trailer shall have reliable brakes and all wheels which shall be capable of efficient operation from driver's seat of the vehicle towing the trailer.



- e. The width of the tank trailer or a tank semi-trailer shall be less than the overall width of the towing vehicle
- f. A tank trailer shall be so connected to the towing vehicle as to cause the trailer to follow substantially the path of the towing vehicle and to prevent the tank trailer from whipping or swerving side to side dangerously.
- g. If tank trailer carrying petroleum Class A is attached to a vehicle carrying petroleum Class B or petroleum Class C, the towing vehicle shall comply with all the provisions of these rules relating to a vehicle for the transportation of petroleum Class A.
- h. A trailer other than a tank trailer shall not be attached to any tank truck.
- i. Where a tank trailer is attached to a tank truck, the total quantity of petroleum transported in the tank trailer and the tank truck shall not exceed 15 kiloliters.
- j. No tank trailer shall be attached to a tank truck having a net carrying capacity exceeding 12 kiloliters of petroleum.
- k. No tank trailer attached to a tank truck shall be operated within a thickly populated area without the written permission of the district authority.

**6.19** The tank shall be fabricated and mounted on the vehicle chassis by a manufacturer approved by PESO.

## **6.20 MARKING AND CERTIFYING**

- a. Manufacturer's Certificate: A certificate signed by the manufacturer of the tank certifying that each such tank is designed, constructed, and tested in compliance with these rules shall be procured, and such certificate shall be retained in the files of the carrier during the time that such tank is employed by him.
- b. In addition to this certificate, there shall be marking on every tank on a metal plate not subject to corrosion, located on the left side, near the front, in a place readily accessible for inspection. Such plate shall be permanently affixed to the tank by means of soldering, brazing, welding, or other equally suitable means. It shall be marked in characters at least 5 mm high by stamping, embossing, or other means of forming letters into or on the metal of the plate itself, the information indicated below. The plate shall not be painted so as to obscure the markings thereon.

Manufacturer's Name
Approved place of manufacture
PESO Approval No. and date
Manufacturer's Serial No
Date of manufacture





Date of manufacture
Original test date (MM/YY)
Test pressure in PSI
Shell material
Weld material
Nominal tank capacity by compartment (front to rear) in KL
Empty weight and tank fittings in Kgs.
Gross vehicle weight. In Kgs.
Loading limits in LPM
Unloading limits in LPM
Date of Tank test.

## 7.0 TANK BOTTOM FITTINGS

### 7.1 FOR TOP LOADING TANK TRUCKS

Bottom draw-off / loading systems shall confirm 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 (Master 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. **(Annexure II )**
3. The operating mechanism (Termed Bottom Operator) for the Emergency Shut off Valves shall be provided with a secondary control (Emergency Release) in an easily accessible position remote from all fill openings and the discharge faucets. **(Annexure III-A )**
4. The Bottom Operator (lever connected to the master valve) 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 kg and the two halves shall not separate during normal handling of the valve but shall separate only when the fusible alloy melts not exceeding 93 degrees C. in the event of a fire. Fusible link shall be procured from PESO approved manufacturer. **(Annexure III-B)**
5. The Emergency Valve shall incorporate a shear off section designed to break when subjected to





excessive strain.

A shear off section which will break under strain shall be provided between the internal shut off valve and discharge faucet. The shear off section shall be located in the piping system outboard of each tank internal valve and within 100 mm of the major radius of the tank shell or within 100 mm of sump, but in no case more than 200 mm from the major radius of the tank shell.

The shear off section shall be machined in such a manner as to abruptly reduce the wall thickness of the adjacent piping (or valve) material by at least 20 percent. **(Annexure IV)**

The minimum allowable road clearance of any tank compartment or protection device located between any two adjacent axles on fully loaded vehicle or vehicle combination shall be at least 4 cm of each 100 cm separately such axles and in no case less than 30.5 cm.

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.
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. Each compartment of a tank shall be fitted with a discharge faucet which shall be substantially made and so attached. The discharge end of the faucet shall be threaded or so designed as to permit the hose being tightly coupled to it.
9. Steel gate valves used for tank faucet shall confirm to IS 10611:1994
10. Provision shall be made to prevent damage to pipework due to vibration by the incorporation of flexible bellow connections within pipework runs.

Typical drawing of the top loading tank truck is shown as **Annexure V- A.**

Typical drawing of BS-IV tank truck with exhaust system is shown as **Annexure V- B.**

## 7.2 BOTTOM LOADING TANK TRUCKS

### 1) MASTER VALVE

Each compartment shall be provided with master valve at the bottom of the compartment.

- a. Master valve may be mechanically operating type or pneumatically operating type.
- b. There shall be fusible element which shall melt off at a temperature not exceeding 93 Deg. C and the master valve shall get closed automatically in case of fire at the bottom of the tank truck.
- c. In case it is mechanically operated it shall be operable from the rear side of the tank truck by operating the levers.
- d. In case it is pneumatically operated, the pneumatic switch shall be provided for routine operation,



However 2 nos. emergency push button shall be provided an easily accessible position remote from all fill openings and the discharge faucets, which will close all emergency valves simultaneously.

- e. The master 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.

## 2) SHEAR-OFF SECTION

Shear off section shall be provided to protect master valve from getting damaged in case of accidental impact on the pipe connecting discharge faucet. Such section shall be clearly marked.

The shear off section shall be machined in such a manner as to abruptly reduce the wall thickness of the adjacent piping (or valve) material by at least 20 percent.

## 3) BOTTOM LOADING ADAPTERS/ VALVES

Each compartment shall be fitted with adapter/valve for loading/unloading operation **(Annexure VI)**.

## 4) BOTTOM LOADING ADAPTER

- a) Bottom loading adapter must be installed on one side (left) of the tank truck
- b) Vertical centerline of the adapters shall be at least 10 inch (254 mm) apart from each other.
- c) Face of the adapter must be in vertical plane and must be located not more than 6 inch (150 mm) inside the maximum width of vehicle in adapter area.
- d) When multiple adapters are installed, adapters must not be horizontally spaced more than 6ft (1.83 m) from center.
- e) Adapters must be installed on center that are not more than 4.5ft (1.37 m) from ground level when vehicle is empty and not more than 2ft (0.61 m) above ground level when tank is full.
- f) To mate with loading couplers, tank truck adapter shall meet API-RP-1004 requirements.
- g) The coupler may have manual or automatic opening.
- h) The adapter must have product opening of 4 inch (101.6 mm) diameter at the exposed outer face or closure of the valve.
- i) The adapter must be designed for working pressure of 75 psi and shall not leak at 1.5 times working pressure.
- j) Mating action of coupler/ adapter shall be of push type with provision for locking as approved by PESO.
- k) The coupling range must permit mating of coupler to the adapter in any position in a range of 360 degree without any coupler contacting an adjacent adapter with adequate spacing.



- l) A safety interlock or two step action must be provided on the coupler to prevent any liquid flow while coupling or uncoupling.
- m) A dust cover with liquid tight seal shall be provided to prevent leakage and to protect the bottom loading adapter
- n) Design of adaptor body shall be such that no product residue shall remain in the adaptor.

## 5) VAPOUR RECOVERY ADAPTERS

- i. Vapour recovery adapters shall be 4 inch in size (**Annexure VII**)
- ii. The vapour recovery adapter shall be of different type than used for product loading line adapter.
- iii. The adapter shall be of poppet type.
- iv. The vapour recovery adapter shall be provided with cap.
- v. Vapour recovery system adapter shall preferably be installed at the rear bottom side of the tank on the product discharge faucet side.
- vi. In case, vapour recovery adapter is installed at the top, it should be located adjacent to the dome of the compartment being filled. The cover should not protrude above the rollover protection device.

## 6) PNEUMATIC CONTROL PANEL

- i. Pneumatic control panel shall be provided to operate the entire bottom loading / venting / other safety interlocks system
- ii. This panel should be placed on the discharge faucet side of the lorry.
- iii. The panel shall be well-protected against any impact of collision.

## 7) OPTICAL SOCKET FOR OVERFILL PROTECTION SYSTEM

- i. This shall provide interface between onboard LORRY overfill sensors and terminal loading rack/control system.
- ii. This shall be provided on the faucet side of the lorry.
- iii. Optic socket design shall be as per API RP 1004

## 8) AIR INTERLOCK VALVES

This is a safety device to engage lorry brakes when button is compressed preventing lorry from driving away during loading/un-loading.

Typical fittings of bottom loading tank truck are shown as **Annexure VIII**.

## 8.0 TANK TOP FITTINGS

### 8.1 TOP LOADING TANK TRUCKS

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 at geometrically centre of the compartment and not less than 450 mm in diameter

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 (studs shall not be used for manhole fitment) airtight fixing all around and a 3 mm thick compressed nitrile cork gasket. ISI marked bolt to be used.

The Manhole shall be enclosed in a dome cover having an internal hinge joint at one end and provision for sealing/locking arrangement at the other end. (**Annexure IX**). 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

#### 1. FILL PIPE

- (I) Fill pipe shall be of mild steel of size minimum 100 mm nominal bore and flange mounted / welded to the manhole base late. 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 shall have openings in the wall not greater than 13 mm in diameter, minimum four holes on diametrically opposite side at two different levels, which should be above the maximum level of the tank contents in order to provide a pressure balance. (**Annexure X**)

All the holes on the wall of the fill pipe shall be covered with two layers of wire mesh gauze (not less than 11 to the linear centimeter), to work as flame arrestor. The stainless steel/brass 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. The internal fill pipe is to have a gauzed opening of minimum 140 Sq. mm at the top level.

- (II) The inner end of the fill pipe shall be provided with a splash deflector arrangement (45-degree angular cut).
- (III) Top open end of the fill pipe shall be externally threaded and fitted with an oil-tight locker cap of non-ferrous metal. The cap shall be fine finished from the inside and provided with a compressed nitrile cork gasket.

#### 2. DIP PIPE

- (i) Dip pipe of nominal bore of 25 mm shall be of mild steel The Dip Pipe shall be welded to the manhole base plate at the geometrical centre of the manhole and compartment. It shall be extended to the datum plate which is at the bottom of the tank and shall be supported against vibration. The dip pipe shall extend up to 25 mm from the datum plate. The pipe shall be truly vertical when the bottom of the tank is horizontal.

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- (ii) Internally, the pipe shall be provided with 5 mm dia holes, diametrically opposite throughout its length and circumference, including at a level above the maximum level of the contents. The vertical distance between the holes shall not be more than 100 mm. The pipe shall not be sealed at the bottom. The openings shall be covered with 2 layers of wire gauze having not less than 11 meshes per centimeter. **(Annexure-X)**
- (iii) 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.
- (iv) 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.
- (v) A datum plate of size 100 x 100 mm and thickness not exceeding 5 mm shall be provided exactly below the dip pipe. The plate shall be weld fitted to avoid tampering.

**3. PRESSURE-VACUUM VALVE**

- (i) Pressure Vacuum valve procured from PESO approved manufacturer shall be mounted on the manhole cover base plate. Specimen drawing is enclosed as **Annexure XI**.
- (ii) PV 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. PV valve manufacturer shall give test certificate to this effect.
- (iii) The settings of the P/V valve shall be
  - Pressure: 210 cm of water gauge
  - Vacuum: 5 cm of water gauge
- (iv) PV 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.

**4. EMERGENCY VENT**

- (i) In addition to the venting through PV valves, each tank compartment shall be equipped with pressure actuated vent or fusible vent or a combination of both, but fusible vent shall not be provided on tanks of capacity 25 kl and above.
- (ii) Pressure actuated emergency vent or vents wherever provided shall be set to open at not less than 0.21 kg/cm<sup>2</sup> and close when the pressure drop 0.21 kg/cm<sup>2</sup> or below and pressure- actuated devices shall be designed so as to prevent leakage of liquid past the device in case of surge or vehicle upset, except that they shall function in case of pressure rise under any condition of vehicle rollover and the relieving capacity of pressure actuated vents shall be related to the capacity of the compartments and shall not be less than as under

Net capacity of tank compartment (KL)	Minimum Emergency Venting (M3 / Hr.)
1	1474



2	1753
3	2372
4	2990
5	3509
6	4083
7	5273

- (iii) An emergency vent procured from PESO approved manufacturer shall be mounted on the manhole cover base plate. Specimen drawing is enclosed as Annexure XII.
- (iv) The fusible type emergency vent wherever provided shall provide a minimum fire venting opening of a net area in sq. cm. equal to 8 plus 4.3 times the gross capacity of the compartment in kiloliters and shall be activated by elements operating at temperature not exceeding 93 degree centigrade and emergency fusible vent shall be so designed as to prevent loss of liquid through the vent in case of vehicle upset except in case of pressure rise in case of upset position.
- (v) The opening on the tank for the emergency vent shall be fitted with 2 layers of non-corrosive metallic wire gauze having not less than 11 meshes per linear centimeter to act as fire arrestor. Such wire mesh shall be welded on a circular ring which shall be welded on the opening from the bottom side of the manhole plate.

## 5. VAPOUR RECOVERY SYSTEM

In case vapour recovery system for Top loading tank Lorries is to be provided, it shall be as per the scheme approved by PESO.

## 8.2 BOTTOM LOADING TANK TRUCKS

Each manhole, fill opening and washout assembly must be structurally capable of withstanding, without leakage or permanent deformation that would affect its structural integrity, a static internal fluid pressure of at least 36 psig (2.53 kg/cm<sup>2</sup>) or cargo tank test pressure, whichever is greater.

Following fittings shall be provided within each manhole plate

### 1. DIP PIPE

Dip pipe shall be provided in the geometrical centre of the compartment. This shall meet all other specification as mentioned for top loading tank Lorries.

### 2. PRESSURE ACTUATED FLAP (PAF): (Annexure XIII)

Pressure actuated flap (PAF) with PV valve shall be provided on every compartment manhole.

PAF of minimum 10" dia provided on manhole cover set to open at not less than 3.63 PSI (0.255 kg/cm<sup>2</sup>), however it shall not allow any pressure built up beyond 0.316 kg/cm<sup>2</sup> (hydrostatic pressure of tank) in compartment in any case.

The PAF shall provide a minimum opening having a net area in sq. cm. equal to 8 plus 4.3 times the gross capacity of the compartment in kiloliters.



PAF shall be capable of withstanding, a static internal fluid pressure of 36 psig (2.53 kg/cm<sup>2</sup>) without leakage or permanent deformation so as not to affect its structural integrity of manhole.

Safety Latch shall be provided to prevent the cover from opening fully when internal pressure is present in the compartment.

PAF shall be so secured to prevent opening of covers due to vibration under normal transportation conditions or shock impact due to a rollover accident on the roadway or shoulder where the fill cover is not struck by a substantial obstacle.

### 3. PV VALVE: (Annexure XIV)

Pressure/Vacuum valve (PV valve) provided on PAF with pressure rating of 3 PSI (210 cm of water gauge) and vacuum rating 5 cm of water gauge (0.005 kg/cm<sup>2</sup>).

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. PV valve manufacturer (approved by PESO) shall give test certificate to this effect.

### 4. VAPOUR VENT: (Annexure XV)

The vents installed on the manhole of the compartment shall have sufficient capacity to prevent damage to the compartment from vapour pressure at maximum loading rate when the tank is vented at atmospheric pressure. Vapour vent shall be pneumatically operated.

It shall be additionally provided with increased spring tension to ensure quick & tight closure of the vent.

Poppet of individual compartment vapour vent shall open into the tank under pressure in normal condition. This feature shall prevent surge pressure leaks & spills in case of roll over.

### 5. OVER FILL PROTECTION SYSTEM:

- i. Each compartment shall be provided with independent overfill sensor which shall give signal to the loading system, whenever the product in the compartment reaches the overfill limit.
- ii. The overfill sensor positioning shall be placed at a position which will ensure that the compartment does not get overfilled at maximum loading rates.
- iii. Interlock shall be provided between overfill protection system and loading rack.
- iv. The overfill sensor shall be of PESO approved make only.

### 6. DOME COVER:

The manhole shall be enclosed in a dome cover having an internal hinge joint at one end and provision for sealing/locking arrangement at the other end. The dome cover shall not restrict the emergency venting capability of the vapour or liquid emergency vent.

### 7. VAPOUR RECOVERY ADAPTORS & SAFETY VENTS:

#### (a) When Vapour recovery system is available

When a vapour recovery system is installed on a vehicle equipped for bottom loading, the system must



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terminate in 4 inch adapter. Vapour recovery system shall be designed so as to ensure at any point of time vapour pressure inside the tank truck does not exceed its design pressure while loading.

**(b) Vapour Dump Vent (Annexure XVI)**

Vapour dump vent is provided for release of vapour, when no vapour recovery system is connected In-built flame arrestor to be provided for the vapour dump vent. Vapour Dump Vent and Vapour Recovery adapter shall have interlocks such that once vapour adapter is connected, vapour dump vent closes. Otherwise, vapour dump vent shall remain in open condition.

## 9.0 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 2g in the direction of travel, 1g at right angles to the direction of travel, 1g vertically upwards or 2g 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.

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.
- d) The tank mounting on the chassis shall be as per the recommendations of the chassis manufacturer.
- e) Anchors shall not allow any movement between the tank and the vehicle during starting, stopping and turning.
- f) All anchors shall be installed in a manner so as to be easily accessible for inspection and maintenance.
- g) 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.
- h) Packing shall be provided between saddle plate and the chassis as per recommendation of chassis manufacturer.
- i) 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.
- j) Tank/Vessel shall be made electrically continuous with the chassis of the vehicle by providing





heavy duty bonding cable / braided wire with proper lug. Tank / Vessel shall be provided with heavy duty earthing arrangement like boss or cleat on stiffener plate for facilitating earthing during loading / unloading operation.

## 10.0 CATWALK

- 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. (Typical drawing is given in **Annexure XVII**).
- Catwalk shall be made of chequered plates or gratings.
- Catwalk supports shall not be welded directly to the tank shell but welded with a padding of 5mm thick plate of size 100x 100 mm.
- In case of Alternative II mentioned in Section No. 11, catwalk shall be above the level of the fittings and capable of withstanding the double the weight of the loaded tank truck.
- 1 No. ladder shall be provided at the rear of the tank.
- Suitable fall protection system shall be provided to ensure safety of the personnel working on top of the lorry.
- Toe guard of minimum height of 6 inch shall be provided around the top edge of the tank truck to enhance safety of personnel working on the top of lorry.

## 11.0 ACCIDENT AND TANK OVERTURN PROTECTION

- All top fittings shall be protected against damage from rollover accidents. This can be achieved by any of the two alternatives below

Alternative I	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. The area enclosed in such protection shall be adequately drained and provided with plugs or cut-outs, to enable the section to be gas freed completely before repair ( <b>Annexure V A.</b> )
Alternative II	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 d of Section No. 10.

- All the fittings shall be provided within the manhole cover base plate.
- Manhole cover lids as specified in Section No. 8 shall be provided.
- 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.

Following crash avoidance features may be considered subject to PESO and other statutory approvals to improve safety features of Tank trucks

### 1. ELECTRONIC STABILITY CONTROL (ESC) SYSTEM

By applying braking to selected wheels, an ESC system assists to correct a deviation from the driver's desired course. The ESC system assesses the driver's intended path and compares it with the actual direction by monitoring the driving inputs (throttle, braking level and steering angle) and the vehicle's performance (lateral deceleration, yaw deceleration and wheel speeds).

### 2. DRIVER FATIGUE MONITORING SYSTEM

Driver fatigue monitoring systems are being developed worldwide using varying technologies, including steering wheel monitors and eye monitoring. Camera systems, mounted in the cabin of the vehicle or fitted to special glasses worn by the driver can focus on each of the driver's eyes.

An optical processing unit measures the time taken for the eyelid to reopen after each blink. Slower eyelid responses indicate driver fatigue and the system combats this in two ways

- Firstly, an audible warning is produced to provide an immediate fatigue warning.
- Secondly, the system compiles a fatigue history that a supervisor can download and review.

### 3. WHEEL NUT INDICATORS AND LOCKS

Checking that all wheel nuts are properly fastened prior to driving is good practice and highly advisable when wheels have been changed. Wheel Nut Indicators are plastic caps which can be fitted over the hexagonal heads of the wheel nuts. The way they are positioned provides a pattern which indicates whether the nuts have loosened over the course of a journey.

Wheel Nut Locks come in the form of a plastic strap which is shaped to fit over the wheel nuts and lock them in place. Even if the nuts loosen slightly they are prevented from coming off, preventing any wheel detachment. Installing wheel nut indicators and locks can reduce maintenance time and both can be easily identified visually.

### 4. DAYTIME RUNNING LAMPS (DRL)

Daytime running lamps are forward facing white lamps, fitted to the front of vehicles. Their function is to make the vehicle more conspicuous against its background at times when headlamps are not typically switched on.

DRL automatically switch on when the engine is started and are designed to switch off when dipped-beam head lights are switched on.

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DRL increases road safety as they substantially raise the visibility of motor vehicles to other road users through a specially designed light beam pattern that controls glare and improves the extent to which the light can be seen with peripheral vision.

### 5. BLIND SPOT ELIMINATION / ENHANCED DAYTIME VISION SYSTEM

A blind spot elimination system assists to provide the driver with a complete view of spaces around the vehicle as well as providing audible and visual warnings. This can be achieved by using a combination of extra mirrors, sensors or cameras mounted on the sides and rear of the heavy vehicle.

Whilst offering great potential in avoiding collisions care must be taken when installing the display screen in the cabin in such a way as to provide the driver with information when desired, without posing as a potential distraction.

A good system has infra-red sensors for night time use. Some systems also operate as rear parking aid systems. Mirror and camera-based blind spot elimination systems can be used.

### 6. CORNERING LAMPS

Cornering lamps complement the functionality of headlamps. While headlamps provide superior illumination of curved roads when driving at normal speeds, cornering lights give better lighting when carrying out low-speed manoeuvres: parking, turning into a driveway, U-turns and driving on extremely winding roads.

When the indicator is activated at low speeds, these lamps illuminate an area to the side of the vehicle, up to 80° of the direction of travel.

### 7. AUTOMATIC TRACTION CONTROL (ATC) SYSTEM

An ATC System complements an ABS and serves to prevent loss of traction which can result in rear-end slipping with a two-staged response

- Firstly, the ATC reduces the drive torque.
- Secondly, it applies the service brakes on one or both sides of the drive wheels to prevent slip and to 'lock' the differential action.

ATC is widely used on Lorries that routinely encounter poor road conditions such as on logging and construction sites.

### 8. REVERSING SAFETY SYSTEMS

The following three technologies will assist drivers to avoid crashes when reversing heavy vehicles

- i. Reversing Buzzer – provides a warning to other road users that the reverse gear has been selected.
- ii. Reversing Camera – provides the driver with a view of the space immediately behind the vehicle
- iii. Reversing Sensor – uses an audible alarm to warn the driver that the vehicle is close to an object at the rear.

### 9. ALCOHOL IGNITION INTERLOCKS



Alcohol ignition interlock systems require the driver to provide a breath sample before operating a vehicle. The technology assesses the blood alcohol concentration (BAC) of the driver and will immobilize the vehicle if the driver exceeds the pre-set BAC limit.

## 10. TYRE PRESSURE MONITORING SYSTEMS

Online tyre pressure reading will be captured in cabin console and low pressure alarm shall be generated if pressure in tyre is below the recommended pressure setting by OEM.

## 11. SAFETY BELT ALARM SYSTEM

Retractable safety belt with alarm indicator should be captured in cabin console. Alarm will be generated if driver is not wearing safety belt when the ignition is “ON”.

## 12. SAFETY AIR-BAG

Safety air bags should be provided for driver and helper. The system will actuate during accident protecting the lives of crew.

## 13. TACHOGRAPH

Tachograph to be fitted in the cabin of the vehicle as per requirement

## 12.0 REAR-END & UNDER RUN PROTECTION

### 12.1 REAR END PROTECTION

Every tank shall be provided with a rear bumper to protect the tank and piping in the event of rear end collision and to minimize the possibility of any part of the colliding vehicle striking the tank or any piping containing product.

- The bumper shall be so located that its inside face is never less than 150 mm to the rear of any vehicle component that is used for loading or unloading purposes.
- The bumper shall be extended on each side of the tank to at least the maximum width of the vehicle.
- The bottom surface of the bumper must be at least 100 mm below the lower surface of any part of tank or piping which contains product during transit and not more than 1 m from the ground when the vehicle is empty.
- Structurally, the bumper shall be designed to successfully absorb the impact of the vehicle with the rated payload with a deceleration of 2g using a factor of safety of two based on the ultimate strength of bumper material and for the purposes of these rules such impact shall considered uniformly distributed and applied horizontally from any direction at an angle not exceeding 30 degrees to the longitudinal axis of the vehicle.



## 12.2 UNDER RUN PROTECTION

- All vehicles shall be protected by a robust steel bumper with Rear and side under run protection device as per IS: 14812-2000, IS: 14682-1999 and as per CMV Rules.
- The under Run protections shall be painted with yellow and white zebra stripes on the entire rear face of the device.
- Under run protection shall be so constructed and or equipped so as to offer effective protection to unprotected road users against risk of falling under side of the vehicles and being caught under the wheels.

## 13.0 ELECTRICAL SYSTEM

**13.1** The electrical system shall be designed, installed and adequately protected so as to minimize 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) The Generator, battery, switches and circuit breakers shall be located in the cabin of the vehicle or in the engine compartment and the battery shall be in an easily accessible position with an approved type heavy duty switch (double pole, minimum 300 amps ratings) for breaking the electrical circuits which shall be placed close to the battery as possible
  - i. Direct or indirect control devices (electrical device) shall be installed, one in the driver's cabin and second on the outside of the vehicle. Both the devices installed, inside and outside the cabin of the vehicle, shall be readily accessible and distinctly marked. The control device located in the driver's cabin shall be within immediate reach of the driver and it shall be protected against inadvertent operation by either adding a protective cover, or by using a dual movement control device or by other suitable means.
  - ii. It shall be possible to open the switch while the engine is running without causing any dangerous excess voltage and the operation of the switch shall not constitute a fire hazard in the explosive atmosphere which can be ensured by using a switch having a casing with degree of protection as per IP 65.
  - iii. The cable connection on the battery master switch shall have a degree of protection IP 54, save if such connection is contained in a housing which may be a battery box.
  - iv. The battery terminals shall be electrically insulated or covered by an insulating battery box cover which is properly vented.



- d) Generators and motors and switches thereof which are not installed within the engine compartment and which remains energized when the battery master switch is open shall be suitable for use in hazardous area and shall meet appropriate requirements of Indian standards for the relevant gas group

Provided that where such generators or motors or switches thereof are installed in an enclosed space, adequate provision shall be made for air circulation to prevent overheating and possible accumulation of inflammable vapors

The battery terminals shall be covered by terminal cap and battery shall be kept inside insulating battery box cover.

- e) All cables shall be secured on the vehicle so that they are protected against mechanical damage and heat.
- f) All control switches shall be in the feed side of the circuit.
- g) All cables shall be armoured and passed through suitable ducts and secured at suitable places in such a manner that during normal use of vehicle the cables are not subjected to mechanical/chemical damages.
- h) 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.
- i) Junction boxes, connectors and all electrical equipment shall be adequately protected and shielded from the ingress of moisture or flammable liquid.
- j) 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.
- k) To enable electrical circuits to be isolated (including any open circuit of alternator field windings), a multi pole master switch shall be fitted as close to the battery as possible and shall comply with the following provisions
- 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.
- l) The electrical circuit provided by the vehicle manufacturer, which is type approved by PESO, shall not be modified.



- m) Electrical cables shall be located such that no part can make contact with any fuel line or exhaust system subjected to excess heat. Suitable insulation shall be provided where such electrical circuits are necessary.

### 13.2 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.

### 13.3 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. The electrical resistance from the external earth lead connector of the vehicle to the ground through the tyres shall not exceed 10 ohms. Bonding wire with crocodile clips shall be always available with the vehicle.

All discharge hoses shall be electrically continuous. Fire retardant hose (braided rubber / composite hose, (EN 13765- 2010) bearing ISI mark or equivalent for the type of petroleum product shall be carried in the licensed vehicle at all times.

## 14.0 DRIVER'S CABIN & CHASSIS





#### 14.1 DRIVER'S CABIN

- a) The height of the vehicle cabin shall be more than that of the tank. In case, the height of the tank is higher than the cabin a suitable height barrier shall be provided on the cabin so that the tank is protected from hitting the overhead obstructions.
- b) The cabin of the vehicle shall be of all metal construction and its rear window, if provided, shall be fully covered with wired glass. Alternatively the cabin and the engine shall be separated from the tank or the load, as the case may be, by a fire resisting shield which shall fully cover the tank or load. Only materials not readily flammable shall be used in construction of cabin components,
- c) There shall be a clear space of at least 150 mm between the tank and the back of the cabin.
- d) A portable ISI marked 9/10 kg cartridge type or stored pressure type DCP extinguisher shall be provided in an easily accessible position away from the discharge faucets on every vehicle. One portable ISI marked 1 kg DCP or 2kg CO<sub>2</sub> fire extinguisher shall be kept in the cabin of the vehicle. All extinguishers must have marking indicating the date for pressure testing.
- e) Petroleum tankers shall be fitted with blind-spot mirrors that give drivers a wider field of vision than conventional mirrors.
- f) All petroleum tankers shall be fitted with vehicle flame proof reversing horn which is clearly audible for by standers.
- g) Seats with retractable seat belts shall be provided for driver and crew.
- h) All vehicle shall have wipers on both the wind screens at all times.
- i) Tyres of the motor vehicles shall be enveloped with effective mud guards.
- j) First aid kit containing items notified under CMV rule shall be provided in the cabin.
- k) Vehicles shall have two wheel chocks.
- l) All tankers shall have two triangles of size 500 mm +/- 50 mm with a red reflecting surface as per CMV rules & AIS 022: 2001 for keeping in front and rear of the vehicle in case the vehicle is stranded on the road.
- m) All petroleum tankers shall be fitted with Anti-lock Braking System
- n) Vehicle monitoring system (VMS) / Vehicle Tracking System (VTS) shall be provided as an additional road safety measure.
- o) The vehicle cabin shall be well ventilated; however vehicles manufactured on and after the 1st January, 2018 shall be fitted with an air conditioning system or with the ventilation system in



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accordance with CMV Rule.

- p) Vehicles shall be fitted with speed limiting device or speed limiting function conforming to AIS-018 2001. The speed governor of every transport vehicle shall be so set that the vehicle is incapable of being driven at a speed in excess of the maximum preset speed of the vehicle except down an incline.

## 14.2 CHASSIS

- i. Unauthorized alterations shall not be permitted on the chassis or any of its aggregates or components.
- ii. No part of the braking system, electrical system, steering system or suspension system shall be altered, when the body is made outside the vehicle manufacturer facilities.
- iii. No part of chassis shall be altered which affects the stability of the vehicle.
- iv. Any unauthorized modification shall call for fresh type approval from OEM.

## 15.0 SPARK ARRESTOR

- a) Spark Arrestor procured from PESO approved manufacturer shall be fitted at outlet of exhaust pipe of the vehicle to avoid emission of sparks. (Specimen drawing enclosed as ( **Annexure XVIII**)).
- b) Its inlet end with swirling blade assembly shall be welded with the outlet end of the vehicle exhaust pipe.
- 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.
- e) If the exhaust of the diesel engine is based on design having electronic fuel management with unit injectors and electronic control unit coupled with turbo charger and inter cooler arrangements, no separate spark arrestor need to be provided, in line with PESO approval.

## 16.0 THIRD PARTY INSPECTION

### 16.1 FABRICATION



Inspection at every stage of fabrication of a POL Tank truck is necessary to ensure that design, materials and fittings as per the specification are used and fabrication is carried out exactly as per the PESO approved drawings and other technical details.

## 16.2 INSPECTION AGENCY

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

## 16.3 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 / any other metal alloy duly approved by PESO 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 (Hydro testing, 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.

## 16.4 VARIOUS STAGES OF INSPECTION

### 16.4.1 1<sup>st</sup> stage:

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

### 16.4.2 2<sup>nd</sup> stage



- a) Inspect that the welding is 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 hydro testing.
- 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.

#### 16.4.3 3<sup>rd</sup> 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) Pressure testing 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.
  - j) Test certificates, Inspection records for the above fabrication stages duly approved by the competent authority shall be available with the tank truck for verification.
- Test Reports for MOC, physical properties like yield strength, % elongation, thickness etc. of sheets/ pipes used for fabrication of tank.
  - Welding materials used for fabrication
  - Duly approved & executed WPS (Welding Procedure), QAP (Quality assurance plan) and ITP (Inspection & Test plan).




- Details of PESO approvals for PV Vents, emergency vents, Pressure actuated flap (PAF), master Valves, Fusible Links, spark arrestor, fitted on the tank truck.
- Zone Zero certificate for Over fill sensors
- Dimensional check for Tank & Cabin for various critical dimensions, safety clearances as per the approved PESO drawing.
- Pressure testing certificate indicating Test pressure and hold time.
- Certification conforming electrical system meeting requirements mentioned in this standard.
- Fabricator Certification conforming cabin meeting requirements as per automotive industry standard and other fittings as mentioned in this standard.

#### 16.4.4 4<sup>th</sup> stage: (Inspection during Operation)

Sr.no	Description	Frequency
1	Check for physical dimensions as per drawings	Yearly
2	Visible signs of tank damage	Yearly
3	Check for external painting	Yearly
4	Safety fitting inspection	Quarterly
5	Inspection of Internal fittings	Yearly
6	Pressure testing of the tank as specified in tank design	5 years / after tank repairs/ tank Modifications
7	Condition of fire extinguisher and first aid box	Monthly
8	PV vent & PAF testing	Yearly
9	Leak test for tank compartments (Compartment to be filled up to the brim)	Yearly
10	Visual Inspection of chassis, mounting ,anchoring	Yearly
11	Visual Inspection of Tyres (Minimum 1.6 mm nonskid depth above tread wear indicator embedded in tyre)	Quarterly

## 17.0 COLOUR SCHEME

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

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- b) Colour coding scheme of tank truck cabin and tank shall be in line with CMV rule.
- c) Every tank truck shall have an Emergency Information Panel 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. The same shall be done with reflective paint / reflective sticker for easy identification during night.
- d) Reflective stickers shall be affixed on the petroleum tank truck in accordance with section 104 of CMV Rules.
- e) “ML” and "Highly Inflammable" shall be indicated as laid down in Petroleum Rules.



## 18.0 REFERENCES

*The following codes, standards and publications have either been referred to or used in the preparation of this document, and the same shall be read in conjunction with this document.*

- a) Petroleum Act, 1934, Petroleum Rules 2002 & Petroleum (Amendment) Rules 2011
- b) Motor Vehicles Act 1988, CMV Rules 1989 & CMV (Amendment) Rules, 2015
- 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) Code No. API RP 1004 Bottom Loading and Vapor Recovery for MC-306 & DOT-406 Tank Motor Vehicles
- f) Code for Federal (CFR) Regulations- Title 49 TRANSPORTATION (Part 178)
- g) IS Code No. 814 - Covered Electrodes For Manual Metal Arc Welding Of Carbon Steel And Carbon Manganese Steel.
- h) IS code 10611:1994 Steel Gate Valves (Flanged and Butt-welded Ends) for Petroleum, Petrochemicals and Allied Industries
- i) IS Code 14812 :2000-Automotive Vehicles - Rear Underrun Protective Device - General Requirements
- j) IS Code 14682 :1999- Automotive Vehicles - Lateral Protection (Side Guards) - Technical Requirements
- k) IS Code 2171: 1999- Portable fire extinguishers, Dry powder (cartridge type) – Specification
- l) IS Code 2878:2004- Fire extinguisher, carbon dioxide type ( portable \_and trolley mounted) –specification
- m) AIS 022 :2001 Automotive Vehicles – Advance - Warning Triangles and Conspicuity Marking Tape – Specifications
- n) AIS 018:2001 Automotive Vehicles -Speed Limitation Devices – Specifications
- o) EN 13765:2010 Thermoplastic Multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of hydrocarbons, solvents and chemicals - Specification



## ANNEXURE I

TANK TRUCK DESIGN SAMPLE CALCULATIONS

MODEL: ALCO COMET 3/1

CAPACITY: 12 KL

TANK DIMENSIONS	
MAJOR AXIS (a)	230.00 cm
MINOR AXIS (b)	145.00 cm
SHELL LENGTH (l)	466.00 cm
DISHED END DEPTH (d)	13.00 cm
TOTAL TANK LENGTH	492.00 cm
TANK SUPPORT HEIGHT	22.00 cm
CHASSIS DIMENSIONS	
FRAME HEIGHT	1015.00 cm
WHEEL BASE	447.00 cm
FRONT OVERHANG	111.80 cm
REAR OVERHANG	167.80 cm
OVERALL LENGTH	726.40 cm
DESIGN CALCULATIONS	
CABIN LENGTH	180.00 cm
PLATE THICKNESS (t)	0.32 cm
SHELL VOLUME $1.06 \times 3.14 \times a \times b \times l / 4000000$	12938.31 L
DISH END VOLUME $4 \times 3.14 \times a \times b \times d / 12000$	454.01 L
TOTAL TANK VOLUME	13392.32 L
FILLING RATIO (MAXM. PERMISSIBLE=0.97)	0.90
PRODUCT VOLUME	12000.00 L
PRODUCT DENSITY	0.85 gm/cu/.cm



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PRODUCT WEIGHT	10200.00 kg
STEEL DENSITY (G)	7.85 gm/cu.cm
TANK SHELL WEIGHT $22/7 \times \text{SQRT}(a \times a + b \times b/2) \times I \times G \times t$	707.03 kg
DISH END WEIGHT $1.4 \times 22/7 \times a \times b \times 2 \times g \times t$	184.23 kg
PARTITION NOS.	3.00
NO. OF PARTITION PLATES	2.00
WEIGHT OF EACH PARTITION PLATE	65.80 kg
TOTAL WEIGHT OF PARTITION PLATES	131.60 kg
TOTAL TANK WEIGHT	1022.85 kg
MOUNTING WEIGHT	350.00 kg
WEIGHT OF GUARD AT TOP	60.00 kg
TANK + MOUNTING WEIGHT	1432.85 kg
PRODUCT + TANK + MOUNTING WEIGHT	11632.85 kg
REACTION AT REAR AXLE = $R_r$	
GAP BETWEEN CABIN AND TANK SHELL (e)	15.00 cm
GAP AT REAR END (f)	39.40 cm
TANK C.G. DISTANCE FROM FRONT AXLE	329.20 cm
$R_r$ (FULL)	8567.19 kg
$R_r$ (EMPTY)	3065.66 kg



**TANK TRUCK STABILITY CALCULATIONS (SAMPLE)****WEIGHT DISTRIBUTION**

DESCRIPTION	FRONT AXLE (KG)	REAR AXLE (KG)
AXLE+SUSPENSION	400.00	900.00
ENGINE+TRANSN+CHASSIS	1395.00	665.00
CABIN	400.00	
CREW	130.00	
PRODUCT+TANK+MOUNT	3065.66	8567.19
TOTAL	5390.66	10132.19
AXLE	5675.00	10200.00

**STABILITY CALCULATIONS****C.G TABLE**

ITEM	LOAD ON			C.G. HEIGHT FROM GROUND LEVEL	
	FRONT AXLE KG.	REAR AXLE KG.	TOTAL KG.	UNLADEN	LADEN
CHASIS FRAME	300.00	500.00	800.00	1015.00	960.00
ENGINE & TRANS.	1095.00	165.00	1260.00	1315.00	1260.00
CREW WEIGHT	130.00		130.00	1860.00	1805.00
CABIN WEIGHT	400.00		400.00	1860.00	1805.00
F.A.+ SUSPENSION WT	400.00		400.00	450.00	435.00
R.A. + SUSPENSION WT.		900.00	900.00	498.00	483.00
PRODUCT WEIGHT	2688.05	7511.95	10200.00		1835.00
TANK + MOUNTING WT	377.61	1055.25	1432.85	1905.00	1850.00
TOTAL WEIGHT	5390.66	10132.19	15522.85		



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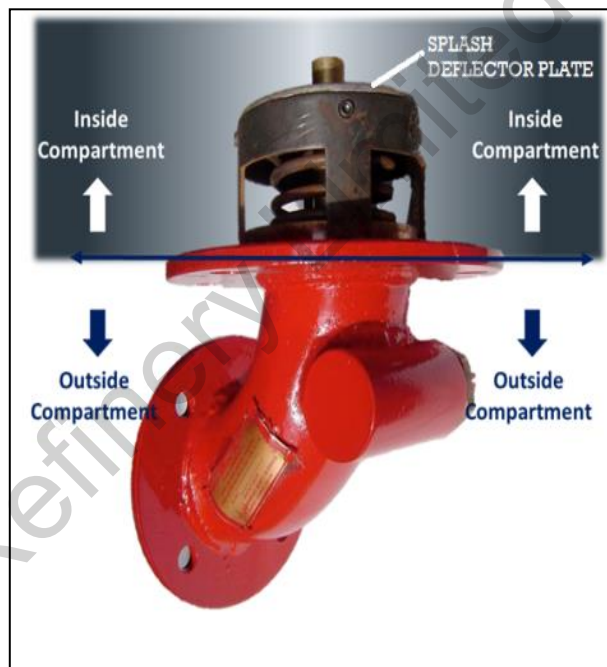
## POL TANK LORRY DESIGN &amp; SAFETY

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STABILITY RATIO		
UNLADEN WEIGHT	WU	5322.85
LADEN WEIGHT	WL	15522.85
DISTANCE BETWEEN REAR END TYRES	X	2105.00
HEIGHT OF C.G. (UNLADDEN)	YU	1279.86
STABILITY RATIO	YU/X	0.61
HEIGHT OF C.G. (LADEN)	YL	1629.13
STABILITY RATIO	YL/X	0.77

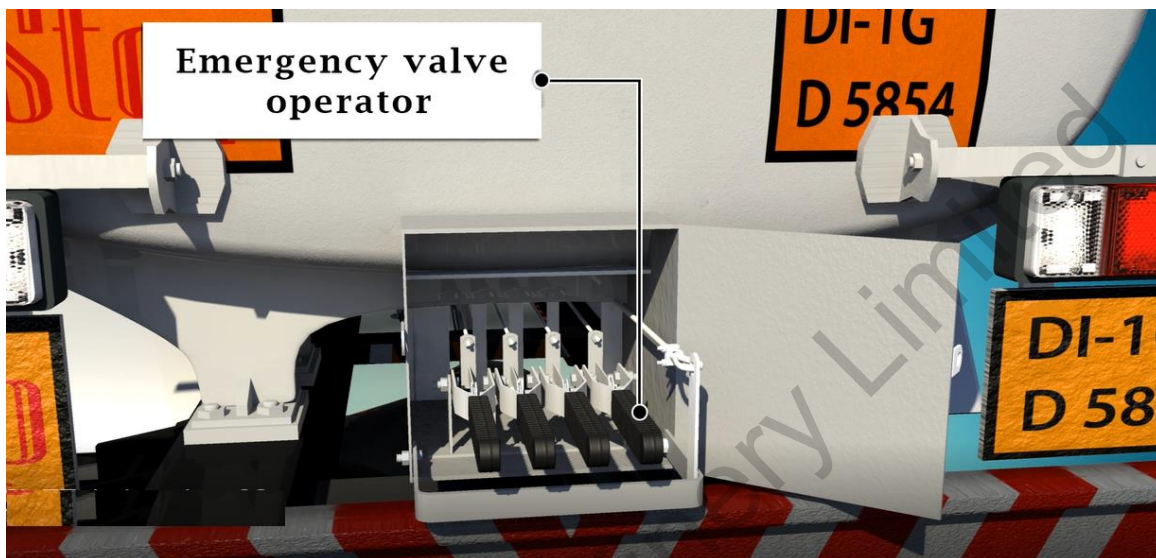
## Annexure II

## TYPICAL MASTER VALVE



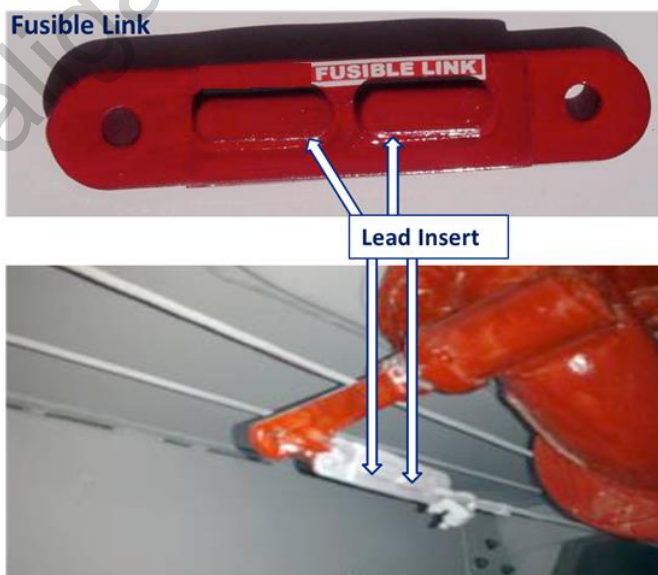
Annexure III-A

TYPICAL EMERGENCY SHUT OFF VALVE



Annexure III-B

TYPICAL FUSIBLE LINK





## Annexure IV

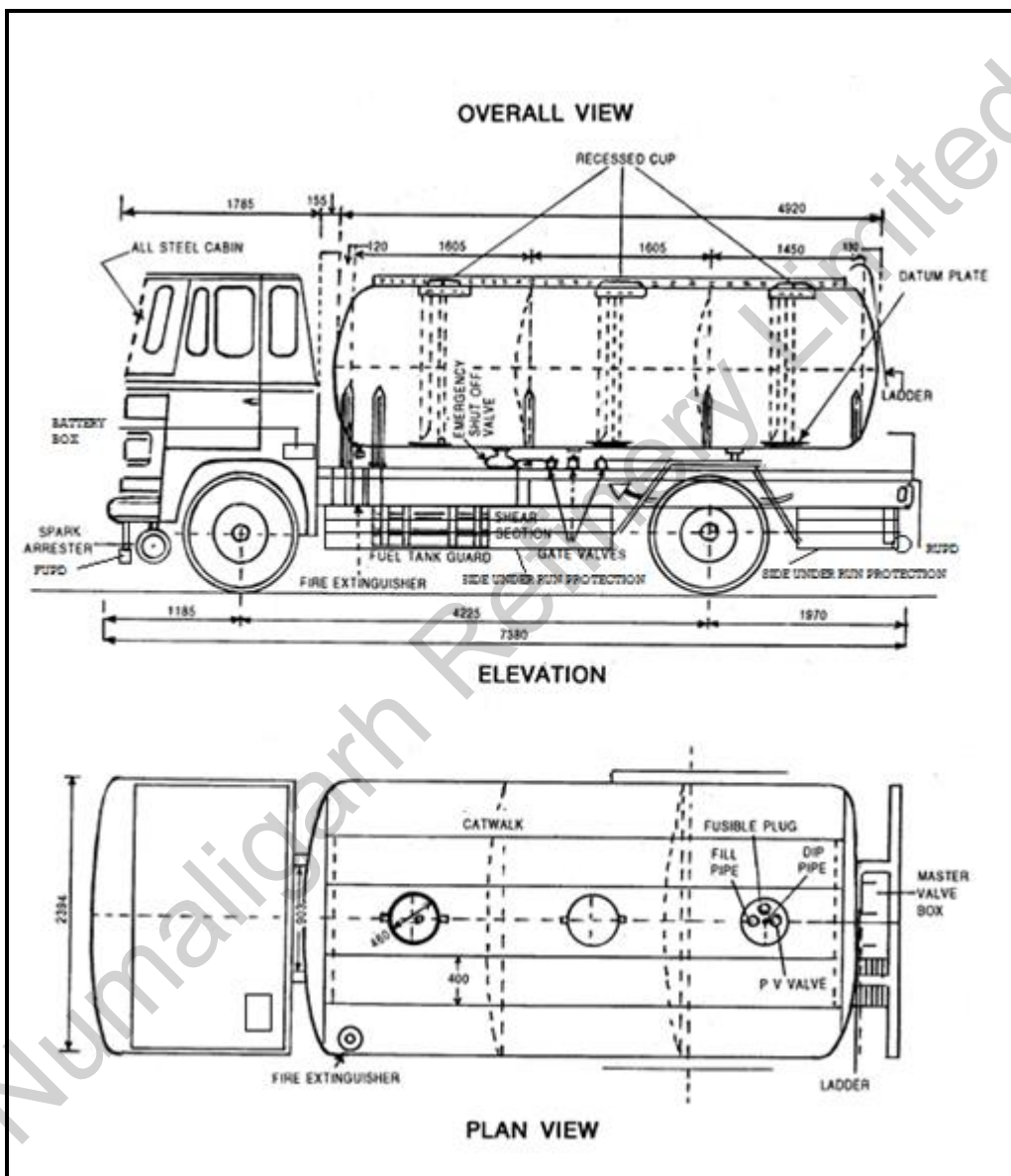
## TYPICAL SHEAR OFF SECTION



POL TANK LORRY DESIGN & SAFETY

Annexure V-A

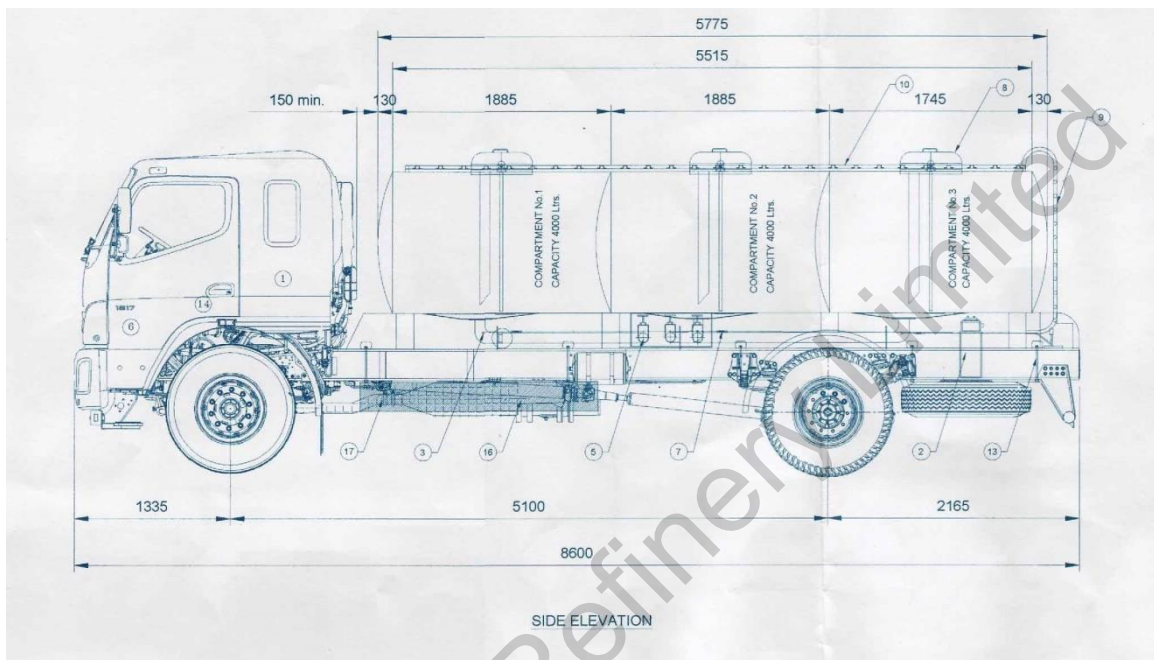
TYPICAL DRAWING OF TOP LOADING TANK TRUCK





## Annexure V-B

### TYPICAL BS IV TANK TRUCK WITH EXHAUST SYSTEM



### TYPICAL EXHAUST PIPE WITH PRIMARY AND SECONDARY PROTECTION





## Annexure VI

## TYPICAL BOTTOM LOADING ADAPTOR





**Annexure VII****TYPICAL VAPOR RECOVERY ADAPTOR FOR BOTTOM LOADING TANK TRUCKS**

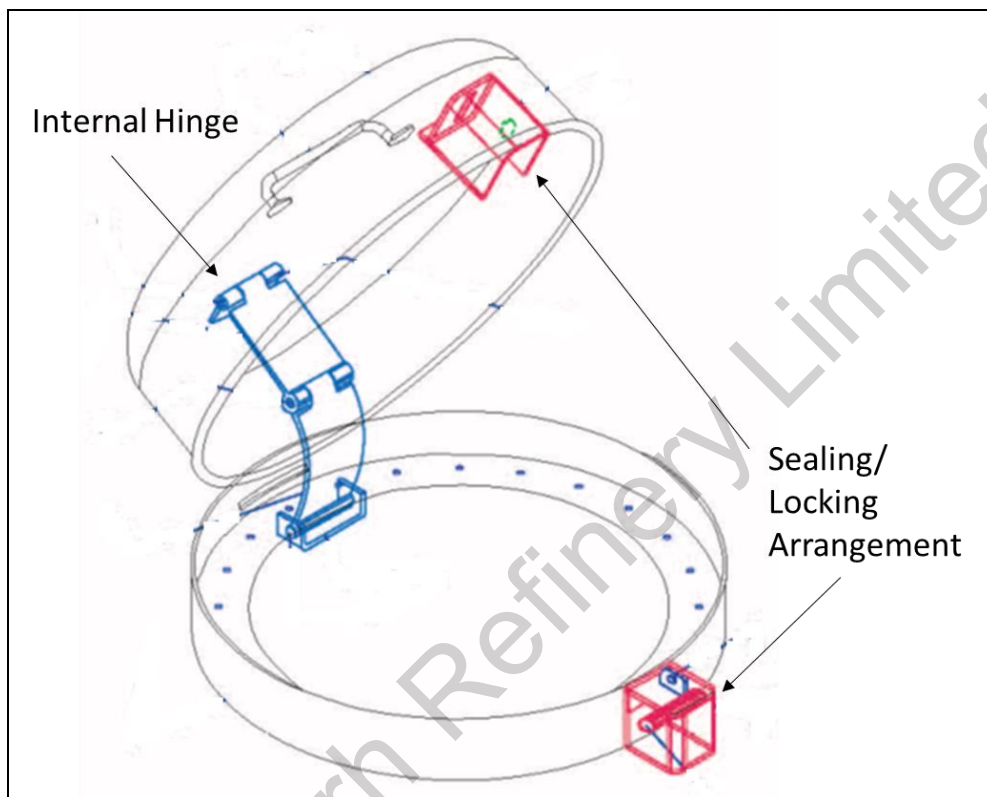
## Annexure VIII

### TYPICAL FITTINGS OF BOTTOM LOADING TANK TRUCKS



**Annexure IX**

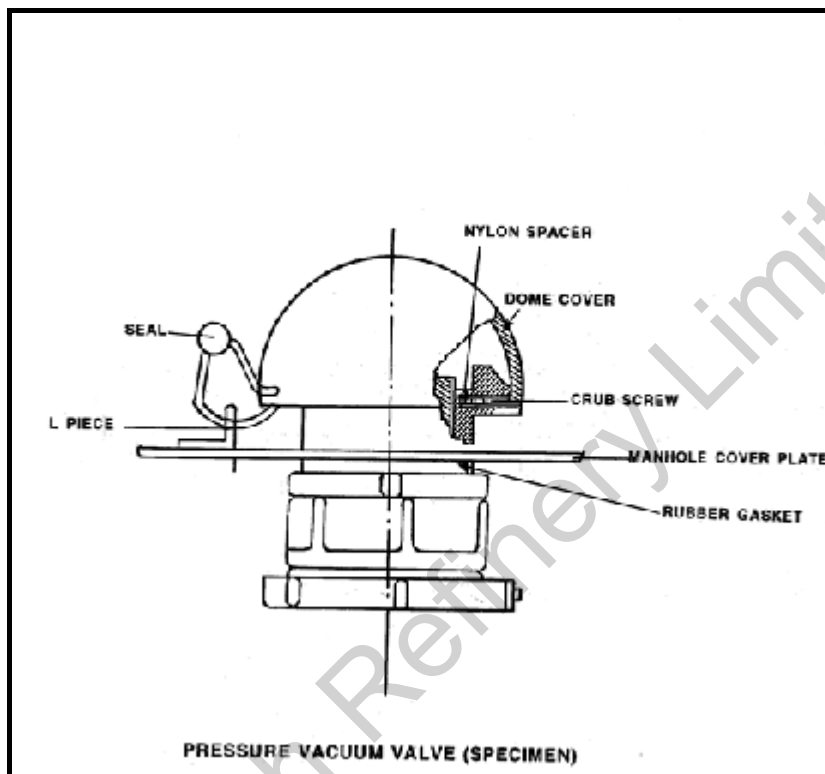
**TYPICAL DOME COVER**



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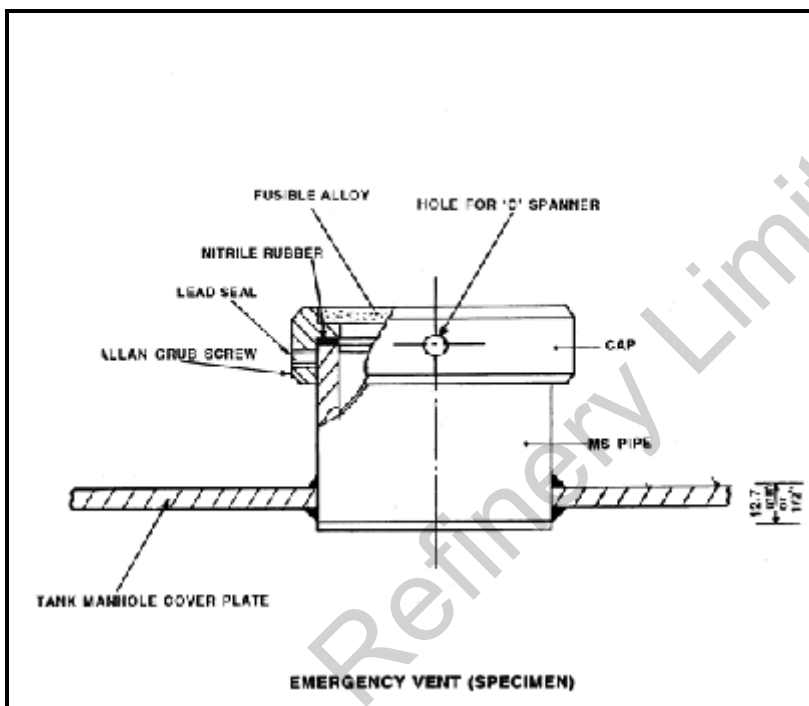
## Annexure XI

## TYPICAL PV VALVE OF TOP TANK TRUCK



## Annexure XII

## TYPICAL EMERGENCY VENT







## Annexure XIII

## TYPICAL PRESSURE ACTUATED FLAP (PAF)



**Annexure XIV****TYPICAL PRESSURE VACUUM VALVE FOR BOTTOM LOADING TANK TRUCK**



**Annexure XV****TYPICAL VAPOR VENT FOR BOTTOM LOADING TANK TRUCK**



## Annexure XVI

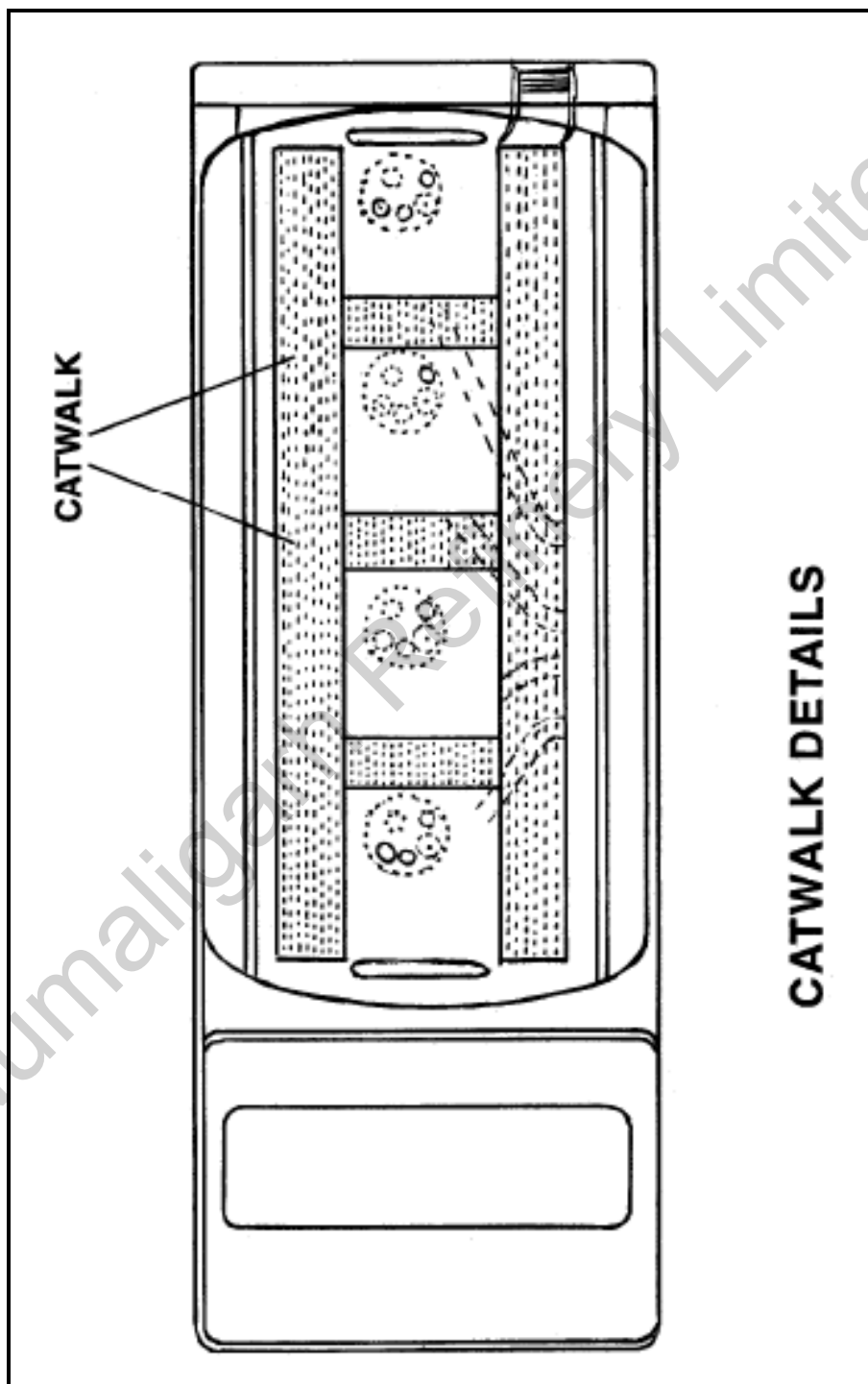
## VAPOUR DUMP VENT





## Annexure XVII

## TYPICAL CAT WALK FOR A TANK TRUCK





## Annexure XVIII

## TYPICAL SPARK ARRESTOR

