DRAFT EAST AFRICAN STANDARD

The petroleum industry — The installation of underground storage tanks, pumps/dispensers and pipe work at service stations and consumer installations — Code of practice

EAST AFRICAN COMMUNITY
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East African Community
P.O. Box 1096
Arusha
Tanzania
Tel: 255 27 2504253/8
Fax: 255 27 2504481/2504255
E-mail: eac@eachq.org
Web: www.eac-quality.net

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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 was prepared by Technical Committee EASC/TC 038, Equipment for Petroleum, petrochemical and natural gas
The petroleum industry — The installation of underground storage tanks, pumps/dispensers and pipe work at service stations and consumer installations — Code of practice

1 Scope

This Draft East Africa Standard provides guidelines for the installation of underground storage tanks of individual capacity not exceeding 125 000 L.

1.1 It covers guidelines on installation for pumps/dispensers and pipe work at service stations and consumer sites.

1.2 This standard also covers the installation of pressurized underground storage tanks for auto-gas.

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.

DIN 53428, Determination of the behaviour of cellular plastics when exposed to fluids, vapours and solids

ISO 2928, Rubber hoses and hose assemblies for liquefied petroleum gas in the liquid or gaseous phase and natural gas upto 25 bar (2.5MPa) - Specification

ISO 845, Cellular plastics and rubbers — Determination of apparent (bulk) density

ISO 844, Cellular plastics — Compression test for rigid materials

ISO 1209-1, Cellular plastics, rigid — Flexural tests — Part 1: Bending test

ISO 3219, Plastics — Polymers/resins in the liquid state or as emulsions or dispersions — Determination of viscosity using a rotational viscometer with defined shear rate

ISO 4590, Cellular plastics — Determination of volume percentage of open and closed cells of rigid Materials
3 Definitions

For the purposes of this document, the following definitions shall apply:

3.1 acceptable
that which meets the requirements of the approving authority

3.2 approved
that which has been authorized by the approving authority

3.3 approving authority
the relevant competent authority in the respective Partner States

3.4 backfill material
gravel, clean and sieved subsoil or sand of specified grading

3.5 competent person
a person who has the necessary knowledge of and ability with regard to the particular process or type of plant and equipment to which this standard refers, to render him capable of the work involved

3.6 dispenser
a unit that consists of one or more meters and one or more hoses and that is fed from a remote pump

3.7 dispensing pump
a unit that consists of one or more meters and one or more hoses and that has its own pump(s) within the unit

3.8 emergency work
works whose “non-execution” will mean continued damage to or potential to cause harm to environment and people

3.9 professional engineer
a competent person registered by the body responsible for registration of engineers in the Partner States

3.11
fibre-reinforced resin tank
a tank made from a number of fibre glass strands (reinforcement) bound together using a resin and catalyst

3.12 filler
a point for filling the tank with a product

3.13 filler box
the box surrounding the filler point

3.14 general works
works like repair and replacement of small items, equipment, paintworks etc for as long as it does not increase the storage capacity or the scale of operations of the facility.

3.15 holiday test defect
a lining or coating defect where the coating is so thin or the coating material has been so degraded or so contaminated that the defect is registered by a suitable holiday detector (correctly used and set at an appropriate voltage) and that the protective properties of the lining or coating are impaired

3.16 oxygenates
a generic term for products such as methanol, ethanol, isopropanol, tertiary butyl alcohol, tertiary methyl butyl ether and tertiary amyl methyl ether

3.17 rapid drainage system
a system that allows drainage of spillage from the filler box to the relevant underground tank and that is controlled by a suitable valve

3.18 submersible pump
a remote pump that feeds one or more dispensers and that is either completely submersed in the product or has its rotating parts submersed in the product within a storage tank

3.19 Auto-gas
mixture of hydrocarbons gaseous under conditions of normal temperature and pressure and maintained in the liquid state by increase of pressure or lowering of temperature which can be used as fuel for internal combustion engine.

Note 1 The principle components are propane, propene, butanes or butenes.

Note 2 LPG can be obtained as commercial butane, commercial propane or a mixture of the two.

3.20 consumer installations/site
site where fuel is stored for own use and not for commercial purposes

4 Tanks
4.1 General

4.1.1 Positioning

Tanks shall be situated at suitable distances from buildings, roadways or other structures so as to comply with the relevant regulations of the respective Partner States.

4.1.2 Steel tanks

4.1.2.1 Steel tanks shall be double wall constructed. In case single wall steel tanks are used, the tanks shall be buried in a concrete enclosure and fitted with leak detection system.

4.1.2.2 Leak detection methods can be, but not limited to any of the following:
   a) Electrical
   b) Mechanical.
   c) Vacuum test
   d) Volume change

4.1.3 Fibre-reinforced resin tanks

Fibre-reinforced resin tanks shall have all materials used in contact with the tank compatible with the fibre-reinforced resin.

4.1.4 Ultraviolet protection

While on site before installation, fibre-reinforced tanks shall be protected against ultraviolet radiation by acceptable means.

4.2 Site topography

4.2.1 Excavations

4.2.2.1 All excavations shall be carried out in an approved manner to comply with the requirements of the relevant regulations of the respective Partner States.

4.2.2.2 The depth of the excavation, measured downwards from the proposed finished ground level or from the top of the finished driveway surface, shall be at least equal to the sum of the tank diameter, plus
   a) at least 150 mm for the depth of the bedding layer, plus
   b) at least 750 mm for the depth of the overlay.

The width and length of the excavation shall be in accordance with the tank plan dimensions, plus a clearance of at least 500 mm all round.

4.2.2.3 The distance between tanks in a single excavation shall be at least 500 mm.

4.2.2.4 The contractor/installer shall use suitable equipment to keep the excavation free of visible water during the construction period and during the installation period. No part of an excavation shall intersect a line projected downwards at 45° from the outer edge of a structural foundation, unless the excavation is approved by and under the strict control of professional engineer (Refer to Figure 1.)
Figure 1 — Clearance required from existing structure

NOTE   Tank should not be positioned close to an existing structural foundation than a 45° line projected downwards from a point 1.5 m away from outer bottom edge of the foundation. (See Figure 1.)

4.3 Corrosion protection

Where cathodic protection is installed in a hazardous location, the safety parameters shall comply with IEC 60079-14.

4.4 Transportation and off-loading of steel tanks

4.4.1 The manufacturer or supplier (or both) shall not permit loading or transport of the tank unless suitable equipment is available and is used.

4.4.2 During transportation, the tank shall rest on sand bags or other suitable padding and shall be held down with webbing straps and not with chains or wire cables.

4.4.3 All tanks shall be fitted with lifting lugs during manufacture, to enable lifting straps and shackles to be used and, if the spread angle exceeds 60° at the apex, a spreader bar shall be used. All lifting equipment shall comply with the relevant safety regulations of the respective Partner States.

4.4.4 When the tank is off-loaded, it shall be lifted (using approved lifting equipment) clear of the transport carriage and lowered either directly into the excavation or onto the saddles, old tyres or other acceptable supporting material of sufficient surface area to prevent damage to the coating of the tank.

4.4.5 The tank shall be lowered gently into the excavation. Rolling of the tank shall not be permitted at any time during transportation, off-loading and installation.

4.5 Transportation and off-loading of fibre-reinforced resin tanks

4.5.1 During transportation, the tank shall rest on sand bags or other suitable padding and shall be held down with webbing straps and not with chains or wire cables.

4.5.2 During off-loading, the tank shall be prevented from rolling over or dropping. Chains or cables shall not be used for off-loading and handling of fibre-reinforced resin tanks unless in
conjunction with lifting lugs. Chains or cables shall not be used around fibre-reinforced tanks or fibre-lined tanks.

4.5.3 During off-loading, the tank shall be lowered either directly into the excavation or onto saddles, old tyres or other acceptable supporting material of sufficient surface area to prevent damage to the tank, until it is installed.

4.5.4 Tank concrete water proof containment shall be provided where single wall tank is installed.

5 Backfilling

5.1 General

5.1.1 Stability

The stability of underground tanks depends on the backfill support, and it is therefore essential that the correct backfill be used. The backfill shall be spread in layers of thickness 150 mm each layer being compacted to the requirements of this standard. Underground tanks are designed to be used with adequate backfill support, and they shall be installed using acceptable construction practices and acceptable fill materials. Improper installation can cause tank damage.

5.1.2 Observation wells

Observation wells (two for a single tank and four for a multi-tank installation) shall be installed for a single walled tank in the following manner before backfilling takes place:

a) a non-metallic slotted/perforated pipe of internal diameter at least 100 mm, wrapped in a porous geotextile, or

b) acrylonitrile-butadiene-styrene (ABS) single-walled wedge-slot tubular screens, shall be placed in each corner of the excavation. The bottom ends shall be plugged and the top ends finished off with a suitable cove.

NOTE The non-metallic piping for the observation wells should be rigid enough to withstand the compaction loads.

5.2 Backfill material

The method to be adopted for the backfilling of excavations for all types of underground tanks shall depend on the type of backfill used, as well as on the approval of the site engineer for the type of backfill material used. One of the following materials shall be used as backfill:

a) sand

it shall be clean, inert, granular, well-graded sand, free from any organic material, and of grading 0.02 mm to 2 mm. Appropriate sand includes:

i) plaster sand,

ii) building sand, and

iii) river sand;

b) stone crushings
It shall be clean and free-flowing crusher dust, obtained from commercial sources, and that complies with the following requirements:

i) 100% passing a 19 mm sieve;

ii) 98% passing a 13.2 mm sieve;

iii) 90% passing a 4.75 mm sieve;

iv) not more than 20% passing a 75 µm sieve; and

v) a pH range of 6.0 to 8.0;

c) gravel:

It shall be clean and free-flowing naturally rounded cohesion-less gravel of nominal diameter 6 mm and of particle size diameter in the range of 3 mm to 10 mm.

NOTE Clay, silts, slags and cinders should not be used.

5.3 Installation of tanks and method of backfilling with cohesive backfill materials

5.3.1 General

A holiday test of 35 000 V, shall be carried out on the tank coating before its installation.

5.3.2 Water level

The water table level shall be maintained lower than the excavation by de-watering from a sump.

5.3.3 Excavation of floor

Ensure that the bottom of the hole is flat, level and free from rocks and other foreign objects, and that the highest point of the excavation is covered with at least 150 mm of backfill material, compacted to the specification of the professional engineer.

If required by the professional engineer, and as an added precaution against product leaks (in pipe or tanks), a suitable non-metallic sheet (see Figure 1) shall be placed on a bed of river sand of thickness at least 150 mm. The sheeting shall be placed such that it has a fall of at least 150 mm to one corner in which an observation well shall be installed.
Figure 2 — Excavation showing tank, polyethylene sheet, concrete saddle and concrete slab in place

5.3.4 Tank installation

Place the tank(s) into the excavation (in their correct position) and level them to ensure that the fitting apertures are in their correct positions. Install the necessary fittings and check to ensure that they are vertical.

5.3.5 Ballast

Fill the tank(s) with sufficient water (or product as previously agreed upon, and subject to the approval of the approving authority), to steady the tank(s) and hold it in position.

NOTE 1 While adding the ballast, use the lifting lug (or webbing strap, as relevant) to keep the tank in position.

NOTE 2 Ballast is not necessary in a dry excavation.

5.3.6 Distribution of backfill

Distribute the backfill material evenly around the tank(s) in uniform horizontal layers, ensuring that no part of the backfill is more than 300 mm above any other part.

The layers shall have a compacted thickness of 150 mm and the backfill shall be compacted to a suitable compaction level as indicated on the approved plan.
Hand-shovel the backfill around the tank(s) and under the ends, and compact each layer. Special attention shall be given to the placing and compaction of the backfill under the overhangs.

The water level in a wet hole shall be maintained at least 300 mm below the level of the lowest point of the backfill at all times.

5.3.7 Other materials

Should the construction programme warrant it, the backfill indicated on the approved plan may be stabilized with ordinary Portland cement. A similar compactive effort shall be used as described in 5.3.6.

5.4 Installation of tanks and method of backfilling with cohesion-less backfill materials

5.4.1 General

Cohesion-less backfill material is regarded as free flowing and can be poured into the excavation, ensuring that no part of the backfill is more than 300 mm above any other part at any given time.

5.4.2 Installation procedure

5.4.2.1 Maintain the water table level below that of the excavation by de-watering from a sump.
5.4.2.2 Spread a layer of backfill of thickness at least 150 mm evenly at the bottom of the excavation.
5.4.2.3 Lower the tank(s) into the excavation and position and level them.
5.4.2.4 Fill the tank(s) in accordance with 5.3.5.
5.4.2.5 Backfill in accordance with 5.3.6. No stabilization with cement is deemed necessary when using this type of backfill. No compaction is required when using this type of backfill, but water can assist in the consolidation of this type of material. The backfill around fibre-reinforced resin tanks shall be cohesion-less gravel (pea gravel).

5.5 Holding down

5.5.1 General

When local conditions indicate the likelihood of the water table rising above the level of the installed tank, precautions shall be taken to counter the buoyancy force on the tank by installing either saddles and a concrete slab or a single suitable concrete slab.

5.5.2 Saddles

5.5.2.1 If the concrete slab is constructed at ground level that load is transferred to the tank shell via the soil, there can be insufficient mass in the slab itself and thus concrete saddles might have to be installed directly on top of the tank shell. Saddles transmit the load of the slab to the tank shell as concentrated loads, and cognizance shall be taken of this fact when the tank is being designed.

It is recommended that saddles are placed a length equalling one quarter of the tank diameter from the tank ends, but the placing shall be as indicated on the approved plan.

5.5.2.2 If a reinforced concrete slab is to be used to hold the tank down, a leak test (see Clause 13) shall be carried out on the tank preferably before the slab is cast, in case the tank has to be removed for repairs.
5.5.2.3 The concrete slab can be constructed directly on top of the tank (separated by backfill material e.g. sand or shingle) to take advantage of the mass of the superimposed soil and to permit access to pipe runs without having to break up the concrete.

5.5.3 Concrete slab

A concrete slab shall be designed such that:

a) its length and width exceed the length and width of the tank(s) by at least 600 mm on all sides,

b) its thickness is at least 150 mm, but may be increased if specified by the professional engineer, and

c) the top and bottom reinforcements consist of mild steel bars of diameter at least 6 mm, at centres of not more than 150 mm in both directions, or of hi-tensile mesh equivalent.

5.5.4 Holding straps

Holding down straps shall be made of non-corrosive material and shall be adequately designed to take the full load of the tank.

6 Pipe connections and manholes on fibre-reinforced resin tanks

6.1 Pipe connections

Piping shall be free to move with the tank. Connections into the tank shall be made with short lengths of acceptable flexible hose, using compression fittings, or double gland type fittings for plain end pipe. Where the piping is of flexible construction, flexible hoses are not necessary.

6.2 Manhole construction

Do not place bricks or other manhole materials directly onto the tank surface. The tank shall be separated from the manhole itself by backfilling material. Manholes may be constructed from but are not limited to the following materials: load-bearing brickwork (fully bedded and jointed), high density poly-ethylene, precast or in-situ concrete and fibre-reinforced resin. Manholes shall be of diameter at least 1 m, and shall be designed so as to prevent the ingress of surface water.

7 Pipe work and fittings

7.1 Piping for tanks other than fibre-reinforced resin tanks (see 6.1) may be of steel black piping, protected against corrosion by wrapping, together with a PVC outer wrap, or of a suitable non-metallic material. However, the pipe work on the upstream (tank) side of the dispensing delivery pump and the dispenser bottom connecting union, or of the shear coupler, shall be installed in accordance with the dispenser manufacturer's requirements.

7.2 All piping shall comply with the requirements for medium pressure rating. When steel piping is used it shall be protected against corrosion by wrapping, together with a PVC outer wrap, with at least 50 % overlaps.

8 Material

8.1 Steel pipe and fittings for welding

8.1.1 General
Piping for welding shall be suitable for working pressures of up to 1 000 kPa (10 bar).

The piping shall be plain end, beveled for welding, electric-resistance welded, submerged arc welded or seamless.

8.1.2 Fittings

Fittings for welding shall comply with the requirements of relevant standards.

8.1.3 Flanges

Flanges for welding shall be of class 150 pressure-temperature rating, slip-on or weld neck flanges that comply with the requirements of an ISO 7005-1.

8.1.4 Gaskets

Gaskets shall be non-asbestos, compatible with the liquid being handled, of thickness at least 1.5 mm and shall comply with an relevant standards.

8.2 Threaded steel pipe and fittings

8.2.1 General

Galvanized pipes and fittings of suitable class may be used.

8.2.2 Fittings

Only threaded carbon steel fittings shall be used. Unions shall be cone-faced.

8.2.3 Flanges

Threaded flanges shall be of steel

8.2.4 Pipe threads

Pipe threads shall comply with ISO 7-1.

8.3 Non-metallic piping

8.3.1 Material

All components of an installation shall be capable of operating in the prevailing soil conditions. If the material is susceptible to degradation from exposure to alkalis, acids, aqueous salts and hydrocarbons, acceptable adequate protection shall be applied.

8.3.2 Fuel compatibility

No significant degradation of the properties of the material shall occur over the life of the installation. The various additives and blends in fuels shall be noted and considered.

8.3.3 Fuel permeability

Where non-metallic permeable materials are used for piping, the rate of permeation shall not exceed 2 g/m per day at a temperature of 23 °C.

8.3.4 Ultraviolet exposure
All non-metallic components shall be able to withstand six months continual weathering before installation without significant property degradation.

8.3.5 Primary delivery pipes

Both positive pressure and vacuum suction lines where the pipes continually contain liquid fuel, shall be capable of withstanding 4 bar positive pressure and a 10 bar peak pressure pulse.

Suction lines shall be capable of withstanding 0.6 bar vacuum and a 0.7 bar peak vacuum pulse, and a 1 bar positive pressure.

8.3.6 Vents

Vent lines that contain petroleum vapours but are not normally exposed to liquid fuel shall be capable of withstanding 1 bar pressure and 0.1 bar vacuum pulse.

8.3.7 Fill pipes

Fill lines experience regular, but short periods of exposure to liquid fuels and continual exposure to petroleum vapours. The lines shall be capable of withstanding 1 bar positive pressure and a 0.6 bar vacuum pulse.

8.3.8 Compressibility

Pipes shall not deform more than 5% when subjected to normal road wheel loads at a cover of 300 mm. Stabilized material or concrete may be used as backfill to reduce any deformation of the pipe.

8.3.9 Transition

When non-metallic piping is used, the transition from steel tank fittings to non-metallic fittings shall be made in the manhole nearest to the tank and under the pumps/dispensers.

8.3.10 Shear-off valve

The vertical riser beneath any remote dispenser shall be firmly fixed so as to ensure the correct functioning of the shear-off valve of the dispenser and shall comply with the manufacturing requirements.

8.4 Installation

8.4.1 Pipe-work

Steel pipe-work shall be laid out in a geometrical pattern and shall be indicated on the plan of the site. All non-metallic piping shall be laid out in accordance with the manufacturer’s recommendations. All welds shall be inspected for compliance by a competent person.

8.4.2 Joint fittings

Only standard fittings shall be used on joints.

8.4.3 Incline on pipe-work
Pipe-work shall be designed by a professional engineer to have an adequate fall to the tank from the dispenser(s) or suction pump(s), vent(s) or breather(s), and fill point(s).

8.4.4 Jointing tape

Jointing tape or compound used on screwed threads shall be of an acceptable quality.

8.4.5 Buried pipe-work

All buried pipe-work shall be covered by backfill of thickness at least 300 mm. A shallower backfill may be permitted if it is of a reasonable engineering design.

8.4.6 Welding

All welding for non-metallic type piping (where applicable) shall comply with an approved standard.

8.4.7 Pipe-work leak test

Before the pipe-work system is backfilled, it shall be isolated from the tank(s) and pump/dispenser and subjected to a hydraulic test, with the pressure being maintained for 15 min at 1 000 kPa, (10 bars) or an ultrasonic leak detector can be used to search for leaks within the system.

8.4.8 Corrosion protection

All steel pipes and fittings shall be corrosion protected by means of wrapping. Cathodic protection of the pipe-work may be the same as for the tank if so specified by the competent person in charge.

8.5 Dip pipes or gauging pipes

Each tank shall have a connection through which the contents of the tank can be manually or automatically gauged. The connection shall be perforated and of nominal diameter at least 40 mm and shall be fitted with a lockable cap capable of sealing against a hydrostatic pressure at least equal to the pressure of the tank or that of the delivery head (whichever is the greatest).

NOTE In order to avoid spillage in case of an overfill, this dip cap should be in the closed, sealed position whilst deliveries are taking place.

8.6 Suction pipes

Where suction pipes are installed to each pump, a non-return valve shall be fitted at the base of and under the pump or angle check valve in the manhole chamber.

8.7 Delivery pipes

Delivery pipes are installed where submersible pumps are used. A single header for each product or a designed header that is site specific shall be run along or underneath the line of the dispenser island(s).

NOTE 1 For maintenance purposes an isolating valve may be fitted to the branches of the dispensers.

NOTE 2 Steel pipes are not allowed as delivery pipes with submersible system.

8.8 Breather pipes or vents pipes
8.8.1 Breather pipes or vent pipes shall be of internal diameter at least 50 mm and shall terminate at a distance of at least 1.5 m away from any opening to a building, the distance being measured horizontally. The vent pipes shall terminate such that the fumes are exhausted vertically upwards or horizontally. Discharge shall not be vertically downwards.

8.8.2 The termination shall be protected by means of a screen. The fact that petroleum vapours are heavier than air shall be taken into account, and free rapid dispersion shall be allowed for at the termination of the vent. No brick or other architectural screening of the vent termination shall be permitted. One vent per tank is required and these shall not be manifolded since overfills can lead to cross-contamination.

8.8.3 The vent outlets shall be located such that they:

a) are not situated beyond the existing building line boundary on a stand excluding the street boundary,

b) allow unrestricted venting to the open air,

c) are at least:
   i) 0.6 m above roof level;
   ii) 3.5 m above ground level;
   iii) 1.5 m from any door, window, or other opening in a building; and
   iv) 4.5 m from any chimney opening, any hot surface, or any source of ignition.

d) are, if possible, within sight of the filling point (under certain circumstances, where the vent outlet is not within sight of the filling point, the approving authority may require that an alternative warning system/procedure be employed to guard against the possibility of overfilling), and

e) are not installed within 3.0 m of any electrical and electronic equipment.

f) In the case of power lines, the distance shall be as determined by the power system operators or electricity regulators in the relevant Partner States.

8.8.4 All breather/vent pipes shall be cross bonded using 25 mm copper cable and connected to a copper earth spike of length at least 1.2 m and of diameter 10 mm, driven into the ground as near as possible to the pipe(s) and connected to the pipe(s) using 25 mm² green-plastic-insulated copper conductor. This copper conductor shall then be connected to the earth continuity of the site by an acceptable means, for example with a copper U-bolt.

9 Fillers, pumps and drainage

9.1 General

Underground tanks should be filled by gravity filling. No direct connection pump deliveries shall be permitted unless there is an engineered system/adaptor fitted which will prevent excess pressure being placed on the tank.

9.2 Fillers

Fillers shall be sited such that surface water and soil are prevented from entering the filler box.

Filler liner shall extend to at least 75 mm from the bottom of the tank to ensure that that there is liquid seal in line.
Each filler shall be sited such that the tanker is able to leave the premises without having to reverse, and can park safely when bulk deliveries are being made. Where limited access prevents tankers from parking or entering the premises, filler sites shall be designed by the professional engineer to accommodate them.

9.3 Filler box

The filler box shall be leak-proof, shall be able to contain the contents of a bulk delivery vehicle discharge hose, and shall be of capacity not less than 35 L.

9.4 Earthing

9.4.1 Metal filler box

Each metal filler box shall have a frame bolt that can be used as an earth connection point, and the filler box shall be connected to the electrical earth continuity conductor of the installation. A metal tag shall be provided onto which the operator can connect the bonding cable from the bulk vehicle while delivering product.

9.4.2 Non-conductive filler boxes

In a non-conductive filler box, the conductive parts inside the box shall be connected to the electrical earth continuity conductor, and a connection point shall be provided onto which the operator can connect the bonding cable of the bulk vehicle.

10 Submersible pumps, dispensers and suction pumps

10.1 General

Submersible pumps, dispensers and suction pumps shall comply with specifications of the relevant regulations of the respective Partner States.

10.2 Dispensers and dispensing pumps

Reselling dispensers and dispensing pumps shall comply with the requirements of the relevant regulations of the respective Partner States.

10.3 Specific requirements

10.3.1 Leak detector

Each submersible pump shall have a leak detector that automatically checks the integrity of the pipe work on the pressure side of the pump.

10.3.2 Shut-off valve

Each dispenser shall be fitted with an emergency shut-off valve that incorporates a shear section and has its body anchored rigidly below the dispenser in accordance with the manufacturer’s specification.

10.3.3 Plinth

Each dispensing pump and dispenser shall be protected by a concrete or brick plinth projecting at least 300 mm from the base and of height at least 150 mm above finished floor level (see Figure 3). Alternatively, the plinth can be widened at the ends only, as illustrated in Figure 4.
10.3.4 **Steel bollards/crash barriers**

Where a plinth cannot be installed, steel bollards or crash barriers may be installed, provided that they are acceptably fixed onto a concrete base.

10.3.5 **Dispensing hose**

Each dispensing pump or dispenser shall be located such that when the hose is fully extended in the direction of any ramp leading down to a basement, no fuel can flow from the nozzle down the ramp or storm water drain.
Figure 3 — Plinth

Figure 4 — Alternative plinth
11 Driveways at truck, bus and earthmoving vehicle refuelling facilities (excluding service stations petrol forecourts that do not have more than two diesel dispensing hoses/nozzles)

To facilitate compliance with the provisions of the relevant environmental regulations of Partner States the driveway area around the diesel dispensers/dispensing pumps where spillage might occur during the refuelling operation, shall be graded such that any effluent run-off will not flow to the street, or into watercourses or into storm water systems without first passing through a gravity separator.

In cases where effluent is mixed with detergents, thus breaking down the petroleum product and rendering the gravity separator ineffective, the effluent shall pass through a dedicated interceptor. Precautions shall be taken to ensure that contaminated rain water or spills do not flow into a foul sewer or storm water system without first passing through a gravity separator.
Figure 5 — Sampling chamber and separator
12 Overfill protection

12.1 Care shall be taken to ensure that the basic indication that an overfill has occurred or is imminent, is not the spilling of the product out of the dip pipe, but a slowing down or stoppage of the delivery meter. To achieve this, a back pressure has to develop in the storage tank.

12.2 The dip cap shall be able to seal against a hydrostatic pressure of at least the pressure of the tank or that of the delivery head (whichever is the greater), and shall be securely closed before delivery takes place.

12.3 The tank shall be fitted with an overfill protector. The critical level shall be such that a space remains in the tank to accommodate the delivery hose volume. (The standard 2 % ullage will suffice.)

13 In-situ leak test

A full system pressure leak test at 40 kPa in accordance with an approved test method shall be carried out on the tank after installation.

14 Electrical installation

14.1 General

All electrical and electronic installation shall comply with the requirements of IEC 60079-14. Uncertified electrical equipment or systems shall not be installed in hazardous locations.

14.2 Electric cables

Electric cables and wiring shall be installed such that they do not come into extended contact with substances that might be harmful to their insulation.

14.3 Buried cables

All power and electronic cables passing under paving and driveways shall be encased in suitable Sleeve piping.

14.4 Sleeve pipes

All sleeve pipes that pass through a hazardous area, whether or not they are for electrical purposes, shall be acceptably sealed to prevent hazardous vapours from seeping into unsafe unprotected locations.

Electrical cables and their conduits shall not be laid in the same ducting with the product piping.

14.5 Accredited electricians and certification of electrical work

14.5.1 Electricians

All electricians who work on installations that fall within the scope of this standard, shall be a certified electrical contractor/electrician who is registered with relevant authority of Partner States.

14.5.2 Electrical installations
All electrical works on installations that fall within the scope of this standard shall be done by a certified electrical contractor/electrician who is registered with relevant authority of Partner States.

14.5.3 Certification

Electricians shall provide a prescribed "Certificate of Compliance" for the work that they carry out.

Electrical work in hazardous locations shall be certified by an accredited person in accordance with the relevant electricity regulations in Partner States.

14.6 Emergency

There shall be an "emergency stop" switch demarcated so as to be easily visible in the forecourt and easily accessible for operation in case of an emergency. When the "emergency stop" is activated, it shall cut off all power to the forecourt. Each pump shall have an individual circuit with overload and thermal overload protection.

14.7 Hazardous installations

Electrical work in hazardous locations requires specialized knowledge and experience, so this type of installation shall only be designed and installed by persons competent in this field and in accordance with IEC 60079-14.

14.8 Service station forecourt area classification

14.8.1 General

The equipment of the forecourt under normal open area conditions shall comply with the requirements in this standard.

14.8.2 Classified area examples

The direct classification examples for typical service station conditions are given in Figures 6 to 11. These classification examples shall also be applied to non-retail dispensing sites. The zone 2 areas indicated cover the possibility of localized hazardous areas being present for short periods, with such areas being well ventilated under open area conditions.

The classified areas indicated relate to the installation of fixed electrical equipment and shall not be considered as extending beyond an unpierced wall, roof or other vapour barrier or solid partition.

14.8.3 Protection of buildings with access to forecourts

Retail shops, sales rooms, storage rooms, restrooms and other buildings with openings to a hazard zone shall be classified according to that zone at the same height throughout the building. Such buildings shall be well ventilated and heating apparatus shall be positioned in such a way that it is not possible to have a source of ignition in a hazardous area during normal operations or in the event of an outside spillage. Fixed heating shall only be of the type where the surface temperature does not exceed 100 °C and all staff shall be warned against introducing any other type of portable appliance.

Retail shops or other types of buildings shall not be within any hazardous area. Further care shall be taken not to introduce sources of ignition into hazardous locations, for example, cold drink dispensers and fridges, electrical signage, sound systems or uncertified portable credit card readers.

14.8.4 Control of non-electrical sources of ignition
The control of non-electrical sources of ignition such as smoking and the running of engines shall be enforced at all times during fuelling. Should such a hazard exist, dispensing of product shall be stopped immediately.

The engine of a vehicle to which product is to be dispensed shall be switched off, to avoid accidental movement or ignition caused by ignition sparking or by backfiring.

Auxiliary engines (for example, on cement mixers or refrigerated trucks) or other sources (for example, gas flames in caravan refrigerators) shall be switched off.

No smoking or naked flames shall be allowed in the hazardous area.

14.8.5 Fuels other than class I products

The requirements in 14.8.2 to 14.8.5 apply to the handling of class I products, for example, petrol type fuels. There is no distinction between the design and constructional features of dispensing units for class I (petrol) and class II (diesel and kerosene) products. Such class II products do not cause a hazardous area outside dispensers, but the inside area classification remains the same.

Figure 6 — Underground tank with class I flammable liquids or class II and III combustible liquids at temperatures at or above their flash points, with gravity filling
Figure 7 — Underground tank with class II and III combustible liquids at temperatures below their flash points, with gravity filling
Figure 8 — Low hose dispenser with vapour barrier

\[ X = \text{the greater of } 1 \ 200 \text{ mm or top of the dispenser or pump hydraulic housing.} \]

Legend:

- \[ \text{Zone 0} \]
- \[ \text{Zone 1} \]
- \[ \text{Zone 2} \]
Figure 9 — High hose metering pump/dispenser — without site glass and without vapour barrier

Figure 10 — High hose metering pump/dispenser — without site glass and with vapour barrier
15 Supervision

15.1 Manufacturing

The purchaser or his appointed agent shall be permitted to inspect the materials or the work of the tank manufacturer at any time.

15.2 Installation

The installer shall provide the purchaser with a certificate stating that a competent person has:

a) examined the excavation and witnessed the placing of the tank in the excavation,

b) witnessed an in-situ leak test being performed on the tank,

c) witnessed a leak test being performed on the pipe-work, and

d) witnessed a 35 000 V holiday test on the tank before it was placed into the excavation.

16 Removal or abandonment of tanks and pipe-work

16.1 Removal

A tank or pipe-work which is leaking or which is to be taken out of service permanently shall be removed from the site, except in cases where there are well justified structural or practical reasons against removal. In such cases the tank or pipe-work may be abandoned on site subject to approval by the approving authority of the respective partner states, and in compliance with the relevant requirements set out in 16.2.

Before any tank or pipe-work is removed, it shall be inspected and certified as free from all liquid hydrocarbons. All safety precautions shall be strictly adhered to at all times.
When a tank or pipe-work is being removed, due precautions shall be taken against risks associated with the following:

a) the likely presence of hydrocarbons in the surrounding soil; and

b) the possible presence of explosive vapours in the tank or pipe-work (or both).

Once a leaking tank or leaking pipe-work has been removed, it is necessary to rehabilitate the surrounding area in compliance with relevant environmental regulations.

16.2 Abandonment

16.2.1 General requirements

When the abandonment of a tank or pipe-work has been duly approved (see 16.1), the tank or pipes shall be filled with an acceptable filler material, for example polyurethane foam, slush concrete, sand and soil etc.

16.2.2 Requirements for polyurethane (PUR) foam used as filling material for abandoned tanks and piping

16.2.2.1 General

Any PUR foam used as a filling material shall:

a) be generally compatible with the tanks or pipe work which it fills and, in particular, shall not be aggressive or corrosive towards such pipe work,

b) evolve no noxious or toxic gases or fumes in the course of its formation or in subsequent service, and retain its structural integrity in normal conditions throughout its service life.

16.2.2.2 Foam-forming system

16.2.2.2.1 General suitability and application procedure

A foam-forming system (isocyanate and polyol with any appropriate additives) to be used for filling a tank or pipe work shall be recommended by the system’s supplier as suitable for the particular application, and the supplier’s instructions shall be followed when the system is being applied on site.

16.2.2.2.2 Properties relevant to cavity filling

When each of the properties of a foam-forming system listed in Column 1 of Table 1 is determined by the corresponding test method indicated in Column 4, the result of the determination shall comply with the relevant requirement given in Column 3 of the table.
Table 1 — Properties of foam-forming systems (determined at 25°C ± 1°C)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property and units</td>
<td>Foam-application</td>
<td>Requirement</td>
<td>Determination method, clause</td>
</tr>
<tr>
<td>Viscosity, mPa.s</td>
<td>Tank filling: Polyol and isocyanate Pipe work filling: Polyol Isocyanate</td>
<td>150 to 250&lt;sup&gt;a)&lt;/sup&gt; 150 to 300&lt;sup&gt;b)&lt;/sup&gt; 150 to 250&lt;sup&gt;ab)&lt;/sup&gt;</td>
<td>B.1.1</td>
</tr>
<tr>
<td>Cream time, s</td>
<td>Tank filling</td>
<td>30 to 90</td>
<td>B.1.2</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>20 to 90</td>
<td></td>
</tr>
<tr>
<td>String time, s</td>
<td>Tank filling</td>
<td>180 to 360</td>
<td>B.1.2</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>120 to 360</td>
<td></td>
</tr>
<tr>
<td>Rose to,e, s</td>
<td>Tank filling</td>
<td>300 to 600</td>
<td>B.1.2</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>240 to 600</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> 150 cP to 250 cP
<sup>b</sup> 150 cP to 300 cP

16.2.2.3 Finished foam

16.2.2.3.1 Origin

The foam shall be produced on site from a system that complies with the relevant requirements given in 16.2.2.2.1 and in accordance with the relevant instructions provided by the supplier of the foam-forming system.

16.2.2.3.2 Physical and mechanical properties

When each of the foam properties listed in Column 1 of Table 2 is determined by the corresponding test method indicated in Column 4, the result of the determination shall comply with the relevant requirement given in Column 3 of the table.

16.2.2.3.3 Dimensional stability

When tested in accordance with B.2.6, the foam shall

a) exhibit no distortion, and

b) maintain its structural integrity.

16.2.2.3.4 Absence of volatile emissions

No chlorinated hydrocarbon vapours or formaldehyde detectable by smell shall be emitted by the foam at any time after the completion of its production.
Table 2 — Physical and mechanical properties of foam

<table>
<thead>
<tr>
<th>Foam</th>
<th>Requirement</th>
<th>Determination method, clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property and units</td>
<td>Function</td>
<td></td>
</tr>
<tr>
<td>Density, kg/m³</td>
<td>Tank filling</td>
<td>30 to 40&lt;sup&gt;a)&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>15 to 20&lt;sup&gt;b)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Closed-cell content, %</td>
<td>Tank filling</td>
<td>&gt; 80</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>&gt; 20</td>
</tr>
<tr>
<td>Compressive strength, kPa</td>
<td>Tank filling</td>
<td>&gt; 150</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>&gt; 35</td>
</tr>
<tr>
<td>Bending properties:</td>
<td>Tank filling</td>
<td>&gt; 15</td>
</tr>
<tr>
<td>Deflection at break, mm</td>
<td>Pipe work filling</td>
<td>&gt; 20</td>
</tr>
<tr>
<td>Force at break, N, min&lt;sup&gt;c)&lt;/sup&gt;</td>
<td>Tank filling</td>
<td>&gt; 15</td>
</tr>
<tr>
<td></td>
<td>Pipe work filling</td>
<td>&gt; 2</td>
</tr>
</tbody>
</table>

<sup>a)</sup> If the test specimen breaks before reaching deflection of 20 mm (see ISO 1209-1).

<sup>b)</sup> 0.030 g/cm³ to 0.040 g/cm³.

<sup>c)</sup> 0.015 g/cm³ to 0.020 g/cm³.

17 Storage and dispensing of auto gas

17.1 General

17.1.1 Auto gas may be sold alongside other vehicle fuels at petrol filling stations or at dedicated auto gas stations.

17.1.2 Auto gas installations at filling stations have to be considered in the same manner as any other part of the installation.

17.1.3 Auto gas may be used as commercial propane, commercial butane or commercial butane-propane mixture.

17.2 Installation

17.2.1 Before any auto gas installation commences, all approvals shall be obtained from all regulatory authorities concerned.

17.2.2 For details of appropriate design requirements for auto gas facilities, references should be made to EAS 924-2.

17.3 Storage

17.3.1 Storage vessels
17.3.1.1 Storage vessels shall be designed and constructed in accordance with ASME VIII or any other internationally recognized pressure vessel code.

17.3.1.2 The Auto gas storage vessels shall be designed for buried or mounded use. In these cases the storage vessel is either buried (completely underground) or mounded (partially underground, but fully covered by the backfill).

17.3.1.3 Storage vessels shall be installed and fitted with appropriate fittings in accordance with EAS 924-2.

17.3.1.4 Auto gas storage vessels shall not be filled beyond their maximum fill level and all vessels shall include a fixed liquid level gauge and shall have means of preventing overfilling.

17.3.2 Position

17.3.2.1 The positioning of auto gas vessels shall comply with EAS 924-2.

17.3.2.2 Distances from the storage vessel outline (in plan) shall not be less than 5.0 m from power cables operating at less than 1 Kv (including telephone cables) and 10 m for cables operating at 1 kV or above.

17.3.2.3 Positioning shall take into account access for both the delivery tanker and the emergency services.

17.3.3 Storage vessel protection

17.3.3.1 All storage vessels and their appurtenances shall be placed in a secure compound to prevent unauthorized access. The compound shall:

a) Provide adequate ventilation (i.e. be of open mesh on at least two sides).

b) Have a height of not less than 1.5 m.

c) Be constructed from non-combustible materials.

d) Have at least two means of exit, situated to minimize the distance to be travelled to escape from a dead end. Gates or access shall open outwards and be easily and immediately opened from the inside. They shall not be self-locking, and shall provide unobstructed means of escape.

17.3.3.2 The compound fence shall be at least 1.5 m (in plan) from the outline of the storage vessel(s). Site specific circumstances may require a risk assessment that may result in the variation of the distance of the compound from the vessels. In certain circumstances, the distance may be reduced to not less than 1 m but only when this distance is to a firewall.

17.3.3.3 Because filling stations are considered as having uncontrolled public access (i.e. they do not have controlled access and a secured perimeter), the fence shall be at least 3 m from the auto gas vessel. This can be reduced to 1.5 m at auto gas refuelling sites provided the compound is under constant surveillance.

NOTE Constant surveillance is defined as where the site has attended operation or guarded 24 h a day, seven days a week and the vessel is visible to site staff either directly or via closed circuit television.

17.3.3.4 Vessels bases shall be capable of supporting the weight of the full storage vessel, with the full area under the shadow of the tank surfaced with concrete. A firewall is required to protect the auto gas vessel(s) from potential sources of ignition and to ensure an adequate dispersion distance to
boundaries and buildings for auto gas leaking from the vessels or its fittings, where normal separation distances cannot be achieved.

17.3.3.5 For mounded and underground storage vessels, above-ground gas diversion walls may be incorporated on no more than two sides to reduce separation distances.

17.3.3.6 All storage vessel installations shall be situated to provide means of access for fire-fighting vehicles.

17.3.3.7 Means shall be provided to isolate the storage vessel(s), pump(s) and dispenser(s) from each other in the case of fire, or other emergency incident (e.g. leakage). This may be achieved by the provision of remotely operated shut off valves (ROSOVs) situated in the compound and at the dispenser.

17.3.3.8 Where storage vessels are situated in such a position that they may be subject to vehicle impact damage, then suitable protection shall be provided (e.g. crash barriers or bollards).

17.3.3.9 LPG cylinders or any other items that are not associated with the auto gas installation shall not be stored within an auto gas compound on a forecourt.

17.3.4 Separation distances

17.3.4.1 The separation distances in Table 3 shall be observed to ensure clearance from a storage vessel and/or associated equipment to other pieces of equipment, buildings or potential sources of ignition which, if these caught fire, would pose a risk to the storage vessel or the associated equipment.

<table>
<thead>
<tr>
<th>Vessels size (tonnes)</th>
<th>Minimum separation distance(m)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Buildings, boundary or fixed ignition source</td>
<td>With firewall (Gas diversion wall for underground vessels</td>
</tr>
<tr>
<td>0.25 to 1,1</td>
<td>3 underground/mounded</td>
<td>1,5 underground/mounded</td>
</tr>
<tr>
<td>1,1 to 4</td>
<td>3 underground/mounded</td>
<td>1,5 underground/mounded</td>
</tr>
<tr>
<td>&gt;4</td>
<td>7.5 underground/mounded</td>
<td>4 underground/mounded</td>
</tr>
</tbody>
</table>

NOTE 1 Separation distances are to valve assemblies and flanges for underground or mounded vessel systems. For underground or mounded storage vessels a separation distance to the storage vessels surface of 1 m of vessels up to 4 tonnes and 3 m for vessels over this size should be maintained.

NOTE 2 Separation distances should not be confused with hazardous area classification.

17.3.4.2 Guidance on separation distances between components is given in Table 4.
### Table 4 — Minimum separation distances

<table>
<thead>
<tr>
<th>Installation</th>
<th>Auto gas vessel</th>
<th>Auto gas Vessel fill connection</th>
<th>Auto gas pump</th>
<th>Auto gas dispenser</th>
<th>Vehicle being filled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage vessel</td>
<td>-</td>
<td>Nil</td>
<td>Nil but not Beneath vessel</td>
<td>0,5 m</td>
<td>3 m</td>
</tr>
<tr>
<td>Storage vessel filling connection</td>
<td>Nil</td>
<td>-</td>
<td>Nil</td>
<td>1 m</td>
<td>3 m</td>
</tr>
<tr>
<td>Auto gas pump</td>
<td>Nil but not Beneath vessel</td>
<td>Nil</td>
<td>-</td>
<td>Nil</td>
<td>1,5 m</td>
</tr>
<tr>
<td>Auto gas dispenser</td>
<td>0,5 m</td>
<td>1 m</td>
<td>Nil</td>
<td>-</td>
<td>Nil</td>
</tr>
<tr>
<td>Vehicle being filled</td>
<td>3 m</td>
<td>3 m</td>
<td>1,5 m</td>
<td>Nil</td>
<td>-</td>
</tr>
<tr>
<td>Underground petrol tank access chamber with fill connection</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>Nil</td>
</tr>
<tr>
<td>Underground petrol tank access chamber without fill connection</td>
<td>3 m</td>
<td>3 m</td>
<td>3 m</td>
<td>3 m</td>
<td>Nil</td>
</tr>
<tr>
<td>Remote petrol tank fill connections</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>Nil</td>
</tr>
<tr>
<td>Petrol tank valves</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>Nil</td>
</tr>
<tr>
<td>Petrol dispensers-explosion protected</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>7,5 m</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Diesel dispensers-explosion protected</td>
<td>3 m</td>
<td>3 m</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Parked cars</td>
<td>6 m or separation distance in Table 5 if less</td>
<td>6 m or separation distance in Table 5 if less</td>
<td>1,5 m</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Buildings, boundary or fixed source of ignition</td>
<td>As Table 5</td>
<td>4,1 m</td>
<td>4,1 m from vehicle fill point</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPG cylinder storage</td>
<td>Separation distances as specified in the Code of Practice for retailing LPG cylinders</td>
<td>3 m</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
17.3.5 Hazardous area classification

For information on suitable electrical equipment refer to IEC 60079.

Where provisions for storage and dispensing of auto gas are to be added to a site dispensing other vehicle fuels, and its hazardous areas overlap the existing hazardous areas for petroleum areas for petroleum related equipment, revised or modified zones shall be determined.

18 Equipment Installation

18.1 Vessels

18.1.1 Where vessels are secured, to prevent horizontal movement, the securing shall be at one end only.

18.1.2 Assessment shall be carried out to check for potential flooding/floatation.

18.2 Pumps

18.2.1 Pumps shall be suitable for auto gas use and installed as close as practical to the storage vessel outlet, but not under the contour of the vessel.

18.2.2 Submersible pumps may be used in underground and mounded storage vessels.

18.2.3 Pumps shall be fitted with a suitable bypass arrangement. The pumps and their motors shall be certified for the hazardous area in which they are installed.

18.2.4 Motors shall have suitable ingress of protection (IP) rating for their location.

18.3 Pipe work

18.3.1 Pipe work shall be installed in accordance with DEAS 924-2 and EAS 924-3.

NOTE Liquid and vapour return pipe work may contain liquid at or above storage vessel pressure.

18.3.3 Non-alloy steel tubes are not suitable for auto gas installation.

18.3.4 Above-ground pipe work is usually seamless steel with high pressure fittings. Underground pipe work needs to be suitable for liquid auto gas and for burying.

18.3.5 Means shall be included in the pipe work design to isolate, by remote operation, sections of the system in the event of fire or emergency. This can be suitably positioned through use of remotely-operated shut off valves (ROSOVs) either on the storage vessel or on the pump outlet, or both. Additionally, means shall be included in the pipe work design to isolate locally to and from the dispenser.

18.3.6 The remotely-operated shut-off valves(ROSOVs) have to fail into the closed position and be able to operate over safe operating range (i.e. 0-25 bar, -20 °C to +50 °C).Solenoide valves shall not rely on a differential pressure across the valve to achieve closure.
18.3.7 Sealants used on threaded joints and gaskets for flanges should be suitable for use with liquid auto gas over the safe operating range (i.e. 0-25 bar, -20 °C to +50 °C). Correctly designed and installed flanged joints shall not require blow out prevention.

18.3.8 The feed to and connections from the auto gas dispenser shall not be in close proximity to any structure or object that could cause abrasive damage to the connections due to vibration, or react to the dispenser solenoid valve closures after each filing operation.

18.4 Dispensers

18.4.1 Auto gas is supplied to the dispenser in liquid form from a pump near to or in the storage vessel. The auto gas may enter a vapour separator where any vapour is removed and returned to the storage vessel via the vapour return pipe-work. The liquid phase auto gas enters the meter through a non-return valve. The metered liquid passes through a different valve, solenoid valve and then the hose assembly to the filler nozzle.

18.4.2 Auto gas dispenser contain flammable liquefied gas under pressure and should only be installed, commissioned and serviced by competent persons in the safe use and handling of auto gas and in accordance with applicable Standards, statutory requirements and Codes of practice.

18.4.3 Modifications to auto gas dispensers may only be carried out following authorization by the manufacturer.

18.4.4 The information provided for dispensers for other vehicle fuels in 10.2 also applies to auto gas dispensers. It should be noted that:

a) All dispensers should be operated via a “deadmans” button.

b) Dispensers may be placed on the island adjacent to a petrol/diesel dispenser and shall be protected against impact by the provision of crash barriers or bollards in the immediate vicinity.

c) All dispensers’ bases shall be securely fixed to a mounting island and pipe work connections fitted with self sealing shear valves or similar devices in both flow and return connections.

d) Self-service dispensers shall be sited where they can be adequately viewed and supervised from the console position.

e) Each dispenser hose assembly shall be provided either with a pull-away coupling or a safe-break connection designed to part at loads typically of 25 kg not more than 50kg to protect the dispenser in the event of a ‘drive-off’ whilst the nozzle is till connected. The coupling shall be designed to part cleanly and seal both ends to prevent loss of contents.

f) The hoses shall be suitable for liquid auto gas and shall conform to ISO 2928 and natural gas up to 25 bar (2.5 Mpa). Specification.

g) Hose and nozzles shall not allow flow of product unless connected to a suitable vehicle connection, and once connected shall be capable of being latched in the open position.

h) All dispensers shall be fitted with sufficient valves to allow for safe isolation, testing and maintenance. These shall include a suitable sized return to storage vessel connection to allow for dispenser testing.

i) For self–service dispensers, a means of communication from the console position to the auto gas dispenser shall be provided (e.g. via the same loudspeaker system used for petrol dispensers).
19 Testing/commissioning

Before testing/commissioning, the documentation and licenses for the installation shall be prepared in accordance with the requirements of the relevant statutory bodies in partner states.

19.1 Electrical installation

The installation and maintenance of electrical equipment shall be in accordance with Manufacturers manuals.

19.1.1 Electrical wiring to pumps and dispensers

19.1.1.1 Emergency switches connected to the site main emergency shutdown system shall be provided;

a) At the control point in the sales building;

b) Incorporated at the site main exterior emergency switch, and

c) In the storage vessel compound adjacent to each exit.

19.1.1.2 Operation of any one these switches shall automatically switch off the electrical supply to all fuel dispensing systems. The system shall only be capable of being reset from inside the console area.

19.1.1.3 Emergency switches shall be clearly labelled.

19.2 Fire extinguishers

The general fire precautions risk assessments shall take into account the presence of auto gas on site. This shall result in the provision of dry powder fire extinguishers. Extinguishers of not less than a total capacity of 18 kg and with a rating of at least 21A and 183B shall be available at assessed locations.

19.3 Maintenance

19.3.1 Examination and maintenance

19.3.1.1 The auto gas installation owner has the responsibility to organize the Written scheme of examination (WSE) drawn by a competent person and ensure suitable maintenance is carried out. Where the ownership is split (e.g. the vessels owned by the gas supply company and the installation owned by the site) then the operator shall ensure that the complete installation is covered.

19.3.1.2 In addition to the WSE, and in order to comply with the relevant regulations, a written maintenance schedule is also required for the parts of the installation operating under pressure.

19.3.1.3 Examination, inspection and maintenance should only be carried out on any pressure part of an installation by competent personnel who know and understand the potential hazards involved.

19.3.1.4 A typical outline written maintenance schedule is shown in Table 5. Items marked with * will usually be included in the WSE.
Table 5 — Typical equipment for inclusion in written maintenance schedule

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Annual b)</th>
<th>In service b)</th>
<th>Thorough c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base and steelwork</td>
<td>Visual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage vessel</td>
<td>Visual</td>
<td></td>
<td>Test</td>
</tr>
<tr>
<td>Storage vessel signs</td>
<td>Visual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage vessel Fittings</td>
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<tr>
<td>— Fill</td>
<td>Test</td>
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<td>Change</td>
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<tr>
<td>— Isolation valve</td>
<td>Test</td>
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<td>Change</td>
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<tr>
<td>— Relief valve*</td>
<td>Visual</td>
<td></td>
<td>Change*</td>
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<tr>
<td>— Pressure gauge(where fitted)</td>
<td>Visual</td>
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<td>change</td>
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<tr>
<td>— Drain</td>
<td>Visual</td>
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<td>Filter</td>
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<td>Pump</td>
<td>Test</td>
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<tr>
<td>— Internal bypass valve</td>
<td>Test</td>
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<tr>
<td>— External bypass valve</td>
<td>Test</td>
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<td>Pipe work</td>
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<tr>
<td>Hydrostatic relief valve</td>
<td>Visual</td>
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<td>Change</td>
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<td>Test point valves(where fitted)</td>
<td>Test</td>
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<td>change</td>
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<td>Underground pipe work</td>
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<td>Cathodic protection (where fitted)</td>
<td>Test</td>
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<td>Dispenser</td>
<td>Test advised d)</td>
<td>Test</td>
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<tr>
<td>— Filter</td>
<td>Visual</td>
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<td>— Measure</td>
<td>Visual</td>
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<td>— Overall</td>
<td>Visual</td>
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<tr>
<td>— Shear coupling</td>
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<tr>
<td>Hoses</td>
<td>Visual</td>
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<td>Hose safe break(breakaway coupling)</td>
<td>Test e)</td>
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<td>Nozzle</td>
<td>Test f)</td>
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</table>

a) Storage vessel maintenance is often carried out by the autogas supplier.

b) The above is only for guidance, the actual intervals should be specified by the competent person who prepares the WSE.

c) Procedures for testing for measure should take into account typical volumes dispensed and the flow rate applicable to the installation under normal conditions.

d) ISO 2928, Specification requires a test at periods not exceeding 12 months for hoses <25 mm inside diameter.

e) Only couplings that are designed to be re-assembled can be tested. For non-reusable couplings the checks can only be visual.

f) Nozzle maintenance at intervals not exceeding that recommended by manufacturer.

19.4 Electrical checks

The maintenance of electrical installations shall be in accordance to IEC 60079-17.

19.5 Auto gas

19.5.1 Road tanker unloading
19.5.1.1 Road tankers delivering auto gas to retail facilities shall be assessed for hazardous area classification together with the provisions of safe entry of vehicles covered in this standard (e.g. in the event of a spillage of flammable material at the site).

19.5.1.2 Whilst road tankers delivering liquid fuels are discharged under gravity at ambient conditions, auto gas will be at its vapour pressure at ambient temperature and will therefore have to be pumped into the storage vessel but without the need for vapour recovery and without creating vapour discharges to atmosphere.

19.5.1.3 Delivery of auto gas is typically from a rigid tanker with an onboard discharge pump. Provided the pump is of high integrity type, this will give rise to a Zone 2 hazardous area around the pump. In cases where and external pump is used for delivery, a Zone 2 hazardous area will be present around any hose connection points around the tanker and the pump will require classification at its fixed location.

19.5.1.4 Further details of pump classification is given in IEC 60079-10. It should be noted that road tankers used for auto gas are highly variable in design and the site operator shall ensure that they are advised of the type of tanker likely to deliver to their site and be provided with a hazardous area classification drawing of the tanker which may be used. Hazardous area classification of the site will be incomplete without this drawing.

19.5.1.5 The hazardous areas found around the delivery area will need to take account of the hazardous areas created during unloading of auto gas. This includes (but is not limited to) hazardous areas around hose reels, gauges, pumps and relief valves on the tanker. The integrity level of these fitting and components will impact upon any associated hazardous area.

19.5.2 Auto gas storage

19.5.2.1 Buried storage vessels will have vessel access chambers which shall be classified as Zone 1 hazardous areas. Where connections are made (e.g. fill point or ullage level indicator operation), this will create a transient Zone 2 hazardous area of 1.5 m above ground around the access chamber during the unloading operation. Where fill points and ullage level indicators are offset (above ground), these will give rise to Zone 2 and Zone 1 hazardous areas respectively of 1.5 m radius.

19.5.2.2 Relief valves with a soft seat, which are regularly maintained and tested, are not considered under the design relief condition for area classification purposes, however, fixed electrical equipment shall not be installed within the direct path of discharge. To allow for small, infrequent leakages they shall be classified with a zone 2 hazardous area of 0.5 m radius. Where other types of relief valves are fitted, this hazardous radius shall be increased to 2.5 m.

19.5.2.3 Provided auto gas storage facilities are purged with nitrogen prior to filling and emptying, within the vessel the ullage shall not contain a flammable atmosphere due to air, and therefore the ullage space can be considered as non-hazardous. Where nitrogen purging is not used, the ullage space within in the vessel shall be classified as Zone 0.

19.5.2.4 Where it is necessary to classify single flanges, they shall have a zone 2 hazardous area of extent appropriate to the integrity of the flange and process conditions encountered in the pipe work, the extent of which shall be at least 1 m.

19.5.3 Auto gas dispensers

19.5.3.1 The design of auto gas dispensers incorporates such safety measures as back-check valves, hose breakaway couplings (safe-breaks) and other isolating valves to limit releases during normal operation to those associated with the filling hose.
19.5.3.2 Dispenser hoses with self-sealing valves in the filling nozzle limit the loss of auto gas on disconnection to 10 cm$^3$. However, this can occur at any position between the dispenser and the full extent of the hose and is therefore classified as a Zone 2 hazardous area equivalent to the length of the hose, to a height of 1.2 m above ground (i.e. typical height to which the hose will be handled during the refuelling operation.)

19.5.3.3 Dispensers with hydrostatic relief valves shall only give rise to infrequent releases of auto gas into the dispenser casing due to the valve lifting. Whilst this results in the inside of the dispenser casing being classified as Zone 1, the resultant hazardous area around any casing vents will be limited to a zone 2 of 1 m radius around the apertures.

19.5.3.4 With adequate low-level venting of the dispenser casing, auto gas shall not be vented from the upper part of the dispenser. However, to ensure uncertified electrical equipment is not mounted on the hydraulic part of the dispenser casing, a nominal Zone 2 of 150 mm shall be applied surrounding the casing.

20 Registration

Each installation shall be licensed by the approving authorities of the respective Partner States before being commissioned and receiving product to operate.

21 Fire protection equipment

Fire protection equipment shall be located on the installation and shall comply with the requirements of fire authorities of the respective partner states.

22 Symbolic safety signs

The appropriate symbolic safety signs shall be put up.
Figure 12 — Typical hazardous area classification for autogas storage and dispenser during fuelling.
Annex A
(normative)

Design and construction of tanks

A.1 General

A.1.1 The minimum internal design pressure for a tank shall not be less than the static head measured from the top of the bulk delivery vehicle to the bottom of the installed tank.

A.1.2 A tank shall be capable of withstanding a working pressure (vacuum) of 20 kPa as per the relevant standard.

A.1.3 A tank shall be able to resist the upward thrust of pressure generated by water surrounding the tank, taking due cognizance of any point loading imposed by the holding-down system.

A.1.4 A tank shall be able to withstand imposed loads generated by a legal maximum loaded wheel and axle system. A limit on the tank diameter might also be necessary if remote suction pumps are used instead of submersible pumps.

A.1.5 All tanks shall be internally free from loose dirt and foreign matter. All openings shall be sealed as soon as tests have been satisfactorily completed. Allowance shall be made for thermal breathing.

A.1.6 The manufacturer shall provide a general calibration chart per tank size.

A.1.7 The major dimensions of a tank shall be as specified by the purchaser.

A.2 Finish

A.2.1 Interceptors are different from gravity separators, in that they take effluent containing emulsifiers and detergents.

A.2.2 The interceptor shall take effluent from potentially contaminated areas for example forecourt, lubricating bay, workshop, wash bay, etc.

The interceptor chamber shall be covered with a suitable manhole and shall be vented by a pipe of diameter at least 50 mm to an elevation of at least 5 m.

The depth of the interceptor chamber, measured from the invert of the outlet to the level of the bottom of the chamber shall be at least 600 mm. Increased depth does not improve the efficiency of the interceptor and complicates cleaning. The minimum plan area of the chamber should be 800 mm × 800 mm.

A.2.3 Interceptor chambers shall be oil proof and waterproof and for this reason prefabricated units should be considered.

A.2.4 A downstream sampling chamber of diameter 300 mm shall be provided for the purpose of sampling the effluent before it enters the foul sewerage system. The minimum retention volume shall be 32 R. The effluent can be sampled for the testing of chemical oxygen demand and, as a field indicator, dissolved oxygen.

A.2.5 Used oil and paraffin may not be taken into this interceptor.
A.3 Used oil and solvent washings (paraffin)

All used oil and contaminated used hydrocarbons shall be handled as per the waste handling regulations of the Partner States.

At every installation, a system and facilities shall be provided for collecting and storing the waste products handled as per waste handling regulations of the Partner States.
Annex B
(normative)

PUR foam-forming systems and foams for filling abandoned tanks and pipework — Test methods

B.1 Tests for foam-forming systems

B.1.1 Determination of viscosity at 25 °C ± 1 °C of the components (isocyanate and polyol) of a foam-forming system

Use the method in ISO 3219.

B.1.2 Determination of foaming characteristics at 25 °C ± 1 °C of cream time, string time and rise time

B.1.2.1 Apparatus

B.1.2.1.1 Laboratory apparatus for small-scale preparation of PUR foam, comprising the following items:

a) mixer, operating within the rotational frequency range 24 s⁻¹ to 29 s⁻¹ (1 440 rpm to 1 740 rpm), equipped with an aluminium disc-type stirrer of diameter 65 mm;

b) balance, accurate to 0.1 g or better;

c) thermometer, reading accurately to within 0.5 °C or better, suitable for measuring temperature in a range encompassing 25 °C;

d) mixing container, polyethylene beaker, or a non-waxed cardboard container, of capacity 500 m³ to 700 m³, and height of side wall preferably not greater than twice the diameter; and

e) glass rod or wooden spatula.

B.1.2.1.2 Stopwatch, reading accurately to 1 s or better.

B.1.2.2 Test specimen

The components (isocyanate and polyol) of a foam-forming system (including any requisite minor additives) for the filling of a tank or pipework, as appropriate.

B.1.2.3 Procedure

NOTE Isocyanates are highly reactive chemicals, aggressive to the skin and eyes. It is essential to ensure that the person performing the foaming characteristics test is thoroughly familiar with the necessary safety precautions, and with procedures for dealing with accidental splashes and spills. The relevant instructions are obtainable from any reputable manufacturer of the isocyanate components of foam-forming systems.

B.1.2.3.1 Thoroughly stir each of the two liquid components of the foam-forming system to ensure their homogeneity.

B.1.2.3.2 Check the temperature of each component and, if necessary, adjust it to a value between 24 °C and 26 °C by gentle warming or cooling with stirring.
B.1.2.3.3 Set up the stirrer for operation in the mixing container.

B.1.2.3.4 Weigh 25 g of the polyol into the mixing container.

B.1.2.3.5 Weigh out 30 g of the isocyanate and add it to the polyol in the mixing container. Immediately after this addition, start the stirrer and the stopwatch simultaneously.

B.1.2.3.6 Continue stirring the mixture in the mixing container for a total time of 15 s ± 1 s, then stop the stirrer (but not the stopwatch) and take it out of the container.

B.1.2.3.7 At the end of the stirring the mixture will be essentially clear. Watch it, and note the time at which it first turns cloudy (“creamy”) and begins to expand. Record as the cream time (in seconds), the length of the period between this time and the time of the start of mixing (see B.1.2.3.5). Check the cream time so recorded for compliance with the relevant requirement given in Table 1.

B.1.2.3.8 Continue watching the expanding mixture, checking at frequent intervals whether “strings” of the tacky material can be pulled away from the surface when it is touched with the spatula or glass rod. Note the time of commencement of this stringing effect and record, as the string time (in seconds), the length of the period between this time and the time of the start of stirring (see B.1.2.3.5). Check the string time so recorded for compliance with the relevant requirement given in Table 1.

B.1.2.3.9 Continue watching the mixture in the container, and note the time at which the expansion in volume ceases, as indicated by the cessation of the upward movement of the top (the white-appearing “cap”) of the rising foam. Record, as the rise time (in seconds), the length of the period between this time and the time of the start of stirring (see B.1.2.3.5) and the time at which the expansion stopped. Check the rise time so recorded for compliance with the relevant requirement given in Table 1.

B.1.2.3.10 If, after completion of expansion, the foam is to be used for determination of properties (see B.2.1), leave it to stand for at least 72 h before such use.

B.2 Determination of foam properties

B.2.1 Foam samples

Take foam samples from free-rise foam prepared as directed in B.1.2. Where so necessitated by the size and number of specimens required for a particular test, the size of container used and the amounts of foam-forming system components may be increased appropriately (in comparison with those given in B.1.2.1.1 d) and B.1.2.3.4 to B.1.2.3.5, respectively).

B.2.2 Density of foam

Determine the foam density using the method in ISO 845. Check the result for compliance with the relevant requirement given in Table 2.

B.2.3 Closed-cell content

Determine the closed-cell content of the foam using method 2 of ISO 4590. Check the result for compliance with the relevant requirement given in Table 2.

B.2.4 Compressive strength

Determine the compressive strength of the foam, in the direction parallel to the direction of foam rise, using the method in ISO 844. Check the result for compliance with the relevant requirement given in Table 2.
B.2.5 Bending properties

Determine the bending properties of the foam using the apparatus and method in ISO 1209-1. Note that the specimens comprising one of the two sets of specimens prescribed by ISO 1209-1 should be cut from the foam sample so that their longitudinal axes are parallel to the direction of rise of the foam, and the longitudinal axes of the specimens of the other set should be normal to this direction.

Check the results of the determination for compliance with the relevant requirements given in Table 2.

B.2.6 Dimensional stability

Determine the dimensional stability of the foam using the method in DIN 53428, using water, gasoline and diesel oil as reagents and expose the specimens for 28 days at 25 °C.

Check the results of the determinations for compliance with the requirements of 16.2.2.3.3.
Bibliography

a) KS 1938 Parts 1 to 6;
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c) EEMUA Publication 190;
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e) KS 2269: 2010 Application of liquefied petroleum and compressed natural gases as engine fuels for internal combustion engines — Code of practice;
f) UK LPG Code of practice 1, Bulk LPG storage at fixed installations part 4: Buried/ mounded LPG storage vessels;
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h) UK LPG Code of practice 17, purging LPG vessels and systems;
i) UK LPG Code of practice 19, Part 1, Liquid measuring systems for LPG. Flow rates up to 80 litres per minute in installations dispensing road vehicle fuel;
j) UK LPG Code of practice 20, Automotive LPG refueling facilities;
k) API RP 1604