DRAFT EAST AFRICAN STANDARD

Road tankers for petroleum-based flammable liquids — Specification

EAST AFRICAN COMMUNITY
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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

In order to achieve this objective, the Community established an East African Standards Committee mandated to develop and issue East African Standards.

The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

DEAS 4:2016 was prepared by Technical Committee EASC/TC 040.
Road tankers for petroleum-based flammable liquids — Specification

1 Scope

1.1 This Draft East Africa Standard specifies the requirements and methods of test for tank vehicles intended for use on public roads, for transportation, at temperatures below their boiling point, of normally stable petroleum-based flammable liquids.

1.2 This standard does not cover tankers for Liquefied petroleum gas (LPG), unstable products and all other flammable liquids other than hydrocarbons.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel


ASTM A234/A234M-07, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A194/A194M-09, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

ASTM A193/A193M-09, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

ASTM A105/A105M-05, Standard Specification for Carbon Steel Forgings for Piping Applications

BS EN 1503, Valves. Materials for bodies, bonnets and covers

BS 1560-3.2, Circular flanges for pipes, valves and fittings (Class designated). Steel, cast iron and copper alloy flanges. Specification for cast iron flanges

ANSI/API Spec 5L, Specification for line pipe

ANSI/ASME B16.20, Metallic gaskets for pipe flanges: Ring-Joint, spiral-wound, and jacketed

ANSI/ASME B16.5, Pipe flanges and flanged fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
ANSI/ASME B16.9, Factory-made wrought butt welding fittings

ANSI/ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges

AISI Steel products manual — Stainless and heat-resisting steel.

ASTM B209, Standard specification for aluminium alloy, sheet and plate.

BS EN 485, BS EN 515, Specification for wrought aluminium and aluminium alloys for general engineering purposes: plate, sheet and strip

ISO 3874, Freight containers — Handling and security

BS EN 12020, BS EN 573, Specification for wrought aluminium and aluminium alloys for general engineering purposes: bars, extruded round tubes and sections.

BS EN 1559, BS EN 1676, Specification for aluminium and aluminium alloy ingots and castings for general engineering purposes

BS PD 5500, Specification for unfired fusion welded pressure vessels

ISO 3874, Series 1 freight containers — Handling and securing.

ISO 3795, Road vehicles and tractors and machinery for agriculture and forestry — Determination of burning behavior of interior materials.

IEC 60529, Degree of protection provided by enclosures (IP code)

IEC 60079, Electrical apparatus for explosive gas atmospheres — General requirements

EAS 357, Truck and bus tyres — Specification

3 Terms and definitions

For the purposes of this document, the following terms and definitions shall apply.

3.1 acceptable
that which meets the requirements of the approving authority

3.2 auxiliary engine
an engine that is additional to the main propulsion engine of the road tank vehicle and that can be operated either on or off that vehicle

3.3 baffle
a non-liquid-tight transverse or longitudinal partition in a tank

3.4 bulkhead
a liquid-tight transverse wall between adjacent compartments of a tank

3.5 compartment
a liquid-tight division of a tank

3.6 compartment tank
Is a tank which is built by dividing the storage tank with a bulkhead, creating two or more independent storage areas

3.7 demountable tank
a tank that is designed to be lifted onto and mounted on a conventional truck that is to be used as a road tank vehicle

Note A tank that is designed as a full load on a rigid chassis, with attachment direct to the chassis in a positive and safe manner, is not classed as a demountable tank for the purposes of this standard.

3.8 double bulkhead
two bulkheads that are placed in a tank next to each other, to divide the tank into two compartments

3.9 explosion protected
descriptive of electrical apparatus that is designed and approved for use in hazardous areas in accordance with one of the protection methods described in the applicable API or IEC Standard

3.10 exposed area
the area of the surface of a tank that is exposed to outside atmosphere direct

3.11 head
a liquid-tight transverse closure at the end of a tank

3.12 road tank vehicle
a tank truck, tank trailer, or truck-tractor-and-tank-semi-trailer combination

3.13 standard reference conditions
these shall be 20 °C and 101.325 kPa absolute

3.14 tank
a container that has a liquid-full capacity in excess of 500 litres, that is used for transporting petroleum-based flammable liquids, and that is mounted permanently or temporarily on a vehicle other than for the purpose of supplying fuel for propulsion of the vehicle

Note The term "tank" embraces the container and all components and ancillary equipment that affect its structural integrity.
tank semi-trailer

a vehicle with a tank mounted on it or built as an integral part of it, and so constructed that, when the semi-trailer is drawn by a truck tractor, through a fifth wheel connection, part of the load rests on the towing vehicle

Note A tank semi-trailer, when coupled to a truck tractor, is an articulated vehicle.

3.16 tank trailer

a trailer with a tank mounted on it or built as an integral part of it, and so constructed that when the trailer is drawn by a motor vehicle, practically all its load rests on its own wheels

3.17 tank truck

a single, self-propelled motor vehicle with a tank mounted on it

3.18 ullage

that portion of the total-volume capacity of a tank that is not occupied by its liquid contents, expressed as a percentage of the total-volume capacity

3.19 Surge plates

A plate usually dished that is used to slow down the effects of inertial forces in a compartment

4 Requirements

4.1 General

Road tank vehicles, trailers and their ancillary equipment shall comply with all the relevant statutory requirements of the respective Partner States.

4.2 Materials

Tanks shall be constructed of an aluminium alloy, low carbon steel, high-strength low alloy steel, or a stainless steel. The metals shall be free from rust, scale, cracks, laminations and surface blemishes, and shall comply with the appropriate requirements given in 4.2.1 to 4.2.3.

4.2.1 Aluminium alloys

The aluminium alloy shall comply with ASTM B209 or acceptable equivalent for sheets.

4.2.2 Steel

4.2.2.1 The different parts of the tanks shall be made from the materials as given in Table 1A below or their equivalents.

Table 1A — Materials for construction of tanks

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Part name</th>
<th>Complying with</th>
</tr>
</thead>
</table>

© EAC 2019 – All rights reserved
i) Shell          ASTM A 36 or ASTM 285 Grade C
ii) Saddle, baffle, cleat, stiffener, flange, cover, structural component  ASTM A 36
iii) Bolti...Studs - ASTM A 193 and ASTM A 194
iv) Gaskets       ANSI/ASME B16.20, ASME B 16.21
v) Pipes          API 5L Grade B or ASME B 31.3
vi) Forgings      ASTM A 105
vii) Flanges      ASME B16.5 or ASTM A 105,
viii) Fittings     ASME B 16.9 or ASTM A 234.

4.2.2.2 Any other suitable low carbon or high-strength low alloy steel of weldable quality and having physical properties at least equal to the appropriate minimum given in Table 1B below may be used for the pressure parts of the tank.

Table 1B — Minimum mechanical properties of steel (other than stainless steel)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical properties</strong></td>
<td><strong>Low carbon steel</strong></td>
<td><strong>High-strength low alloy steel</strong></td>
<td></td>
</tr>
<tr>
<td>Yield stress, MPa, min.</td>
<td>172</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td>Ultimate tensile strength, MPa, min</td>
<td>310</td>
<td>414</td>
<td></td>
</tr>
<tr>
<td>Elongation: ( l_0 = 5.65 \sqrt{s} ) %, min (^a)</td>
<td>20</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Impact resistance (^b) at -20 °C, J, min.</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) \( l_0 \) is the original gauge length
\(^b\) is the cross sectional area

4.2.3 Stainless steel
A stainless steel shall comply with the requirements for one of the following grades of AISI steels (or acceptable equivalent):

304, 304L, 310, 316, 316L, 317, 317L, 321 or 347.

Note The attention of purchasers is drawn to the advisability of using (to avoid carbide precipitation) one of the low carbon grades or one of the stabilized grades.

4.2.4 Pipes, fittings and other ancillary equipment

All materials for pipes, fittings, valves, manifolds, etc., shall be of a suitable material that is compatible with the material of the tank and with the flammable liquid that is to be transported in the tank.

4.2.5 Gasket joint rings and other components

Gasket joint rings and components designed to come into contact with the flammable liquid shall be of a suitable material that is compatible with the flammable liquid that is to be transported in the tank.

4.2.6 Other materials

Components that do not come into contact with the flammable liquid may be of any material of adequate strength and that is acceptable for the required duty.

Note Consideration should be given to the effects of galvanic corrosion when dissimilar metals (especially when one of these is aluminium or an aluminium alloy) are used in combination.

4.3 Tank design

4.3.1 General

A tank and its ancillary equipment shall have been designed in accordance with sound engineering principles, due consideration having been given to expected road conditions. The maximum width of any tank and its service equipment/accessories shall be such that it does not project beyond the overall width of the vehicle on which it is mounted or by which it is being towed. The minimum allowable road clearance of any tank component or protection devices located between any two adjacent axles on a vehicle or a vehicle combination shall be at least 12.5 mm for each 300 mm separating such axles and in no case shall this clearance be less than 300 mm.

4.3.2 Capacity

The tank, which may be of the single-compartment or multi-compartment type, shall have a total-volume capacity (including ullage of at least 3.0 % at 55 °C of that capacity) as required, and in no case shall the capacity of a compartment exceed 13,000 L. In addition, the total-volume capacity of a tank, calculated on the liquid density of the product that is to be transported, shall be such that when the road tank vehicle is fully loaded, its mass does not exceed the appropriate requirements of the relevant statutory requirements of the respective Partner States.

4.3.3 Shape

The tank may be circular, elliptical or any other acceptable cross-section, and shall be self-draining.

4.3.4 Maximum stress value

The maximum calculated stress value of a tank (including all stresses given in 4.3.5 to 4.3.7) shall not exceed 20 % of the tensile strength of the material used for its construction.
4.3.5 Design pressure

The design pressure shall not be less than the vapour pressure at 55 °C of the motor gasoline that meets relevant statutory requirements of the respective Partner States plus the pressure exerted by the static head of liquid in the fully loaded tank in the normal position, based on the greater of the density at 20 °C of the flammable liquid for which the tank is being designed, or 985 kg/m³.

4.3.6 Dynamic loading

Each tank and its components and ancillary equipment shall be designed to withstand dynamic loading in all directions and for all load configurations. The total dynamic loadings shall be deduced by multiplying the static loads in question by the following acceleration factors considered individually:

a) 2 g in the direction of travel;

b) 1 g in the vertically upwards direction;

c) 2 g in the vertically downwards direction; and

d) 1 g in the transverse horizontal direction.

4.3.7 Additional loading

The following additional loads shall be taken into account and, where applicable, a vector summation of all the loads under dynamic loading conditions shall be made:

a) Superimposed loads such as operating equipment, insulation, linings, hose tubes, cabinets and piping;

b) Reactions at supporting lugs and at saddles or other supports; and

c) Differential thermal expansion of dissimilar metals.

4.3.8 Distribution of loads

The loads from supports shall be borne by bulkheads, baffles or ring stiffeners, and shall be distributed as widely over the members as is practicable by using pads, gussets or other appropriate means of avoiding stress concentration.

4.3.9 Thicknesses of the shell, heads, bulkheads and baffles

4.3.9.1 The thicknesses of the shell, the heads and, where fitted, the bulkheads and baffles, shall be;

a) Such that, under dynamic loading conditions, the maximum stress value given in 4.3.4 is not exceeded, and

b) Not less than the relevant minimum given in Tables 2 or 3, as appropriate, and in no case, except at the knuckle-radius, shall the thickness of a tank head be less than the thickness of the shell.

4.3.9.2 The material thicknesses given in Tables 2 and 3 are based on a liquid density of 985 kg/m³. Where the liquid density of the flammable liquid to be conveyed in the tank exceeds 985 kg/m³, the thickness of the shell will have to be proportionally increased.
4.3.9.3 Where an aluminium alloy is used for the construction of a head, bulkhead, baffle or ring stiffener, it shall be in the 0 (annealed) or stronger temper. A shell shall be constructed of material with properties at least equal to grade 5454 of ASTM B209 in the H32 or H34 tempers, or, where lower tensile strength tempers are used, the minimum thickness of shell material given in Table 2 shall be proportionally increased.

Note Consideration should be given to the loss of strength of an aluminium alloy in the welded condition.

4.3.10 Stiffening of heads, bulkheads and baffles

4.3.10.1 Unless a proven equivalent form of stiffening is provided, the following requirement shall apply:

i) Surge-plates and partitions shall be dished. With a depth of dish of not less than 10 cm or shall be corrugated, profiled or otherwise reinforced to give equivalent strength. The area of the surge-plate shall be at least 70 % of the cross sectional area of the tank in which the surge-plate is fitted.

ii) There shall be a surge plate at every 1.5 m distance in the tank.
Table 2 — Minimum thickness of shell material

<table>
<thead>
<tr>
<th>Rated capacity, V litres/m of tank length</th>
<th>Maximum shell radius R in m</th>
<th>Minimum thickness d in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L &lt; 0.9 m</td>
<td>0.9 m &lt; L ≤ 1.4 m</td>
</tr>
<tr>
<td></td>
<td>LCS SS, HSLA AL LCS SS, HSLA AL LCS SS HSLA AL</td>
<td></td>
</tr>
<tr>
<td>V &lt; 1400</td>
<td>1.8 &lt; R</td>
<td>2.0 1.6 2.2</td>
</tr>
<tr>
<td></td>
<td>1.8 &lt; R &lt; 2.3</td>
<td>2.0 1.6 2.2</td>
</tr>
<tr>
<td></td>
<td>2.3 &lt; R ≤ 3.2</td>
<td>2.0 1.8 2.4</td>
</tr>
<tr>
<td></td>
<td>3.2 &lt; R</td>
<td>2.4 2.0 2.8</td>
</tr>
<tr>
<td>1400 &lt; V ≤ 2100</td>
<td>1.8 &lt; R</td>
<td>2.0 1.6 2.2</td>
</tr>
<tr>
<td></td>
<td>1.8 &lt; R &lt; 2.3</td>
<td>2.0 1.8 2.4</td>
</tr>
<tr>
<td></td>
<td>2.3 &lt; R ≤ 3.2</td>
<td>2.4 2.0 2.8</td>
</tr>
<tr>
<td></td>
<td>3.2 &lt; R</td>
<td>2.8 2.4 3.0</td>
</tr>
<tr>
<td>2100 &lt; V &lt; 2700</td>
<td>1.8 &lt; R</td>
<td>2.0 1.8 2.4</td>
</tr>
<tr>
<td></td>
<td>1.8 &lt; R &lt; 2.3</td>
<td>2.4 2.0 2.8</td>
</tr>
<tr>
<td></td>
<td>2.3 &lt; R ≤ 3.2</td>
<td>2.8 2.4 3.0</td>
</tr>
<tr>
<td></td>
<td>3.2 &lt; R</td>
<td>3.0 2.8 3.5</td>
</tr>
<tr>
<td>V &gt; 2700</td>
<td>1.8 &lt; R</td>
<td>2.4 2.0 2.8</td>
</tr>
<tr>
<td></td>
<td>1.8 &lt; R &lt; 2.3</td>
<td>2.8 2.4 3.0</td>
</tr>
<tr>
<td></td>
<td>2.3 &lt; R ≤ 3.2</td>
<td>3.0 2.8 3.5</td>
</tr>
<tr>
<td></td>
<td>3.2 &lt; R</td>
<td>3.5 3.0 4.4</td>
</tr>
</tbody>
</table>

\(^1\)The minimum thicknesses given in the table can be less than those required in terms of 4.3.9.1(a)

Legend:

L indicates distance between heads, bulkheads, baffles or ring stiffeners.

LCS indicates low carbon steel.

SS indicates austenitic stainless steel.

HSLA indicates high-strength low alloy steel.

AL indicates aluminium alloy.
Table 3 — Minimum thickness of heads\(^1\), bulkheads and baffles

<table>
<thead>
<tr>
<th>Rated capacity (V)/m of tank length</th>
<th>Minimum thickness, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LCS</td>
</tr>
<tr>
<td>(V &lt; 1400)</td>
<td>2.0</td>
</tr>
<tr>
<td>(1400 &lt; V &lt; 2100)</td>
<td>2.4</td>
</tr>
<tr>
<td>(2100 &lt; V &lt; 2700)</td>
<td>2.8</td>
</tr>
<tr>
<td>(V &gt; 2700)</td>
<td>3.0</td>
</tr>
</tbody>
</table>

\(^1\) The minimum thicknesses given in the table can be less than those required in terms of 4.3.9.1(a).

Legend:
- LCS indicates low carbon steel.
- SS indicates austenitic stainless steel.
- HSLA indicates high-strength low alloy steel.
- AL indicates aluminium alloy.

4.3.11 Circumferential reinforcement

4.3.11.1 Double bulkheads, where fitted, shall be separated by means of an air space that is vented and provided with drainage facilities (see 4.3.11.2).

4.3.11.2 Each ring stiffener shall be continuous around the circumference of the shell, and, where an air space is enclosed, the space shall be vented and provided with drainage facilities.

4.3.11.3 Baffles shall be adequately vented on the horizontal and vertical structure.

A ring stiffener shall have a section modulus about the neutral axis of the ring section parallel to the shell, which is at least equal to the value calculated by the following formula:

\[
\frac{I}{C} = KW\]

Where,

- \(I/C\) is the section modulus, in cubic millimetres;
- \(K\) is 0.0069 for low carbon, high-strength low alloy, and austenitic stainless steel, and 0.01186 for aluminium alloys;
- \(W\) is the width or diameter of the tank, in millimetres; and
\( L \) is the ring spacing (distance from the midpoint of the unsupported shell on one side of the ring stiffener to the midpoint of the unsupported shell on the opposite side of the ring stiffener), in millimetres.

4.3.11.4 Where a ring stiffener is welded to the shell in accordance with 4.4.3, a portion of the shell may be used as part of the ring section in calculating the ring section modulus. The portion of the shell used in this calculation shall not exceed the relevant maximum given in column 3 of Table 4.

Table 4 — Circumferential ring stiffeners — Shell section credit that may be included in ring section modulus

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of welds between ring stiffener and shell</td>
<td>Distance ( f ) between parallel ring stiffener-to-shell welds,</td>
<td>Shell section credit, max.</td>
</tr>
<tr>
<td>12</td>
<td>Less than 20 ( d ).</td>
<td>20 ( d ) + 20 ( c )</td>
</tr>
<tr>
<td></td>
<td>More than or equal to 20 ( d )</td>
<td>40 ( d )</td>
</tr>
</tbody>
</table>

\( c \) is the shell thickness, in millimetres; and \( f \) is the distance between parallel circumferential ring stiffener to shell welds, in millimetres.

4.4 Construction

4.4.1 General

A tank, its components and ancillary equipment shall have been constructed in accordance with sound engineering practices. When a tank is subjected an internal hydrostatic pressure at least equal to the design pressure, it shall not burst or leak.

4.4.2 Welding

4.4.2.1 General

4.4.2.1.1 The welder and the welding operator shall be qualified and certified for the type of welding and the material being weld.

4.4.2.1.2 All welding shall be carried out by means of an acceptable welding process and using a suitable filler metal.

4.4.2.1.3 The welding procedure used shall be such as to ensure that the filler metal, the heat-affected zone and the surrounding parent metal are free from cracks, unacceptable cavities and trapped slag, and, when relevant, acceptably free from tungsten inclusions.

4.4.2.1.4 Butt welds shall have complete penetration with 10% radiography testing. Fillet welds shall have a leg length at least equal to the thickness of the thinner of the parts being welded together.

4.4.2.2 Welds in steel and stainless steel

The mechanical properties of welded joints shall be equal to at least 85% of (and the corrosion
resistance at least equal to) the minimum specified for the parent metal.

4.4.2.3 Welds in aluminium alloys

4.4.2.3.1 When subjected to a transverse tensile test, a weld joint in an aluminium alloy, with the reinforcement removed, shall have a tensile strength of at least the relevant value given in Table 5.

4.4.2.3.2 In the case of a joint between two dissimilar alloys, the tensile strength shall be at least that of the alloy that has the lower tensile strength.

Table 5 — Tensile strength of aluminium alloy weld joints

<table>
<thead>
<tr>
<th>Sl .no.</th>
<th>Alloy designation</th>
<th>Ultimate tensile strength MPa. min</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>5083</td>
<td>275</td>
</tr>
<tr>
<td>ii)</td>
<td>5251</td>
<td>160</td>
</tr>
<tr>
<td>iii)</td>
<td>5454</td>
<td>215</td>
</tr>
<tr>
<td>iv)</td>
<td>8061</td>
<td>165(^a)</td>
</tr>
<tr>
<td>v)</td>
<td>6063</td>
<td>120(^a)</td>
</tr>
<tr>
<td>vi)</td>
<td>6082</td>
<td>165(^a)</td>
</tr>
</tbody>
</table>

\(^a\)These values are for material welded in the TF condition after natural aging for 3 days.

4.4.3 Baffle and ring stiffener joints

A baffle or baffle-attaching ring or a ring stiffener used for tank reinforcement (see 4.3.11) shall be fully welded around the circumference of the tank.

4.4.4 Overturn protection

4.4.4.1 Generally, an overturn damage protection device on a road tank vehicle shall be designed and installed to withstand any load normal (perpendicular to the tank surface) or tangential (in any direction perpendicular to the normal load) to the tank shell, applied anywhere over the protected part of the tank and equal to at least twice the weight of the loaded road tank vehicle.

4.4.4.2 The design shall be based on the ultimate strength of the material used. These design loads may be considered independently. If more than one overturn protection device is used, each device shall be capable of carrying its proportionate share of the applicable loads and, in each case, at least a quarter of the applicable total tangential load. The design shall, by means of calculations, tests or a combination of test and calculations, be proven capable of carrying the applicable loads. Deformation of the damage protection device is acceptable, provided that the devices being protected are not damaged.

4.4.4.3 An overturn damage protection device that would otherwise allow the accumulation of liquid on the top of the tank, shall be provided with a drain that directs the liquid to a safe point of discharge, away from any structural component of the road tank vehicle.
4.4.5 Manholes and fill openings

Each tank compartment shall be provided with a manhole of diameter at least 400 mm, or with a 400 mm x 300 mm oval manhole. In the case of an oval manhole, the orientation shall be as required. The manhole cover shall be fitted with a hatch for open top filling of each compartment and shall be fitted with locking and sealing mechanisms. The manhole cover and the hatch closure shall not leak or fail when the tank is subjected to the test given in Annex E.

4.4.6 cover locks

Locking devices on cover lids to prevent them from opening during a rollover should be included. Latches should be parallel to the tank side and face the rear when in the locked position so that in a forward/slide motion roll over, they will be forced toward the “locked” position.

4.5 Tank accessories

4.5.1 General

All attachments to a tank shall be made from materials that are compatible with the material of the tank.

4.5.2 Valves

4.5.2.1 Design and mounting

4.5.2.1.1 Each liquid discharge opening shall be provided with a spring-loaded valve that opens towards the tank interior and is of a type that, when de-energized, will close automatically. The valve seat shall be located within the mounting pad and the valve stem shall not be attached to the actuator.

4.5.2.1.2 The valve assembly shall be of a design such that, in the event of an accident, the actuator and the outlet pipe can break away, causing the valve to close automatically. Additionally, all valves and pipes fitted on the tank for the purpose of filling or discharge shall be adequately protected by an under and side rail damage protection device.

4.5.2.2 Controls

Valve actuators shall be operated by mechanical, hydraulic or pneumatic means, with controls designed to give rapid response. An additional control (emergency trip) shall be situated in a position away from any discharge point, and an acceptable means of automatically closing the valve(s) in the event of a fire shall be provided.

4.5.3 Vents

Each tank compartment shall be provided with at least one pressure-and-vacuum vent that is designed in such a way that it prevents loss of liquid through the vent owing to surge or to the vehicle’s overturning. The vent(s) shall be mounted, shielded and drained in such a manner as to prevent the accumulation of water. The exits of all vents other than emergency vents shall be covered with wire gauze of nominal aperture size in the range 425 µm to 600 µm. Each vent shall comply with the appropriate of the requirements given in 4.5.3.1 to 4.5.3.4.

4.5.3.1 Normal vents
A normal vent shall have an unrestricted outlet area of at least 280 mm$^2$. When tested in accordance with annex D, the vent shall start to open at a pressure not exceeding 7 kPa, and shall start to open at a vacuum not exceeding 3 kPa.

4.5.3.2 Filling and discharging vents

4.5.3.2.1 Where a tank compartment is designed for filling and discharging with the hatch closure closed, it shall be provided, where necessary, with an artificial vent or vents that, at the specified liquid loading and discharging rates for the tank, ensure(s) that the pressure in the tank, cannot exceed 20 kPa and the vacuum cannot exceed 7 kPa.

4.5.3.2.2 Unless effective protection against overfilling is provided, the vent(s), when tested in accordance with 6.5.2.8, shall have sufficient venting capacity to ensure that, in the case of accidental overfilling, a tank pressure of 20 kPa is not exceeded.

4.5.3.3 Emergency vents

4.5.3.3.1 The following requirements shall be complied with:

Each tank or compartment of a tank (as relevant) shall be provided with one or more emergency vents of total capacity not less than the appropriate minimum given in table 6.

a) Pressure-actuated emergency vents shall be designed such that, in the case of a pressure increase, the vent(s) will function in any overturn attitude of the vehicle. Each such vent shall open at a pressure of 25 kPa and close as soon as the pressure drops below this value, and shall have a flow rate determined and corrected to standard reference conditions, of at least 170 m$^3$ of free air per hour.

b) Where the pressure-actuated emergency vent(s) cannot provide the total minimum venting capacity required in terms of (a) above, one or more fusible emergency vents shall be fitted to increase the rate to at least the required value. The venting capacity of a fusible vent shall be determined at a pressure of 35 kPa.

4.5.3.3.2 A fusible vent shall:

i) Be actuated by an element that operates at a temperature not exceeding 120 °C,

ii) Have an unrestricted outlet area of at least 800 mm$^2$, and

iii) Be so positioned that, under normal conditions, it cannot come into contact with the flammable liquid transported in the tank.
### Table 6 — Minimum emergency venting capacity

<table>
<thead>
<tr>
<th>Exposed area of tank compartment ( \text{m}^2 )</th>
<th>Emergency venting capacity ( \text{m}^3 \text{ of air/} \text{Vh} )(^1), min.</th>
<th>Exposed area of tank compartment ( \text{m}^2 )</th>
<th>Emergency venting capacity ( \text{m}^3 \text{ of air/} \text{h} )(^1), min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>480</td>
<td>30</td>
<td>6 650</td>
</tr>
<tr>
<td>3</td>
<td>720</td>
<td>35</td>
<td>7 260</td>
</tr>
<tr>
<td>4</td>
<td>960</td>
<td>40</td>
<td>7 830</td>
</tr>
<tr>
<td>5</td>
<td>1 200</td>
<td>45</td>
<td>8 370</td>
</tr>
<tr>
<td>6</td>
<td>1 440</td>
<td>50</td>
<td>8 880</td>
</tr>
<tr>
<td>7</td>
<td>1 680</td>
<td>55</td>
<td>9 370</td>
</tr>
<tr>
<td>8</td>
<td>1 920</td>
<td>60</td>
<td>9 840</td>
</tr>
<tr>
<td>9</td>
<td>2 160</td>
<td>65</td>
<td>10 300</td>
</tr>
<tr>
<td>10</td>
<td>2 400</td>
<td>70</td>
<td>10 700</td>
</tr>
<tr>
<td>12</td>
<td>2 880</td>
<td>75</td>
<td>11 200</td>
</tr>
<tr>
<td>14</td>
<td>3 360</td>
<td>80</td>
<td>11 600</td>
</tr>
<tr>
<td>16</td>
<td>3 840</td>
<td>85</td>
<td>12 000</td>
</tr>
<tr>
<td>18</td>
<td>4 320</td>
<td>90</td>
<td>12 400</td>
</tr>
<tr>
<td>20</td>
<td>4 800</td>
<td>95</td>
<td>12 800</td>
</tr>
<tr>
<td>25</td>
<td>6 000</td>
<td>100</td>
<td>13 200</td>
</tr>
</tbody>
</table>

\(^1\) Free air measured under standard reference conditions.

### 4.5.3.4 Flow rate of vents

When tested, the flow rate of a vent, in cubic metres per hour \( (\text{m}^3/\text{h}) \) corrected to standard reference conditions, shall be at least that specified by the manufacturer.

### 4.5.4 Piping and fittings

The piping and fittings shall have been designed for the pressures involved and, before attachment to the tank, shall have been subjected to a pressure of 200 kPa but, in the case of valves, manifolds and fittings that are subject to bottom loading to a pressure of 800 kPa, and shall show no sign of leaking.

Piping and fittings shall comply with the following requirements:
They shall not project beyond the sides or the ends of the vehicle, and shall be so protected as to minimize accidental damage.

b) Piping and flexible couplings shall be designed for a maximum flow rate of 7 m/s, and to withstand the most severe combined stresses of the vapor pressure of the product at a temperature of 55 °C and either the superimposed pumping pressure or the shock loadings caused by vehicle movements.

c) Fill pipes of diameter exceeding 50 mm shall terminate not less than 50 mm and not more than the pipe diameter from the bottom of the tank, while fill pipes of diameter 50 mm and smaller shall terminate not more than 50 mm and not less than the pipe diameter from the bottom of the tank.

d) Unless bolted inside the manhole cover, a fill pipe shall;

i) be vented to the vapor space of the tank by a vent of diameter at least 10 mm (or of equivalent area), fitted with wire gauze of nominal aperture size in the range 425 µm to 600 µm, and so shrouded as to redirect the liquid down to the fill pipe; and

ii) have a closure of a type such that excess pressure is automatically relieved before the closure is opened.

4.5.5 Dip tubes

Where a dip-tube opening is provided, it shall comply with the relevant requirements of clause 4.5.4(d) for venting and pressure relief. The tube shall be stayed and of length such that it will guide the dip stick towards a reinforcing plate of thickness at least equal to that of the tank shell but not less than 3 mm. Each dip stick shall be accompanied with valid and certified corresponding calibration charts accredited by the relevant authorities in respective Partner States.

4.5.6 Access to manholes and fill openings

4.5.6.1 Ready access to each manhole or fill opening shall be provided by means of a fixed ladder, except that a tank that has more than one manhole or fill opening shall be equipped with a skid-proof catwalk/platform that makes the fitting of more than one ladder unnecessary. The skid-proof catwalk/platform shall be provided with a fall protection system of either collapsible hand rail or suitable steel wire for fastening of safety harness type.

4.5.6.2 The fixed ladder shall be designed such that:

a) The first step height does not exceed 550 mm from the ground;

b) The intermediate steps are equally spaced and do not exceed 300 mm apart;

c) There is a toe hold clearance of at least 130 mm;

d) The access steps preferably slope inward; and

e) Hand holds are fitted above the height of the top step/rung/platform.

Note The access ladder is recommended to be at the front of the tank.

4.5.7 Attachment of non-liquid-carrying components
4.5.7.1 Where practicable, attachment of non-liquid-carrying components shall be made to the overturn damage protection device or sub-frame of the vehicle and the following requirements shall, in all cases, be complied with:

a) Attachment of heavy components to the shell or head of the tank shall be made by means of mounting pads of shape and size such that excessive stress concentration on the tank is prevented. The thickness of a pad shall not exceed the thickness of the shell or head (as relevant), or the weld joint design shall be such that, when force is applied in the region of the pad, shear failure of the weld will occur without causing the tank to rupture.

b) Skirting structures, conduit clips, brakeline clips and similar light components of a suitable metal of thickness not exceeding 70% of that of the shell or head to which they will be attached, or of construction or material appreciably less strong than the shell or head, may be secured directly to the shell or head, provided that each component is so designed and installed that damage will not affect the flammable-liquid retention integrity of the tank.

4.5.7.2 Light components shall be secured to the tank shell by continuous welding or in such a manner as to preclude formation of pockets that could become sites for corrosion.

4.6 Pumping systems

4.6.1 Power source

Where a pumping system is fitted to the vehicle, it shall be driven by one of the following means:

a) The tractive engine of the vehicle;

b) A flameproof electric motor

c) An air motor or an hydraulic motor; or

d) A spark-ignition auxiliary engine shall not be used to operate the pumping system.

e) An auxiliary compression-ignition engine of sound design and construction and that;

i) Has an air intake, fitted with an efficient flame arrester or located in a position such that in the case of a backfire, flammable vapor in the atmosphere will not be ignited,

ii) Has an exhaust system free from leaks, that is mounted at least 100 mm from the tank and from all liquid-carrying components, and that discharges the gases at the rear of the cab,

iii) Has an electrical system (if fitted) that complies with the applicable requirements of hazardous environment with flammable vapors always, and

iv) Is located in a suitable position and so shielded that flammable vapors are not drawn towards the engine and that spillages or leaks do not come into contact with the engine or the exhaust system, but that is not so enclosed that overheating or the accumulation of explosive vapors can occur.

4.6.2 Pumps

The pump shall be suitable for the required application and shall have a rotational speed that is so controlled that the rating of the pump cannot be exceeded. The body shall be non-porous and made of a non-flammable material. The pump shall be mounted on the vehicle in a suitable position and
protected from accidental damage.

4.6.3 Working pressure

The working pressure of a pumping system shall be as required. The entire system, after assembly, when hydraulically tested in accordance to Annex C at its normal working pressure, shall not leak.

4.7 Hoses

4.7.1 Normal hoses

4.7.1.1 A normal hose for the conveyance of flammable liquids shall be compatible with the liquid to be transported, and its length, nominal size, maximum working pressure and type (which shall be one of the following) shall be as required:

a) Type 1: a hose that has electrical continuity; or
b) Type 2: a hose that has an anti-static cover and no electrical bonding.

4.7.1.2 When tested in accordance with an approved method and after flexing, a type 1 hose shall have electrical continuity from end to end, and a 1 m length of a type 2 hose shall have an electrical resistance of not less than $10^4 \, \Omega$, and not more than $10^7 \, \Omega$.

4.7.1.3 When tested in accordance with the approved hydraulic pressure test, a hose shall withstand a pressure of twice the maximum working pressure without bursting.

4.7.2 Hose carriers characteristics

a) Self-draining storage hose carriers, to be fitted on the left hand/right side of tank.

b) The hose carriers shall have rounded ends and with no sharp protrusions or edges liable to damage the hoses.

c) The hoses shall be clamped securely into the hose carrier by means of straps.

d) The hose carrier shall be of sufficient length of prevent the hoses end from hanging out of the rear end.

e) The hose carriers may serve as mudguards on the rear most axle sets.

4.7.3 Testing hoses

4.7.3.1 Hose shall pass visual examination first to qualify for pressure testing.

4.7.3.2 Hoses shall be examined and pressure tested at least every twelve (12) months or earlier if signs of deterioration occur.

4.7.3.3 Hoses shall be pressure tested using water as test liquid.

4.7.3.4 Gravity drop low pressure hoses shall be pressure tested at manufacturer’s recommended test pressure but not less than 35 kPa.

4.7.3.5 Pump delivery high pressure hoses shall be pressure tested to be at 1.5 times (150 %) the maximum working pressure.
4.8 The road tank vehicle

4.8.1 Cab

4.8.1.1 The cab of a road tank vehicle shall be of sound design and construction and so mounted that a distance of at least 150 mm is provided between the back of the cab and the front of the tank.

4.8.1.2 The driver’s cab shall be constructed from materials that are not readily flammable. When tested in accordance with ISO 3795, the following cab components shall have a burn rate not exceeding 100 mm/min.

   a) seat cushions and backs,
   b) safety belts,
   c) head linings,
   d) opening roofs,
   e) arm rests,
   f) all trim panels including door, front, rear and side panels,
   g) compartment shelves,
   h) head restraints, floor coverings,
   i) sun visors,
   j) curtains,
   k) shades,
   l) wheel housing covers,
   m) engine compartment covers,
   n) mattress covers, and
   o) any other interior materials including padding and crash-deployed elements that are designed to absorb energy on contact by occupants in the event of a crash.

4.8.1.3 Where a window is provided in the back of the cab, it shall be non-opening and of safety glass that is also hermetically sealed and fitted with fire-resistant retention.

4.8.1.4 Cab heaters other than those operated from the vehicles’ engine and electrical lighters where fitted shall be removed. Auxiliary sockets where fitted shall be provided with sealable caps.
4.8.1.5 A special, clearly marked document holder shall be mounted in a conspicuous position in the cab (see 4.8.6.2).

4.8.2 Shielding of engine

4.8.2.1 Where the engine or any component part of the engine extends beyond, or is exposed at the rear of the cab, it shall be shielded from overhead spillage by a shield made of metal or other suitable non-absorbent material. Care shall be taken to ensure that engine cooling is not restricted.

4.8.2.2 The engine shield shall be designed so that;

a) It protects the cargo tank from a fire in the engine compartment; and

b) It prevents any flammable liquid spilt during the loading of the tank or as a result of the front compartment being ruptured from entering the engine compartment.

4.8.3 Chassis and mounting of tank(s)

4.8.3.1 The chassis of a road tank vehicle and the means of attachment of tank(s) shall be designed to withstand the loadings given in 4.3.6 and 4.3.7, based on the mass of the fully loaded tank(s), complete with fittings and attachments, subject to a permissible stress of not more than the value given in terms of 4.3.4.

4.8.3.2 The tank(s) shall form an integral part of, or be attached to, the chassis in a positive and safe manner and such that relative movement between a tank and the chassis is restricted and no excessive stress due to loading or vehicle movement is introduced into the shell.

4.8.4 Stability

The height of the centroid of the tank cross-section at half the tank length shall fall within an isosceles triangle that has a base length at ground level equal to the overall width between the outside walls of the outside tyres of the major load axles, and that has base angles not exceeding 62°.

4.8.5 Demountable tanks

4.8.5.1 A demountable tank shall comply with all the appropriate requirements of this standard, except that an ISO container tank designed for the conveyance of petroleum-based flammable liquids may be used, provided that such a tank is properly secured as spelt out in ISO 3874 the truck through the bottom corner fittings by means of acceptable securing devices, e.g. twist locks or pin-type securing devices.

4.8.5.2 When so required, a demountable tank shall be fitted with lifting lugs. Such lugs shall be so designed as to withstand the maximum stress values induced when a fully loaded tank is being lifted.

4.8.5.3 A demountable tank of capacity not exceeding 3 000 L shall be exempt from the requirements given in:

a) Emergency vents, and

b) Overturn protection, provided that each fitting is protected by at least a vertical metal strip of thickness not less than 4.5 mm and which extends continuously around the fitting and projects not
less than 25 mm above the fitting (or unless each fitting is provided with equivalent protection).

4.8.6 Placard and document holders

4.8.6.1 Holders for identification placards

A holder for identification placards shall be fitted on each side and at the rear of a tank. Holders shall be of such size and shape that suitable placards can be fitted that identify the type of liquid being conveyed and describe the action to be taken in the event of an emergency. Placard holders are not required when a decal type of placard is affixed on the tank direct.

4.8.6.2 Document holder in cab

A special, clearly marked lockable document holder shall be mounted in a conspicuous position in the cab (for easy location in an emergency). The holder shall be large enough to store delivery documents relevant to the current product being transported.

4.8.6.3 Document storage container

If other instructions are also carried, such as documents for other commodities (e.g. on the return trip), a lockable document storage container for these documents shall be mounted in a conspicuous position in the cab.

4.8.7 Exhaust systems

4.8.7.1 General

4.8.7.1.1 The vehicle engine exhaust shall discharge sideways of the vehicle at a point not closer than 1 m from any tank outlet or liquid discharge point.
4.8.7.1.2 All trucks shall be equipped with spark arrester

4.8.7.2 Shielding of exhaust

Where the exhaust system extends beyond, or is exposed at the rear of, the cab, that part of the system shall be shielded. The diameter of the shield shall exceed that of the exhaust pipe by at least 100 mm, and the shield shall be so mounted that overhead spillage will not come into contact with the exhaust or mufflers.

4.8.8 Brakes

4.8.8.1 Brakes shall comply with the relevant statutory requirements of the respective Partner States. Vehicles equipped with endurance braking systems emitting high temperatures and are placed behind the rear wall of the driver’s cab shall be equipped with a thermal shield securely fixed and located between this system and the tank or load so as to avoid heating of the tank shell or load.

4.8.8.2 The thermal shield shall be made of durable material so designed that its surface temperature does not exceed 200 °C. The thermal shield shall protect the endurance braking system against any outflow or leakage of the load/cargo.

4.8.9 Electrical wiring and equipment

Electrical wiring and equipment that could be in a hazardous location shall be ingress and explosion protected in accordance with IEC 60529 and IEC 60079. Screw-in bulbs shall not be used except in
safe areas classified by statutory code.

4.8.9.1 Wiring system

4.8.9.1.1 The wiring shall have adequate current-carrying capacity and mechanical strength and shall be connected, insulated and protected against physical damage, in keeping with sound engineering practice. Insulation-gripping type terminals shall be used, except on the battery and starter cables.

4.8.9.1.2 For truck-tractors (prime-movers) and rigid vehicle chassis, the electrical wiring system shall be installed in accordance with one of the following;

a) An insulated return standard where the vehicle “chassis” is floating electrically and is not connected to either the negative or positive pole of the battery with all electrical equipment having supply and return cables.

b) A chassis return standard where the negative pole of the battery is connected from the negative terminal on the battery master switch (switched side) to the vehicle chassis, with electrically powered equipment having a supply cable and the return via connections to the chassis.

c) An insulated return standard but where connection is made from the negative terminal on the battery master switch (switched side) to the manufacturer’s dedicated earth point.

4.8.9.1.3 A suitable nameplate shall be fitted inside the cab clearly visible from through the nearside door aperture showing which of the three above electrical systems is fitted.

4.8.9.1.4 For semi-trailers and trailers, the electrical system shall be installed to an insulated return standard where the trailer-tank structure is “floating” electrically and is not connected to either the negative or positive pole of the battery (via the trailer connection). All the electrically powered equipment shall have the supply and return cables connected to the trailer electrical system with no connection made to the tank structure.

4.8.9.2 Circuit protection

Each circuit, other than the starting and ignition circuits, shall incorporate a protective device such as a fuse or a manual reset circuit breaker. Each headlight shall be treated as a separate circuit. A clearly labeled means of isolation (preferably a double-pole switch on a two-wire system of a rating of not less than 300 Amps) shall be provided for the purpose of isolating all electrical circuits. This device shall be located in such a position that it is;

a) Clearly visible,

b) As near to the battery as is practicable, and

c) Easily accessible to a person sitting in the driver’s seat or standing on the ground outside the vehicle.

If a tachograph or an on-board computer is fitted, the electrical supply to the tachograph may bypass this means of isolation. Intrinsically safe equipment that could be needed whilst the battery is isolated may also bypass this means of isolation. The circuit protective devices and isolating means should be mounted inside and at the front of the cab.

Note Where a vehicle is fitted with an alternator and the battery is isolated before the engine is stopped, damage to the alternator is likely unless its field coils have been disconnected. On such vehicles, the battery isolation switch should be of the type that automatically opens the alternator field coil circuit immediately before the battery is isolated.
4.8.9.3 Coaming and manifold lights

Each light fitted for the purpose of illuminating the top fittings and the catwalk (where applicable) or the manifold and discharge area of a tank shall be explosion-protected with switches operable from the cab. The lens of each light shall be protected by a stout wire guard, of mesh size approximately 12 mm, mounted at least 12 mm clear of the lens.

4.8.9.4 Battery

The battery shall be mounted in a safe position away from the tank, valves and pumping system, and if the battery is not fitted in the cab or engine compartment, it shall be enclosed in a covered battery box. The battery terminals shall be electrically insulated or covered by an electrically insulated battery box cover.

4.8.10 Fire extinguishers

4.8.10.1 Each vehicle shall be provided with two portable fire extinguishers having at least a 20 – B C rating.

These fire extinguishers shall be located in an accessible place on each side of the vehicle, and shall be securely held by a reliable quick release bracket type holder.

4.8.11 Rear bumper

4.8.11.1 Stout steel guards or the frame of the vehicle shall be used to protect the lower part of the rear of the tank and piping in the event of a collision, and to minimize the possibility that the tank will be struck by any part of a colliding vehicle.

4.8.11.2 The bumper shall be designed to provide sufficient resistance to rear impact shall be fitted over the full width of the tank at the rear. This bumper shall be an addition to the rear under-run device.

4.8.11.3 The face of the bumper (in elevation) shall be at least 100 mm high. The ends of the bumper and the rear under-run device shall have no sharp edges and should either be rounded or if manufactured from an extruded or box section, fitted with plastic end caps.

4.8.11.4 Where the rear under-run device or the bumper form part of a step for tank top access, the foot holds shall be covered with a suitable anti-slip surface.

4.8.11.5 The bumper shall be mounted such that:

a) Its inside face or edge is not less than 100 mm to the rear of the tank and its fittings at any point

b) No lower than the height of the chassis on the rigid tanker; and

c) No lower than the height of the tank mountings on trailers and semi-trailers.

4.8.11.6 For tankers without a separate chassis- i.e. semi trailers and trailers, the mounting of the rear under-run device and the bumper shall be designed and validate through testing or analysis to withstand credible impact forces without generating any high stress concentrations which can affect the integrity of the tank shell for the following conditions:
a) Low level impact on rear under-run device only;

b) High level impact on bumper only; and

c) Simultaneous high and low level impact on rear under-run device and bumper.

4.8.11.7 The bumper and the rear under-run device shall be bolted to their supports and their supports bolted to the chassis or the under-structure to enable replacement or repair without the need for in-situ hot works

4.9 Manhole covers

Manhole covers, including fill openings, shall comply with the requirements of one of the following tests:

a) a drop test (see Annex E), after which there shall be no leakage, or;

b) a pressure test (see Annex E). The unit shall be structurally capable of withstanding, without leakage or permanent deformation that would affect its structural integrity, the greater of a static internal fluid pressure of 25 kPa or the tank test pressure.

4.10 Tools and first aid kits and other accessories

Each truck-tank shall be fitted with the following kits and accessories that comply with the relevant statutory requirements of the respective Partner States;

a) A minimum of two wheel chocks;

b) A reflective conspicuity tape of a width of 25 mm (minimum) round in addition to the two chevron signs fixed at the rear;

c) A set of tools and accessories sufficient in number, quantity and size to take care on the spot minor jobs;

d) A first-aid box kept in an easily accessible place in the truck;

e) A spill response kit capable of responding to a credible spill incidence that the truck can encounter;

f) Two safety triangles;

g) Cones; and

h) Set of emergency Instructions including emergency contacts.

4.11 Hand rails or safety cables

Hand rails/safety cables are to be fitted on top of the tank on both sides running inside and parallel with the roll over valances from front to rear of the tank. These cables are for attaching a personnel safety harness and shall be fall tested to withstand 1500 N.

4.12 Access ladder
4.12.1 A suitable tank top access ladder shall be provided and mounted either at the rear or front of the tank in such a manner that it will not interfere with operating requirements, lead to a breach of any applicable regulations, or be a safety hazard.

4.12.2 The ladder shall be fixed at both ends and all rungs shall be of non-slip material. Non-slip material shall be fitted to any other ladder access ‘step’ e.g. under run bumper. The ladder shall be easily accessible from ground level, either by having the lowest rung no more than 500 mm above grade or by fitting additional steps integrated into the rear bumper bar or under-run protection device.

4.13 Tyre and wheel requirements

4.13.1 The tyres used on the vehicles shall comply with EAS 357.

4.13.2 Retreading of tyres is an option that many fleets use to extend the life of tyre casings. Retread tyres shall comply with relevant standards. However, retreaded tyres shall be used only on drive or trailer axles and not on steering axles.

4.14 Auxiliary equipment

a) Two high intensity reversing lights shall be fitted to the rear of the vehicle, angled to the rear and slightly outwards.

b) An audible reversing warning device shall be fitted on the rear of the vehicle.

c) A number plate mounting bracket with light shall be fitted.

d) Rear high mounted stop light is to be fitted.

e) Mud flaps are to be fitted behind the rearmost wheels. The flaps will be attached to separate brackets and will not be suspended from the mudguards.

f) Ease of entry and exit from the cab. Appropriate exterior cab mounted grab handles should be provided to prevent slips and falls. The ends of steps should include guards to protect the driver against injury to his legs when entering the cab.

g) Driver’s seat and steering wheel. The position of the steering wheel should be easily adjusted. The seat should be adjustable with articulated upper back supports to relieve back fatigue.

h) Large exterior rear and side view mirrors. Exterior mirrors are to be provided and mounted in such a way as to provide a vibration free view of what is behind and on both sides of the vehicle.

i) High intensity fog lights shall be provided.

5 Marking

5.1 Tanks

5.1.1 The tank serial number shall be stamped on a visible part of the tank.

5.1.2 Each tank shall, in addition, bear the following information legibly and durably marked on a
flameproof data plate that is adequately secured to the tank or attached structure facing forward of the tank, near the front and in a place readily accessible for inspection:

a) The manufacturer's name, trade name or trade mark;
b) The serial number of the tank;
c) The date of manufacture;
d) The date of test;
e) The design pressure;
f) The tank capacity, in litres, per compartment (front to rear);
g) The maximum liquid load, in kilograms;
h) The maximum design liquid density, in kilograms per cubic metre;
i) The maximum fill rate, in litres per minute, and pressure, in kilopascals;
j) The maximum discharge rate, in litres per minute; and
k) The statement: “This vessel complies with CD/K/4/2016 (but only in conjunction with the inspection authority stamp).

5.2 Tank body marks

Each tank used for transportation of petroleum shall, whether loaded or empty, be conspicuously marked on each side and rear thereof in letters at least 18 Inches high on a background of sharply contrasting color the word ‘FLAMMABLE’, “DANGEROUS” and “KEEP DISTANCE.”

5.3 Vents

Each vent shall be legibly and durably marked with its flow capacity and the pressure at which this was determined, or with a reference number. Where a vent is marked with a reference number, the supplier shall provide, in a pamphlet or booklet, details of the flow capacity and pressure for that reference number.

5.4 Static charge dissipation wire

A static charge dissipation wire shall be installed in the approximate center of each compartment. Wire should be firmly attached at the top to the manhole cover and at the bottom to the bottom valve splash shield. All new tank trailer orders should specify the hollow core static charge dissipation wire unless the compartment is fitted with a central sounding tube.

6 Inspection and test methods

6.1 Inspection

6.1.1 The entire testing shall be done by a competent person approved by the approving authority in the respective Partner States and records shall be maintained.
6.1.2 Visually examine and, using any means that will provide the required accuracy, then measure the tank and components of the road tank vehicle for compliance with all the relevant requirements of Clauses 4 and 5 for which tests are not given in Annex E.

6.2 Test method

The test methods shall be as outlined in Annexes A to E.

7 External and internal painting

The tank truck shall be adequately painted externally to prevent corrosion arising from atmospheric influence.

Painting shall be carried out as per the following and in accordance with the purchasers approved color scheme:-

a) Surface preparation shall be done with the help of blast cleaning.

b) Primer shall be epoxy zinc chromate of two coats with minimum dry film thickness of 35 microns/coat.

c) Finish coat shall be acrylic polyurethane paint of two coats of minimum dry film thickness of 30 to 40 microns/coat,

d) For jet fuel, the inside of the tanker shall be painted with epoxy paint. For the other fuel tankers the inside may be painted with epoxy paint.

8 Certification

A certificate shall be issued for each tanker after inspection and testing by the Inspecting Authority. The initial certificate will remain valid and subsequent recertification of the tanker be obtained from the inspecting Authority at intervals as specified by the respective authority in relevant Partner States.

9 Issuance of permits

The permits for the road tankers shall be issued by the relevant Authorities in respective Partner States.

10 Purchase and supply documents

These documents shall be as detailed in Annexes F and G.
Annex A
(normative)

Resistance of the tank to hydrostatic pressure

A.1 With the manhole cover removed, the manhole opening covered with a plate and all relief valves clamped, plugged or otherwise rendered inoperative, subject the tank to an internal hydrostatic test pressure equal to the higher of the marked design pressure or 35 kPa.

A.2 Maintain the pressure for 30 min to verify that the tank does not burst or leak. If the tank is compartmented, test each compartment separately, ensuring that the adjacent compartments are empty and at atmospheric pressure.
Annex B

(normative)

Hydrostatic or pneumatic testing of pipes, valves, manifolds and fittings

Prior to attachment, subject each pipe, valve, manifold and fitting used for the conveying of liquid, to a hydrostatic or a pneumatic test at the relevant pressures. Maintain the pressure at 35 kPa for 30 min to detect any leaks.
Annex C
(normative)

Resistance of the pumping system to hydraulic pressure

After final assembly, subject the entire pumping system (if fitted) of the road tank vehicle to a hydraulic pressure test at normal working pressure. Continue pumping for 30 min to detect any leaks.
Annex D
(normative)

Pressure, vacuum and flow testing of vents

D.1 Apparatus

D.1.1 Steel test tank

Shall be of depth 0.3 m, and of length and width each 1 m, suitably constructed to withstand a pressure of at least 500 kPa, with provision for mounting a manhole cover, adaptors for fitting additional vents, where required, and an 80 mm screwed inlet at the bottom.

D.1.2 Pressure gauge, capable of reading from -10 kPa to +500 kPa.

D.1.3 Air flow metre

D.1.4 Water flow metre

D.1.5 Exhauster

D.1.6 Compressed air supply

D.1.7 Water supply

D.2 Procedure

D.2.1 Fit, in the normal operating positions, the manhole cover, and the hatch and, where relevant, any additional vent(s) of the prototype used on the test tank. Test the appropriate vent(s) as given in D.2.2 to D.2.11 with, when relevant, all other vents sealed or rendered inoperative.

D.2.2 Connect the exhauster, air flow meter and pressure gauge to the tank. Operate the exhauster, record the vacuum at which the vent starts to open, and check normal vents for compliance with 4.5.3.1.

D.2.3 Where relevant, slowly increase the rate of exhaustion to a value corresponding to the maximum liquid discharging rate (see 5.1(j)). Check that filling and discharging vents do not allow the vacuum to exceed 7 kPa (see 4.5.3.2).

D.2.4 Disconnect the exhauster and replace it with the compressed air supply. Slowly introduce dry air and check the pressure at which the vent starts to open for compliance with 4.5.3.1 in the case of normal vents, and with 4.5.3.3(b) in the case of pressure-actuated emergency vents.

D.2.5 Adjust the air flow until steady operating conditions are obtained at a pressure corresponding to the pressure specified by the manufacturer. Except in the case of a fusible vent (which is tested as in clause D.2.10), record the flow rate and check for compliance with 4.5.3.4.

D.2.6 When relevant, adjust the air flow until a steady pressure of 35 kPa is obtained and check the flow rate of pressure-actuated emergency vents for compliance with 4.5.3.3(b).

D.2.7 When relevant, adjust the rate of air flow to the maximum liquid filling rate for the tank (see 5.1(i), and check filling and discharging vents for compliance with 4.5.3.2.
D.2.8 Adjust the air flow to obtain a pressure in excess of 25 kPa, slowly decrease the air flow, and check the pressure at which the emergency pressure vent closes, for compliance with 4.5.3.3(b).

D.2.9 When relevant, connect the tank to the flow meter, pressure gauge and water supply. Adjust the flow rate to the maximum liquid filling rate for the tank (see 5.1 (i)) and check the filling vent for compliance with the relevant requirement of 4.5.3.2.

D.2.10 Dry the tank, manhole cover and vents. Where a fusible vent is fitted, remove the plug. Connect the air supply, flow meter and pressure gauge to the tank and, by introducing dry air at a steady pressure of 35 kPa; verify that the total venting capacity of the emergency vents comply with 4.5.3.3(b).

D.2.11 Where a fusible vent is fitted, by repeating 6.5.2.4 with the plug removed and with all other vents sealed, verify the accuracy of the flow rate specified by the manufacturer (See 5.2 and 4.5.3.3 (c)).
Annex E
(normative)

Testing of manhole covers (hatch closures, when fitted)

E.1 Drop test

E.1.1 The test shall be conducted as follows:

a) Attach the baseplate of the manhole cover, including the fill opening, of the prototype to the end of a steel tube of such thickness that it will not distort during the test, and that has a length of 1.5 m to 1.6 m, and a shape such that the sealing ring of the baseplate forms a liquid-tight joint with the tube, and with a suitable stop at the open end of the tube;

b) Place the assembly in a suitable apparatus with the manhole cover at the bottom. Fill the tube with water to a depth of between 0.9 m to 1 m

c) Raise the assembly vertically to a height of 1.5 m ± 0.05 m (measured from its lowest point); and

d) Allow the tube and fitted manhole cover to fall freely through a distance of 1.20 m ± 0.01 m and arrest the fall abruptly by means of the stop at the open end of the tube.

E.1.2 Consider the manhole cover (and hatch closure, if fitted) to have passed the test if the assembly remains liquid-tight throughout, except that slight leakage is permissible on impact, provided that the leak stops immediately thereafter.

E.2 Pressure test

E.2.1 The test shall be conducted as follows:

a) Fit each manhole cover, including the fill opening, with a safety device that prevents the cover from opening fully when internal pressure is present;

b) Secure each cover with fastenings that will prevent opening of the covers as a result of vibration under normal conditions of transportation, or of shock impact due to a rollover accident on the roadway or shoulder, provided that the covers are not struck by a substantial obstacle.

c) Mark each cover permanently, by stamping or other means, with

   i) The manufacturer’s name;

   ii) The test pressure kPa; and

   iii) A statement certifying that the manhole cover meets the pressure test requirements.
Annex F
(normative)

Notes to purchasers

The following information shall be availed in tender invitations and in each order or contract:

a) The type and grade of metal required for the tank(s) (see 4.2.1);
b) The type of road tank vehicle;
c) The total volume capacity of the tank, in litres
d) The normal working pressure of the pumping system (see 4.6.3);
e) The length, nominal size, maximum working pressure and type of hoses (see 4.7);
f) Whether lifting lugs are to be fitted to demountable tanks (see 4.8.5);
g) Whether identification placard holders are to be fitted (see 4.8.6);
f) When relevant, the volume capacity of the individual compartments.
Annex G
(normative)

Information to be supplied by the manufacturer

The manufacturer shall supply the purchaser with the following information in the form of a data book with each road tank vehicle produced:

a) Details of the markings required for tanks and vents in terms of clause 5;

b) Design calculations that prove compliance with the relevant requirements of 4.3;

c) Where applicable, certificates covering the chemical analysis and tensile properties of all metal(s) used for the construction of the tank(s), piping and fittings (see 4.2.1 and 4.2.2);

d) Where applicable, certificates covering the charpy V-notch impact values for the metal(s) and weld deposit(s) used in the construction of the tank(s) (to prove compliance with the requirements of 4.2.1 and 4.4.2.2);

e) Weld procedure test results that prove compliance with 4.4.2;

f) Proof of compliance of the prototype and of road tank vehicles of the same model designation with the requirements for manhole covers (see 4.4.5), vents (see 4.5.3) and hoses (see 4.7); and

g) The results of pressure tests carried out in accordance with 6.2 to 6.6.
Annex H  
(normative)  

Inspection record  

Inspection of a road tank vehicle during and after its fabrication should include the following items and should be supported by a full, detailed inspection report:

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<th>Item Inspected:</th>
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<td>4.5.5</td>
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</table>
4.5.6 Access to manholes and fill openings

4.5.7 Attachment of non-liquid-carrying components

4.6.1 Power source for pumping system(s)

4.6.2 Pump(s)

4.6.3 Working pressure

4.7.1 Normal hoses

4.7.2 Aircraft fuelling hoses

4.8.1 Cab

4.8.2 Shielding of engine

4.8.3 Chassis and mounting of tank(s)

4.8.4 Stability

4.8.5 Demountable tanks

4.8.6 Placard and document holders

4.8.6.1 Holders for identification placards (if applicable)

4.8.6.2 Document holder in cab

4.8.6.3 Document storage container

4.8.7 Exhaust systems

4.8.7.1 General

4.8.7.2 Shielding of exhaust

4.8.8 Brakes

4.8.9 Electrical wiring and equipment

4.8.9.1 Wiring system

4.8.9.2 Circuit protection

4.8.9.3 Coaming and manifold lights

4.8.9.4 Battery

4.8.9.5 Electrical bonding

4.8.10 Fire extinguishers
4.8.11 Rear bumper
5.1 Marking of tanks
5.2 Marking of vents