PHILIPPINE NATIONAL STANDARD

PNS/DOE FS 3:2006
ICS 75.200

Auto-LPG dispensing stations

DEPARTMENT OF TRADE & INDUSTRY PHILIPPINES

BUREAU OF PRODUCT STANDARDS

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Foreword

This Philippine National Standard Auto-LPG dispensing stations, PNS/DOE FS 3:2006 was prepared by the Department of Energy's OIMB Technical Committee on Petroleum Processes and Facilities (DOE OIMB-TCPPF) designated as BPS/TC 68 with the Bureau of Product Standards through the Technical Working Group on Auto-LPG Dispensing Stations (TWG Auto-gas). This standard was approved for adoption as Philippine National Standard by the Bureau of Product Standards.

This standard was initially developed by BPS-TC 6 (LPG Cylinder) and subsequently subsumed under the coverage of the DOE OIMB-TCPPF and completed through the TWG on Auto-LPG Dispensing Stations.

In the preparation of this standard, the Australian / New Zealand Standard Storage and Handling of LP Gas, AS/NZS 1596:2002 and PLPGA (Philippine Liquefied Petroleum Gas Association) Safety Code, LPGA Code of Practice No. 20:2001 Automotive LPG Refueling Facilities, NFPA 58 and Fire Code of the Philippines were considered.

1 Scope

This standard covers the requirements for the installation of auto-LPG dispensing stations for retail operation and garage-based sites for on-vehicle dispensing of LPG for vehicles of any type.

If any dispensing for the general public can occur, the installation becomes a retail station as defined, and specific additional requirements apply. The additional requirements for retail station is to adequately ensure public safety attendant to the nature of operation.

This standard does not apply to forklift cylinder refilling.

Only fixed and vehicle-mounted fuel tanks are permitted for filling at dispensing stations. LPG cylinders for household use shall not be allowed for refill in an auto-LPG dispensing station.

NOTE 1 Since refilling stations may at times be located in commercial or residential areas having sensitive occupancies, certain planning and land use requirements apply.

2 Reference

The titles of the standard publications referred to in this standard are listed on the inside front cover.

3 Definitions

For the purposes of this standard, the following terms and definitions shall apply:

3.1
authority
the authority having jurisdiction statutory (legal) control of a particular matter

3.2
boundary
the boundary of the whole of the site under the same occupancy as that on which the installation is include

3.3
capacity (of a tank or cylinder)
the total volume of the space enclosed within the tank or cylinder, expressed in kiloliters or liters, gals, m^3 or ft^3 which is often referred to as “water capacity”

3.4
compound
an area bounded by natural ground contours or by a bund, and intended to retain spillage or leakage. (A pit or tank may be used to provide the same function)

3.5
decanting
a procedure in which the liquid phase of LPG is transferred from one container to another by utilizing the difference in pressure between the two containers

3.6
emergency shut-off-system
a control system that facilitates safe LPG shut-down in an emergency

3.7
excess flow valve
a normally open valve which closes automatically when a predetermined flow rate in a particular direction has been exceeded

3.8
filling connection
a loading connection suitable for use with LPG and compatible with the tanker coupling or site coupling

3.9
firewall
a wall or other barrier constructed and placed with the object of preventing the spread of fire or the radiation of heat from any one place to some other place

3.10
ignition source
a source of energy sufficient to ignite a flammable atmosphere and includes naked flames, smoking, exposed incandescent material, electrical welding arcs and electrical or mechanical equipment not suitable for use in the particular hazardous zone

A vehicle is not regarded as being an ignition source while it is entering or leaving the hazardous zone surrounding an LPG dispenser or a bulk LPG filling connection. However, it is treated as a potential ignition source during the period of bulk liquid transfer, and precautionary measures need to be taken.

3.11
internal (component)
a fitting or component constructed so that significant working parts are within the container shell and damage to exposed portions will not prevent effective safe seating or closure

3.12
non-return valve (check valve)
a valve which permits flow in one direction only

3.13
positive shut-off
a valve which when actuated to the closed position blocks off all flow. The actuating stem shall be permanently connected to the flow blocking components

3.14
practicable
practicable having regard to-

(a) the severity of the hazard or risk in question;
(b) the state of knowledge about that hazard or risk and about ways of removing or mitigating that hazard or risk;
(c) the availability and suitability of ways to remove or mitigate that hazard or risk; and
(d) the cost of removing or mitigating that hazard or risk.

3.15
protected place
any of the following:
(a) a dwelling, place of worship, public building, school or college, hospital, theater or any building or open area in which persons are accustomed to assemble in large numbers, whether within or outside the property boundary of the installation;
(b) a factory, workshop, office, store, warehouse, shop or building where the people are employed, that is outside the property boundary of the installation; and

3.16
public place
any place, other than private property, open to the public and including a street or road

3.17
shall
indicates that a statement is mandatory

3.18
should
indicates a recommendation

3.19
site
location of the auto-LPG dispensing station or where such a facility may be installed

4 Requirements

4.1 LPG tank

This Section shall cover only LPG tanks located and used in an Auto-LPG dispensing station operation or a garage-based site.

4.1.1 Tank design and construction

LPG tanks shall be designed, constructed, and tested in accordance with accepted unfired pressure tank codes such as ASME Section VII Division 1 and 2 or other equivalent International accepted Codes and Standards.

4.1.1.1 The design pressures of the LPG tanks shall not be less than the vapor pressure of the actual grades of LPG to be handled at the highest temperature that the contents will reach during normal service. This temperature shall not be less than 40 °C.

4.1.1.2 Materials used for LPG tanks shall be suitable for use at the lowest temperature the contents will reach in normal service, which may be below the minimum ambient temperature, and shall in any event be suitable for use at 0 °C.

4.1.1.3 Each tank shall be provided with a permanently fixed nameplate indicating the following information:

a) name and address of tank manufacturer or trade name of the tank or tank supplier
b) design code;
c) manufacturer's serial number;
d) water capacity in liters, gallons, m^3 or f^3;
e) design and maximum operating pressure in Bar, Mpa, PSIG, kg/cm^2;
f) minimum design metal temperature in °C @ MAWP in PSI;
g) Outside surface area in m^2 or ft^2;
h) Shell thickness and head thickness;
i) OL (overall length), OD (outside diameter), HD (head design);
j) Material specification;
k) Year of manufacture/test date; and
l) inspecting authorities' identification if any.

4.1.2 Storage tank – Location and spacing

4.1.2.1 The minimum separation distance between an above ground LPG tank and containers of liquid fuels having flash points below 65 °C shall be 6 m. No horizontal separation distance is required between above ground LPG tank and underground containers of flammable or combustible liquids.

4.1.2.2 Tank installations shall be designed and installed as follows:

a) LPG tanks shall not be installed above or below any other tank such that their outlines overlap when viewed in plan;
b) Tanks must be installed such that the discharge from the pressure relief valve is at least 15 m (50 ft) horizontally away from any building openings and not less 15 m (50 ft) from any source of ignition or mechanical ventilation air intakes;
c) The filling connection and the vent from liquid level gauges shall not be less than 15 m (50 ft) away from any source of ignition or mechanical ventilation air intakes;
d) Separation distances for above ground tanks may be reduced by the provision of fire or radiation walls;
e) Precautions must be taken when tanks are interconnected in the liquid phase to ensure that the maximum permissible liquid level in any tank is not exceeded;

f) Liquid return line to the storage tanks from pumps must be designed to avoid overfilling by the inadvertent return of product to tanks otherwise isolated; and
g) In the event of a garage-site, the minimum distance of separation between an LPG storage tank and oxygen or gaseous hydrogen shall follow Table 1.
h) Refer to Table 2 for additional minimum separation distances within the facility

Table 1 – Separation distance of LPG tanks from oxygen and hydrogen containers

LPG tank capacity	**Oxygen container total capacity**		
	11 m^3 or less	**11 m^3 to 566 m^3**	**More than 566 m^3**
4.5 m^3 (1200 gal) or less	None	6 m (20 ft)	7.6 m (25 ft)
Over 4.5 m^3 (1200 gal)	None	15 m (50 ft)	15 m (50 ft)

4.1.2.3 For retail station, the number of above ground LPG storage tanks shall not be more than two with an aggregate capacity of 16 kL.

4.1.2.4 The number of underground tanks in one automotive dispensing site shall not be more than two with an aggregate capacity of 65 kL.

4.1.2.5 No permanent source of heat should be located within 15 m of an LPG storage tank.

4.1.2.6 Weeds, long grass, deciduous shrubs and trees, and any combustible material should be removed from an area within the required minimum safety distances.

4.1.2.7 Head-to-head positioning of above ground tanks is not allowed .

4.1.2.8 LPG storage tanks shall not be located directly beneath electrical power cables. For cables carrying less than 1.0 kV, the tanks should be sited at least 1.5 m from a line drawn vertically downwards from the power cables. For cables carrying 1.0 kV or greater the distance should be increased to 7.5 m.

Table 2 – Minimum separation distances

		Storage Tank or Assembly for Buried/Mounded Tanks	Storage Tank Fill Connection	LPG Pump	LPG Meter Or Dispensing Hose Anchoring Point	Vehicle Being Filled
1.	LPG storage tank	--	Nil	Nil But not Under	3m [2]	3m
2.	Storage tank filling Connection	Nil	--	Nil	3m	3m
3.	LPG pump	Nil but not Under	Nil	--	Nil	1.5m
4.	LPG dispenser	3m	3m	Nil	--	Nil
5.	Vehicle being filled	3m	3m	1.5m	Nil	--
6	U/G petrol tank manhole with fill connections [1]	7.5m	7.5m	7.5m	7.5m	Nil
7.	U/G petrol tank manhole without fill connections [1]	3m	3m	3m	3m	Nil
8.	Aboveground tank for liquids <65 °C flash point	Distances from Other Flammable Liquids Flammable liquid (FP=Flashpoint) FP < 32 °C Tank size up to 3,000 liters Tank size over 3,000 liters	Minimum separation LPG tank up to 135m³ (60 MT) 6m to bund wall Appropriate distance in Table 1 for LPG tank or 3 m to the tank/ bund. Whichever is the lesser 3 m to the bund wall or diversion wall and 6 m to tank			
9.	Remote petrol tank fill Connections [1]	7.5m	7.5m	7.5m	7.5m	Nil
10.	Petrol tank vents [1]	7.5m	7.5m	7.5m	7.5m	Nil
11.	Petrol dispensers - Explosion protected [1] Diesel dispensers- Explosion protected [1]	7.5m 3m	7.5m 3m	7.5m Nil	Nil Nil	Nil Nil
12.	Non-Explosion Protected Fixed Electrical Equipment and Non-Explosion Protected Equipment on dispensers, e.g. computer Indicator	Must be outside any designated zone 1, 1 or 2 area.				
13.	Parked Cars	6m or separation distance in COP Part 1 if less	6m or separation distance in COP Part 1 if less	1.5m	Nil	Nil
14.	Buildings, boundary or Fixed source of ignition	7. 5 m 4 m [3], 15m [4]	7.5 m	7.5 m	N.A. (Defined by filling hose)	
15.	LPG Cylinder Storage	3 m	3 m	3 m	3 m	3 m

Legend:

[1] Or as required by the HSE or National/Local Authority

[2] Electrical equipment in dispensers shall not be located inside a more hazardous flammable zone than that for which it is certified

[3] With fire wall

[4] From open flame

4.1.3 Storage area

4.1.3.1 Bund walls should not be constructed around LPG storage tanks.

4.1.3.2 Diversion kerbs with a height not exceeding 380 mm to avoid forming gas traps may be required to direct possible leakage away from tanks and sources of ignition to a safe area for dispersion.

4.1.3.3 No LPG storage tank should be located within the bunded enclosure of:

a) a tank containing any other flammable liquid.
b) a tank containing liquid oxygen or other hazardous or cryogenic substance.
c) any heated storage tank e.g. a fuel oil tank.

4.1.3.4 The ground beneath or adjacent to tank connections or ancillary equipment should be cemented or compacted and arranged to prevent either the accumulation of any liquid beneath them or its flow affecting other tanks or important areas. Provision should be made for handling the run-off of cooling water applied under fire conditions.

4.1.3.5 To prevent the formation of gas pockets the vicinity of LPG storage tanks should be free from pits and depressions within the required separation distance.

4.1.3.6 Open drains, or ducts located within the storage tank safety distance which would permit access and passage of LPG vapors must be fitted with a water trap or be otherwise suitably sealed.

4.1.3.7 The storage tank area shall be provided with enclosures of at least 1.8 m high industrial-type fence, chain link fence, or equivalent protection to prevent any unauthorized operation of any of the container appurtenances, system valves, or equipment. The gate for the enclosures shall be of the swing-out type. The aboveground tank shall be suitably protected from physical damage from collision. Where impact protection is required for the tank, it shall be at least the equivalent of the W guardrail-type highway crash barrier, installed in accordance with the supplier's instructions.

4.2 Warning signs and notices

A tank or tank storage area shall be provided with signs, markings and notices in accordance with Annex A.

4.3 Tank foundation

4.3.1 Aboveground tanks

Design of the foundation should take into consideration:

a) Ground conditions with special reference to the allowable bearing pressures.
b) The necessity to avoid flotation, if there is a risk of flooding, by securely anchoring, weighting or the use of adequate height.
c) The necessity to avoid settlement particularly differential settlement.

d) Expansion and contraction of the tank shell.
e) The greatest combined effect incurred by static loading due to the weight of the tank, its contents, water used for hydrostatic test, wind loading, operational loading such as vibration, thermal effects etc.
f) Drainage of tank.

4.3.2 Underground tanks

4.3.2.1 Tanks shall be set on firm foundations and shall be securely restrained against flotation. The back fill material should be free of rocks or other abrasive material and should be carefully consolidated.

Underground tank installed in areas with no vehicle traffic shall be installed at least 0.15 m (6 in.) below grade. In areas where vehicle traffic is expected, a non-interchangeable underground tank shall be installed at least 0.460 m (18 in.) below grade, or the tank shall be protected from damage from vehicles.

In areas that are subject or are likely subject to traffic (see Figure 1 and Figure 2), the cover shall consists of one of the following options:

a) a minimum of 0.91 m (36 in.) of well tampered backfill
b) a minimum of 0.46 m (18 in.) of well tampered backfill, plus at least 0.15 m (6 in.) of reinforced concrete
c) a minimum of 0.46 m (18 in.) well-tampered backfill, plus at least 0.20 m (8 in.) of asphaltic concrete

4.3.2.2 Tank fittings and appurtenances shall be accessible for operation or repair without disturbing the mounding materials.

4.3.2.3 Protection shall be provided for the fitting housing, housing cover, tank connections and piping against vehicular damage.

4.3.2.4 Underground tanks shall be protected from superimposed above ground loading, e.g. due to vehicular traffic or other cause, either by fencing off the area under which tanks are buried or protecting them with a reinforced concrete slab or other adequate cover. If the tank area is not fenced off, the tank manhole cover and the tank fittings should be protected against damage and tampering.

4.3.2.5 Underground tanks must be protected against corrosion by suitable coatings and cathodic protection.

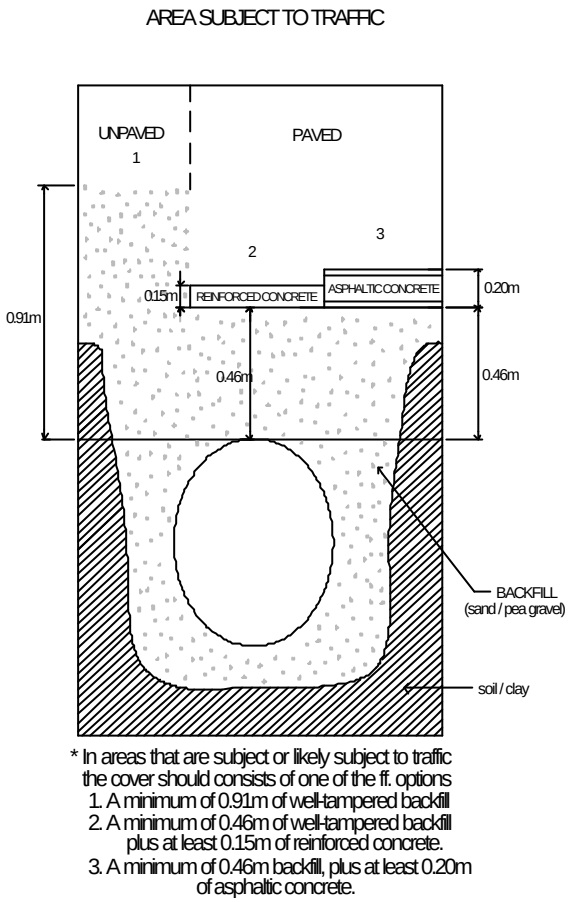


Figure 1 – Area subject to traffic

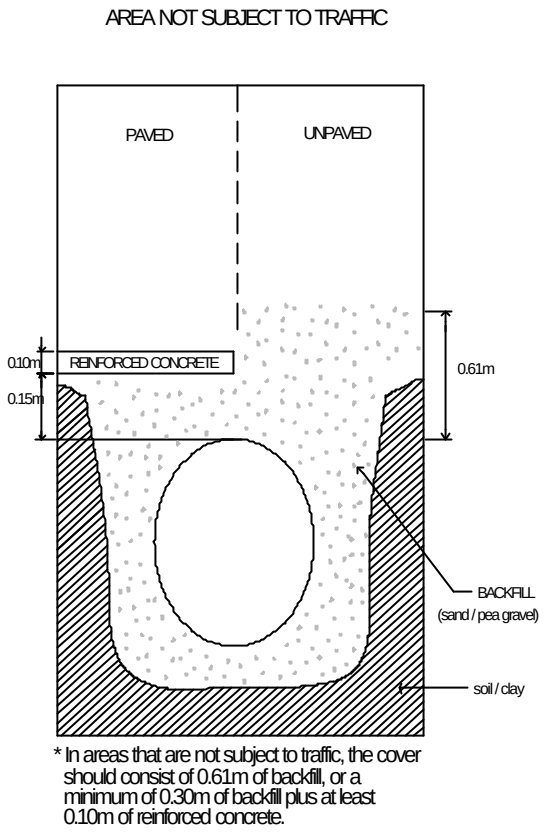


Figure 2 – Area not subject to traffic

4.4 Fire walls

4.4.1 Fire or radiation walls may permit separation distances to be reduced. They should be of such length that the distance from the tank to a boundary or fixed ignition source measured around the end of the wall is not less than the required safety distances. Tanks shall not be located less than 4 m from the fire wall.

4.4.2 Fire wall must be solid, without openings, and constructed from brick, concrete or suitable non-combustible material and for tanks up to and including 500 liters water capacity, they shall not be less than the height of the tank. For larger tanks they shall be not less than 2 m high or the height of the tank, whichever is the greater.

4.4.3 Not more than two fire walls should be provided for any storage tank and the remaining two sides should be such that natural ventilation is not significantly impaired.

4.4.4 A fire wall may be built on a boundary but in such cases it must be wholly under the control of the occupier of the LPG storage site.

4.4.5 For tanks up to and including 7500 liters water capacity, the fire wall may be the wall of an existing building, in which case the following additional requirements must be met:

4.4.5.1 There should be no openings in the wall either to the sides or above the top of the storage tank.

4.4.5.2 There should be no overhanging eaves or similar projections constructed from combustible materials immediately above any storage tank. No external stairway or fire escape should be positioned above a storage tanks or be allowed to terminate in the storage area.

4.5 Fittings and nozzles

4.5.1 LPG tanks shall be provided with at least one each of the following:

a) Pressure relief device situated at the vapor portion of the tank;
b) Fixed maximum liquid level device or equivalent high level alarm;
c) Liquid level gauge or indicator;
d) Pressure gauge;
e) Drains or other means of removing liquid contents;
f) Filling connection; and
g) Liquid withdrawal connection.

4.5.2 All fittings installed on the tank shall be suitable for LPG service over the range of temperatures and pressures that the product will reach in service.

4.5.3 Where liquid may be trapped between closed valves, pipe work and fittings could be subjected to pressure greater than the tank design pressure due to the thermal expansion of the liquid. In such cases the hydrostatic relief valve pressure is then the required minimum design pressure of that part of the system. This hydrostatic relief valve pressure shall not be less than 2.8 MPaG (400 PSIG) or more than 3.5 MPaG (500 PSIG) unless installed in a system designed to operating pressure above 2.4 MPaG (350 PSIG). For a system designed above 2.4 MPaG (350 PSIG) the setting of hydrostatic relief pressure shall not be less than 110 % nor more than 125 % pressure of the system design pressure.

4.5.4 Tanks with internal diameter 1.7 m or greater shall be provided with manholes for internal inspections. The minimum size of the manhole shall be 0.45 m.

4.5.5 Pressure relief valve

4.5.5.1 Each tank should be equipped with one or more pressure relief valves of the tamper proof, direct spring loaded or equivalent type. Relief valves should be installed such that they are in direct communication with the vapor space of the tank.

4.5.5.2 Pressure relief valves should be set to start to discharge at a pressure 125 % of the maximum service pressure given in 4.1.1.1.

4.5.5.3 For above ground tanks the minimum rate of discharge at full flow for spring-loaded pressure relief valves is based on the outside surface of the containers on which the valves are installed. The surface area of containers not so marked (or not legibly marked) can be computed by the use of the applicable formula.

1. Cylindrical container with hemispherical heads:

   Surface area = overall length x outside diameter x 3.1416

2. Cylindrical container with other than hemispherical heads:

   Surface area = (overall length + 0.3 outside diameter) x outside diameter x 3.1416

NOTE This formula is not precise but will give results with limits of practical accuracy in sizing relief valves.

3. Spherical containers:

   Surface area = outside diameter squared x 3.1416

where:

A is the total outside surface area of container in square feet.

4. The following formula is used for flow rate for all containers in items 1, 2 and 3 above:

   Flow rate CFM Air = $53.632 \times A^{0.82}$

where:

A is the total outside surface area of container in square feet.

IMPORTANT These rates of flow are the minimum permissible at full discharge and applies to the relief valve systems including pipe work, check devices etc., as installed. Allowance must therefore be made for the reduction of quoted safety relief valve discharge rates arising from the flow resistance of check devices, multiple valve manifolds or other restrictions, when determining the size or number of relief valves required.

4.5.5.4 For underground and fully mounded tanks the full flow capacity of the pressure relief system may be reduced to not less that 30 % of the capacity specified in 4.5.5.3.

4.5.5.5 In the case of tanks fitted with separate or single relief valve, provisions may be made for their removal for testing or servicing by the use of an automatic check device, provided this valve is retained in the fully open position by the presence of the relief valve and close before the relief valve is completely removed.

4.5.5.6 Each pressure relief valve should be plainly and permanently, marked with the following:

a) manufacturer's identification including name and catalogue or type number;
b) start to discharge pressure or set pressure;
c) flow capacity in terms of air at 15.6 °C and 1.013 bar absolute;
d) date of manufacture; and
e) size of valve, in inches or mm.

4.5.5.7 Pressure relief valves shall be thoroughly inspected e.g. corrosion every 5 years and replaced every 10 years.

4.5.5.8 For above ground tanks exceeding 3,785 liters and for all underground and mounded tanks, the relief valves should be fitted with vent pipes adequately supported and having outlets at least 2 m above the top of the tank to which they are fitted and not less than 3 m above ground level.

a) Vent pipes should be sized for the full flow of the relief valves to which they are fitted.
b) The vent pipe must be designed and installed so that in the event of ignition of discharged products, flame impingement on any tank, equipment or piping is avoided.
c) The vent pipes should be protected against internal/external corrosion.
d) If the relief valve does not allow for the drainage of water that may enter, a drainage point shall be included in the vent pipes. The top of the vent pipe should be protected with rain cap.

4.5.5.9 For tanks 3,785 liters and less where vent pipes are not fitted, the relief valves should be installed so that any discharged products do not impinge on any tank, equipment or piping.

4.5.5.10 All pressure relief valves should be provided with a rubber cap at all times to protect it from dust, dirt, foreign particles, rain water and prevent the corrosion and pitting on top of valves.

4.5.6 Shut-off valves and emergency valves

4.5.6.1 All liquid and vapor connections which permit flow out of or into a tank shall have a positive shut-off valve capable of manual operation located as close as practicable to the tank in combination with an excess-flow valve installed in the container connection or an actuated liquid withdrawal excess-flow valve with connection not smaller than 19 mm (3/4 in.) national pipe size, except that this requirement shall not apply to connections for pressure relief valves or where the passageway into the tank is 1.4 mm diameter or less *(see NFPA 58 – 5.7.71 (B) (C) and Table 5.7.7.1)*

4.5.6.2 For liquid withdrawal connections to LPG dispensers, the positive shut-off valve required by 4.5.6.1 shall be provided with an emergency remote actuation facility. The emergency remote actuation facility must meet the following requirements:

a) The shut-off valve shall be capable of closing automatically on loss of actuating power or fire engulfment. Electricity driven valves need not close automatically on fire engulfment if the power supply is adequately fire protected so that remote actuation remains available;
b) The location of the valve shall be as close as practicable to the tank and should preferably be the primary shut-off valve on the tank. If the valve is not mounted directly on the tank it should be no further than 1.5 m from the tank when viewed in plan or within any security fence, whichever is the closer; and
c) Where valve actuators are fitted they should be sized to operate the valve at the maximum pressure that may be reached in service.

4.5.7 Excess flow valves

4.5.7.1 All connections into the tank greater than 3 mm diameter for liquid and 8 mm diameter for vapor, with the exception of those for relief valves, shall be protected with an excess flow valve or a back check valve (non-return valve).

4.5.7.2 The flow rate for closure of excess flow valve should be below that likely to result from complete fracture of the line it is protecting but should prevent premature closing by sizing flow rate substantially above the expected design flow rate.

4.5.8 Fixed max liquid level device

4.5.8.1 The device shall be of a type that allows vapor or liquid to bleed from a valve attached to a dip-tube to indicate when the maximum permitted level is reached during filling.

4.5.8.2 The design length of the dip tube shall be determined by the grade and temperature of LPG being stored. The following are recommended maximum levels:

Table 3 – Standard filling level

Type of LPG	Maximum volume-filling ratio, %		
	Above ground tank		Underground tank
	5 kL or Less	Over 5 kL	
Commercial propane	80	85	90
Butane/Propane mix	85	90	92
Commercial butane	90	92	94

4.5.8.3 The connection through the tank shall not be larger than 1.4 mm diameter unless fitted with an excess flow valve and shall be installed so that it is visible from the filling point.

4.5.9 Filling connections

4.5.9.1 All filling connections shall be located on the vapor space of the storage tank and shall be equipped with the following:

a) an excess flow valve or back check valve (non-return valve); and
b) a shut-off valve capable of manual operation.

4.5.9.2 Remote filling connections shall terminate with a manual shut-off valve and suitably protected with hydrostatic relief valve.

4.5.10 Pressure gauge

All tanks should be equipped with a suitable pressure gauge connected to the vapor space of the tank. Pressure gauge connection hole to the tank should be preferably not larger than 1.4 mm diameter and should be protected by a suitable shut-off valve.

4.5.11 Drain connection

4.5.11.1 Drain connections maybe fitted at either the top or bottom of the tank. It should be provided with an excess flow valve and a shut-off valve not more than 50 mm nominal diameter. The outlet of the drain valves should be provided with a length of piping terminating with a second shut-off valve during draining. The length of piping should be such that the risk of simultaneous obstruction of the two valves, e.g. by freezing of any accumulated water, is minimized.

a) The additional pipe work and second valve may be fitted at time of draining provided that the fixed drain valve is protected by an excess flow valve fitted upstream.
b) The outlet of the drain valve system should be blind-flanged, plugged or otherwise secured against tampering when not in use.

4.5.11.2 No drain should discharge into or be in the proximity of any drainage system.

4.5.12 Contents gauge

4.5.12.1 All contents gauges should clearly indicate whether they read in % of water capacity, % or fractional LPG capacity, or actual contents in gallons, ft^3, m^3, etc.

4.5.12.2 Any gauging device that relies on bleeding to atmosphere, such as a rotary tube, fixed tube or slip tube, shall be such that:

a) the bleed hole maximum opening is not larger than 1.4 mm diameter unless it is protected by an excess flow valve.
b) It cannot be completely withdrawn in normal gauging operations.
c) The gland is capable of being repacked without withdrawing the tank from service.

4.5.13 Temperature gauges

4.5.13.1 Temperature gauges when fitted shall be installed in suitable thermo wells.

4.5.13.2 The thermo wells shall be in the form of blind tubes of suitable length and strength, oil filled, permanently welded to the tank and constructed in accordance with the tank design code.

4.6 Pumps

4.6.1 Pumps used shall be made of materials suitable to the grade of LPG and the range of temperatures and pressures the product will reach in service. Cast iron shall not be used.

4.6.2 Positive displacement pumps must have a by-pass and/or other suitable protection system against excessive pressure. Pump bypass shall connect to the tank vapor space.

4.6.3 Pumps should also be protected by suitable strainers/filter devices and shall have a provision to fit a pressure gauge on the discharge side of the pump.

4.6.4 Mechanical seals are preferable to packed glands.

4.6.5 Electric motors and other electrical equipment must be suitable for use in areas classified in Table 4.

4.6.6 Where remote starters are installed, a flame-proof means of isolation with lockout should be fitted adjacent to the pump motor to facilitate servicing.

4.6.7 Submersible pumps when used shall not impose unacceptable loads on the tank and shall be designed to allow removal and replacement of the pump with minimal loss of LPG to the atmosphere if the tank contains LPG.

4.7 Dispensing systems

4.7.1 General design

4.7.1.1 All dispensers used must comply with AS 2229.2 / NZS 6109.2 “Fuel dispensing equipment for explosive atmospheres” or its equivalent and which shall be provided with an excess flow valve and manual shut-off valve in all LPG pipes attached to the cabinet.

4.7.1.2 For dispensers in retail stations, they must additionally be equipped with remote-operated shut-off valves and a pipe shear provision with the valves below or as close as possible to ground level, with the shear provision above them. Where the remote-operated valve can be relied upon to shut-off automatically in the event of pipe shear, the excess flow valve may be omitted.

Dispensers should be suitably protected against damage from impact. Use of bollards and guardrails should be provided.

In addition, the system shall incorporate the following:

a) Control valves

The following control valve shall be provided inside the dispenser cabinet and as close as practicable to the flexible hose between the dispenser cabinet and the breakaway coupling:

i. A manually operated positive shut-off valve.

ii. An excess-flow valve.

b) Pump control

A switch shall be provided within or adjacent to the dispenser which can shut down the remote pump; alternatively, this switching action may be performed automatically by the positioning of the hose nozzle in and out of its receptacle.

c) Return line

A return line from a dispenser shall be equipped with excess flow and positive shut-off valves. A continuous liquid bypass in the dispenser shall be provided.

4.7.2 Dispensing hose

The dispensing hose assembly shall comply with AS 1869:1996: "Hose and hose assemblies for liquefied petroleum gases (LP Gas), natural gas and town gas" and shall incorporate a self-sealing hose break coupling which complies with the following requirements:

a) The coupling shall disconnect in the event of undue force being applied to the hose, such as a vehicle moving off with the hose connected.

NOTE The coupling should be capable of being re-assembled after separation, preferably without the need for draining the hose, the use of special tools, or the replacement of parts. The replacement "shear pins" of break-away coupling shall not be locally fabricated but must be source-out from the original supplier of "break-away" coupling of the same brand.

b) The force required to separate the coupling shall be less than 600 N for internal hose pressures of 700 kPa to 2500 kPa.

c) The coupling shall retain the liquid within each section of the hose after separation when pressures of 700 kPa to 2500 kPa are maintained in the hose. The volume of liquid lost as a result of parting shall not exceed 15 mL, and the coupling shall not leak after disconnection.

4.7.3 Dispensing nozzle

The dispensing nozzle shall comply with the following requirements:

a) The connection provision shall be of the quick-connect type;

b) A provision to start and stop gas flow shall be incorporated and shall be quick-acting (i.e. not a screw-down valve). Where accidental discharge is possible, e.g. a quarter-turn valve, a safety catch shall be provided; and

c) Shall be self-sealing, dish type and conforming to the following:

i. it shall not be possible to discharge fuel unless the nozzle is connected to a vehicle-filler connection; and

ii. the liquid released on disconnection shall not exceed 4.5 cc.

4.7.4 Location of LPG dispensers

LPG dispensers shall not be located within 3 m of an above-ground tank unless the tank is protected from a potential fire at the dispenser by the provision of a firewall.

4.7.5 Dispenser service lines

The length of any dispenser service line that is above-ground shall be the minimum possible, and shall be protected against damage as far as practicable.

4.7.6 Lock-up provisions

A dispenser open to the public shall incorporate provisions for locking the nozzle to the dispenser when the unit is not available for operation.

The dispenser shall be locked when it is not intended to be available for operation.

4.7.7 Filler caps

At least two spare standard metal automotive filler caps shall be kept on site for use in the event of a leak at a vehicle-filling connection.

4.7.8 Hose reach zone

The location of the hose reach zone on the dispenser shall permit compliance with the following requirements:

a) No part of the vehicle being refueled shall be in a public place; and
b) A public place, a protected place, an entry into a building, a pit or opening into a closed drain, a basement or an above-ground tank for flammable liquids, shall not be within the hose reach zone of the dispenser. (See Figure 2 for an illustration of terms)

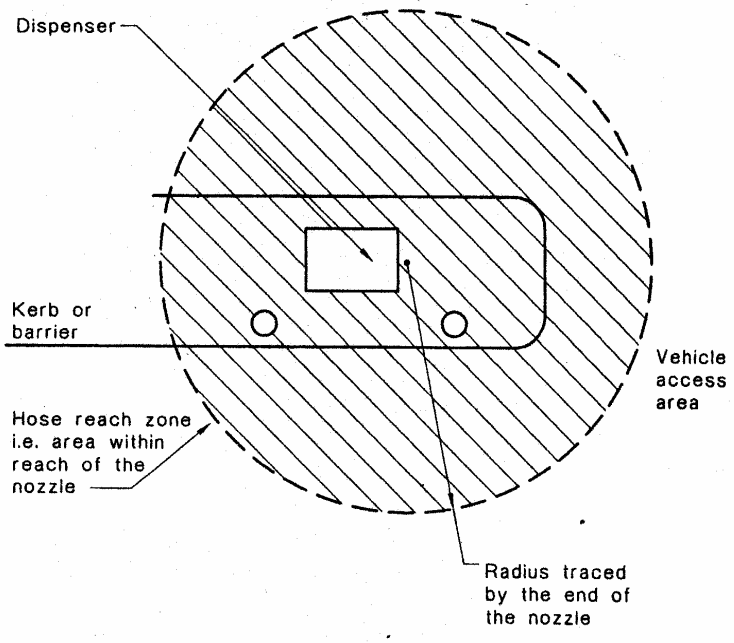


Figure 3 : Typical hose reach zone

4.7.9 Vehicle filling area

The standing area for the vehicle being filled shall not slope more than 1 in 20.

4.7.9.1 Illumination

The area within which the filling connection can be made shall be illuminated to a level of not less than 50 lux whenever the unit is available for service.

4.7.10 Spillage control

The ground below an above-ground tank shall be treated to prevent the accumulation of any flammable liquid or LPG beneath the tank, in particular

a) the ground area not less than 1.5 m beyond the tank or up to the boundary wall or barrier (if within 1.5 m) shall be paved or be resistant to saturation by flammable liquids; and
b) it shall not be possible for any spillage elsewhere to flow under the tank. (Kerbs or diversions, grading to not steeper than 1 in 40, humps, or plinths under the tank are recognized control methods)

4.7.11 LPG tank truck ingress and egress

The configuration and character of the entrance from and the exit to the roadway shall be such as to minimize the likelihood of a vehicle hitting the LPG tank truck while it is entering or leaving the site. Features to be considered during the installation and design stage shall include road width, gradients, line of sight, traffic volumes and traffic speed.

The LPG tank truck entry and exit driveways should be located to ensure that the tank truck has ready access to the site so as to reduce the time it may need to be exposed to traffic while entering or leaving the site.

4.7.12 LPG tank truck unloading position

The LPG tank truck unloading position shall be such that-

a) the LPG tank truck is positioned wholly within the site during unloading; and
b) the LPG tank truck parking area has a separation distance of 7.6 m from any building, structures and/or any ignition sources and 15 m away from any outdoor places of public assembly including schoolyards, athletic fields and playgrounds. Separation distance from buildings or structures with fire resistive wall may be reduced to 3.1 m.

NOTE The possibility of high momentum impact on the tanker from vehicles accidentally leaving roadways shall be avoided at all times.

The unloading of a LPG tank truck shall only proceed when the exit is not obstructed and it is positioned in such a manner that it can leave the site without recourse to reversing.

Where the LPG tank truck parking area is away from the fill point, vehicles shall be prevented from driving over the filling hose.

4.7.13 Remote shut-down system

A remote shut-down system shall be fitted and shall be as follows:

a) Capable of initiation at the following locations as a minimum, with at least one actuation point being accessible at all times:
i. Within 10 m from the tank filling point.
ii. Either at the dispenser or at a point which is easily accessible to the attendant.
iii. At a remote location external to any building and away from the tank filling point and console, in a direction to allow ready egress from the site.
b) Of a fail-safe design which will close all liquid supply, pump bypass and vapor return tank connections and shut down the pump systems as quickly as possible with a response time of no more than 10 seconds when operated from any point.
c) Checked in accordance with the requirements of the site safety management system (see Clause 6) and the test results recorded and the records retained on site. Should any defect compromising safety be identified in the system, the tank shall be manually isolated until such time as the system is returned to full function.
d) Designed and installed so that manual action is required to re-open the valves to resume operation.
e) Designed and installed so that it achieves a high degree of reliability.
f) Provided with instructions on how to actuate and marked with "LPG EMERGENCY STOP".
g) Provided with clear access to the actuation points and with such access being maintained.

4.8 LPG piping requirements

4.8.1 Piping system shall conform to the provisions of a recognized piping standard, i.e. NFPA 58 LPGas Code, ASME B31.3 (Process Piping) or equivalent.

4.8.2 Pipe joints over 50 mm in nominal size shall be welded or flanged. Joints 50 mm in nominal size or smaller may be welded, flanged or screwed with taper threads conforming to API standards. If the pipe connection is screwed or threaded, the pipe shall be SCH 80.

4.8.3 Pipelines in which liquid LPG may be trapped, e.g. between shut-off valves, shall be protected against excessive pressure caused by thermal expansion of the contents. If pressure relieving devices discharge to atmosphere, the discharge should not endanger personnel or equipment.

4.8.4 Pipelines shall be adequately supported and have adequate flexibility to compensate for thermal expansion, contraction, or any operational stresses.

4.8.5 Exposed above-ground pipe work interconnecting two adjacent, parallel above-ground tanks shall be located within the fenced enclosure of the tank area.

4.8.6 Buried steel pipe work shall be adequately protected against corrosion.

4.8.7 Valves and fittings shall be made of steel, hot stamping brass or nodular iron with equivalent strength and ductility over the design pressure and temperature range. Cast iron valves and fittings other than those of nodular iron shall not be used.

4.8.8 Hoses shall be suitable for the grade of LPG which they are to handle. They shall be designed to withstand a minimum bursting pressure of four times the maximum pressure they will carry in normal service. Hose assemblies (hose with couplings, connectors) that are expose to pressure of tank must be designed to 2.4 MPaG (350 PSIG) and hydro test to 120 % of its design pressure.

4.8.9 Shut-off valves shall be incorporated at the ends of all pipelines to which properly identified hoses are connected.

4.8.10 All piping shall be color coded and properly identified. Use Blue color for Liquid line and Yellow for Vapor line.

4.8.11 Gaskets for flanged joints shall be resistant to liquid phase LPG. Gasket of natural rubber or bonded with natural rubber shall not be used. Metallic gaskets or stainless steel spiral wound "graphite-filled" gaskets shall be used for flanged connected joints.

4.8.12 Any liquid line between the pump and the dispenser that exceeds 10 m in length shall be provided with a manual isolating valve close to the pump outlet but not before the bypass line.

4.8.13 For convenience in maintenance it is recommended that a manual isolating valve be installed so that the piping between the tank and the pump can be shut off.

4.9 Testing and commissioning

4.9.1 General

4.9.1.1 The testing and commissioning of the LPG storage and dispensing system should be undertaken only by competent personnel and in accordance with manufacturer's instructions where applicable.

4.9.1.2 Tanks shall be inspected externally and internally, before being placed into service, by authorized and qualified engineers for the following:

a) after installation:
b) after construction;
c) after it has contained materials other than LPG;
d) after it has been reinstalled in other location;
e) after it has been exposed to fire;
f) because of marked damage due to handling and other exposures; and
g) at periodic intervals required by competent authority depending upon the nature of operation and conditions of the tanks.

4.9.1.3 The manufacturer's certificate and the records of inspection shall be kept and made available for examination during the operating life of the tank.

4.9.1.4 Inspection of tanks shall consist of any or a combination of the following tests:

a) visual examination;
b) tests for leakage;

c) ultrasonic thickness tests;
d) radiographic tests;
e) magnetic particle tests;
f) hydrostatic test when considered necessary by the competent authority; and
g) other related tests.

4.9.1.5 When tanks are subjected to hydrostatic test, the required test pressure are the following :

a) for tanks fabricated based on Edition 2001 or later of ASME Code Section 8, Division 1, 1.3 times the design pressure or maximum allowable working pressure.
b) for tanks fabricated earlier than 2001, 1.5 times the design pressure or maximum allowable working pressure.

4.9.2 Leak testing – Tanks and fittings

4.9.2.1 Tank fittings and appurtenances shall be leak tested prior to filling. The leak test pressure shall not be less than 6 bars gauge but no more than 90 percent of the tank design pressure.

4.9.2.2 The test medium can either be inert gas or water. Using inert gas, pressurize tank and associated fittings and check with soap solution for signs of leakage. For water, fill tank completely and pressurize. Check to ensure zero pressure drop over a period of not less than 30 minutes.

4.9.3 Purging

4.9.3.1 All tanks and associated fittings should be purged until there is insufficient oxygen inside to support combustion. To do so, the air should be either evacuated or replaced with an inert gas, water or LPG vapor.

4.9.3.2 If inert gas is used, this needs to be removed from the tank with LPG vapor, taking care to direct the purged gas/LPG sources, boundaries, buildings or public places or to a flare stack. Care should be taken during purging to ensure the safe dispersion of un-ignited purge gases. If purge gases are flared this should be outside the normal separation distances.

4.9.3.3 When LPG vapor is used to replace air, the tank and fittings will for a period of time contain a flammable mixture. A competent person should vent to the atmosphere in a safe manner. A flame arrestor must be fitted in the vent line to prevent flashback should the LPG/air mixture ignite.

4.9.3.4 If using water as a purge medium, check before starting that the tank and its support will be capable of holding the full weight of water. After purging, ensure that all the water is removed from the tank.

4.9.4 Initial fill

A responsible and properly trained person should be present and in control throughout the initial fill. Care should be taken to limit flash vaporization on initial fill. This can be

achieved by pressurizing the tank with vapor before introducing liquid LPG. During initial fill, any inert gas shall be safely vented from the tank.

4.10 Ignition source control

This section shall apply to the minimization of ignition of flammable LPG-air-mixtures resulting from the normal or accidental release of nominal quantities of liquid or vapor from LPG systems.

The design of the installation shall be such that ignition sources are not located in and are not permitted in a hazardous zone as described in Table 4.

Table 4 – Area classification

Source of release	Extent of classified area	Area classification
Storage tank	Within 1.5 m from the discharge orifice of liquid level detective device, i.e. Fixed sources of ignition set out in Table 2.	Zone 1
Relief valve discharge points, bleed/drain outlets	Within direct path of discharge.	Fixed electrical equipment should not be installed
	Within 1.5 m in all other directions from the Zone 1 points of discharge	Zone 1
	Beyond 1.5 m but within 4.5 m in all directions from the point of discharge (or the separation distance for tanks up to 2500 liters water capacity shown.	Zone 2
LPG tank truck loading and unloading	Within 1.5 m in all directions from where connections are made or disconnected for product transfer.	Zone 1
	Beyond 1.5 m but within 4.5m from the point of connection or disconnection.	Zone 2
Pumps	Within 1.5 m in all directions	Zone 1
	Beyond 1.5 m but within 4.5 m in all directions.	Zone 2
Dispenser	Entire space within dispenser and 0.25 m horizontally from the enclosure exterior up to an elevation of 1.2 m above dispenser base; entire pit or open space beneath	Zone 1
	Up to 0.25 m above ground within 6.1m horizontally from any edge of enclosure	Zone 2

A vehicle is not regarded as being an ignition source while it is entering or leaving the hazardous zone surrounding a LPG dispenser or a bulk LPG filling connection. However, it is treated as a potential ignition source during the period of bulk liquid transfer, and precautionary measures need to be taken.

The installation of lightning protection equipment shall not be required on LPG bulk storage tanks.

4.10.1 Electrical equipment

All fixed electrical equipment installed within classified areas specified in Table 4 shall comply with the requirements for those areas

4.10.2 Area classification

The hazard zones are classified according to the degree of probability that flammable concentrations of gas may ignite the hazardous zone defined as follows:

a) **Zone O** – An area in which an explosive gas-air mixture is continuously present in normal operation.

b) **Zone 1** – An area in which an explosive gas-air mixture is likely to occur in normal operation, and if it occurs it will only exist for a short time.

c) **Zone 2** – An area in which an explosive gas-air mixture is not likely to occur in normal operation, and if it occurs it will only exist for a short time. By implication an area which is not classified Zone 0, 1 or 2 is deemed to be non-hazardous or safe with respect to the operation of electrical equipment.

4.10.3 Electrostatic precautions

4.10.3.1 Means shall be provided to ensure that no electrostatic potentials exist between the LPG tank truck delivery connection and the stationary storage tank fill connection which could cause a spark when these connections are either made, or broken. The following precautions shall therefore apply.

4.10.3.2 Tanks shall be permanently bonded to an effective grounded earthing point to prevent the accumulation of static electricity. The earthing point should be located so that the LPG tank truck can discharge any static electricity to this earth by means of its earthing/bonding cable before delivery connections are made.

4.10.3.3 Electrical continuity shall exist between storage tank transfer couplings and the earthing point connection, through the tank. The earthing connections shall always provide a good electrical connection, and shall therefore always be kept free of rust and shall not be painted.

4.10.3.4 All earthing points for the dissipation of static electricity shall have an electrical resistance to earth not greater than $1x10^6$ ohms.

4.10.3.5 Pipelines, fittings and hoses conveying liquid phase LPG should have electrical continuity and be effectively connected to earth. Detailed information on the operation on the generations of static electricity and advice on earthing and bonding is given in BS 5958 parts 1 and 2. In the case of ball valves attention is drawn to the need for the ball and actuating lever to have electrical continuity with the valve body and adjacent pipe work.

4.10.3 Protection against lightning

LPG storage tank and equipment do not require specific protection against lightning strike.

4.11 Re-qualification and maintenance

4.11.1 Storage tanks

4.11.1.1 Major examinations of LPG storage tanks shall be carried out by a competent person and the data plate marked with the date of examination month and year e.g. 7/99

Tank records for above ground installations should distinguish between 5 year visual external inspection and 10 year examinations. Examinations must be carried out before the end of the fifth or tenth year (as appropriate), following the year of the previous examination.

The frequency of examinations for identified storage tanks shall comply with the following table.

Table 5 – LPG tank re-qualification

Type of installation	Frequency	Storage tank examination
Above ground	Every 5 years	Full external visual examination. NDT may be used to supplement the external examination if necessary. Tanks with a thermal insulation should have separated areas of the tank exposed for visual examination or NDT. The number and spacing of such exposed areas to be determined by a competent person.
Above ground	Every 10 years	Full visual internal examination, thickness check and hydrostatic test.
Underground and Mounded tanks	Every 5 years	Full visual internal examination, thickness check or hydrostatic test. In the case of tanks without manholes, alternative procedures may be considered subject to the approval of a competent person and, where appropriate, the inspecting authority.
NOTE It is suggested that advantage might be taken of an occasion when a tank is empty to start a new cycle.		

4.11.1.2 Above ground 5-year examination

a) Identify tank by data plate/tank markings or stampings.

b) Visual examination of external surfaces and all welds for signs of defects, where considered necessary, defects can be assessed by non-destructive test (NDT) methods.
c) Carry out examination of fittings in accordance with 4.9.2.
d) Check that tank relief valves have been replaced in accordance with 4.11.2.1. The pressure relief valves should satisfy the design requirements of the tanks in terms of set pressure and capacity.
e) After satisfactory examination ensure that the date is marked on the data plate.
f) Issue report.

4.11.1.3 Above ground 10 year examination

a) Carry out stages as listed in five year examination in 4.11.1.2.
b) Carry out wall thickness checks or hydraulic test or internal examination.
c) After satisfactory examination ensure date is marked on the data plate.
d) Issue report.

4.11.1.4 Underground/Mounded 5 year examination

a) Identify tank by data plate markings or stampings.
b) Full internal visual examination and also wall thickness check or hydrostatic test. (Where internal examination is not practical the outside surfaces of the tank must be exposed for examination or as directed by the competent person).
c) Check that fittings are in order. (See 4.9.2).
d) Check that pressure relief valves have been replaced in accordance with 4.11.2.1. The pressure relief valve should satisfy the design requirements of the tank in terms of set pressure and capacity.
e) After satisfactory examination ensure date is marked on the data plate.
f) Issue report. Such test shall be considered as minimum requirement, otherwise follow the manufacturers recommended schedule and procedure.

4.11.2 Tank fittings inspection

4.11.2.1 Pressure relief valves

Pressure relief valves shall be thoroughly inspected, e.g. signs of corrosion and replaced every 10 years with new units set at a pressure not exceeding the tank maximum working pressure. Pressure relief valves more than 10 years old shall not be re-used. The test date and other details stamped on the body should be checked. At the same time consideration should be given to replacing any non- corrosion protected stack pipes with galvanized or equivalent. To facilitate removal, stack pipes should not be fitted into valves using sealing compounds. Teflon tape is sufficient.

Relief valve drain holes should be checked to ensure they are clear. Where internal corrosion of stack pipes is suspected i.e. if rain caps are missing and /or corrosion resistant pipes are not used, consideration should be given to the removal of the stack pipes for examination of the relief valve to ensure that their operation would not be jeopardized by corrosion or corrosion debris. Missing rain caps shall be replaced.

A pressure relief valve shall not be removed from a check device while a tank is under pressure unless a serviceable replacement is available to be immediately fitted.

No attempt to remove a pressure relief valve mounted in a tank under pressure must be made unless the pipe and construction of the check device can be identified and the manufacturer's instructions for the safe removal of the relief valve is fully understood. These devices shall include positive means of confirming that the check device has closed before unscrewing the relief valve proceeds to an otherwise dangerous stage.

4.11.2.2 Pressure gauges

Where fitted, pressure gauges should be examined regularly and its isolating valves operated regularly during tank filling/loading to prevent from getting stuck-up. Gauges may be calibrated against a reference standard or replaced if defective or every ten (10) yearly intervals.

4.11.2.3 Excess flow valves, non-return valves

Check the operation of excess flow valves and non-return valves at intervals not greater than 10 years.

4.11.2.4 Contents gauges

Any gauging device that relies on bleeding to atmosphere such as a rotary tube, fixed tube or slip tube should be checked regularly during tank filling or loading. Other types of contents gauges should be checked as necessary e.g. during product transfer.

4.11.2.5 Temperature gauges (where fitted)

Not less than once every 10 years check the accuracy of the gauge.

4.11.2.6 Shut-off valves

Manual shut-off valves should be tested for ease of operation at least once a year, or at a frequency determined by a competent person.

NOTE The dangers of shutting off/turning on a gas supply must be taken into account when checking valve operation.

Remotely operated shut-off valve should be checked for operation at least once per year, or at a frequency determined by a competent person.

All Shut-off valves should be tested for effective operation at not more than 10 years intervals.

4.11.2.7 Filling/off loading equipment

Filling connections shall be visually checked for damage/wear/ leakage at intervals not exceeding a year.

Hoses should be visually examined every day if used daily and at each time before use if less frequently.

4.11.2.8 Studs bolts

Studs/bolts, nuts and washers should be replaced if they are damaged or show signs of severe corrosion. Use stud bolts ASTM A 193 Gr B7 (high tensile)

5 Fire protection system

Adequate fire fighting equipment must be provided to deal with LPG fires or other fires which might threaten the LPG installation. The following minimum facilities should be provided.

a. Above ground LPG storage tanks

Water must be provided to cool above ground LPG storage tanks and also to control fires nearby which might threaten the storage tanks. At minimum of 20 mm diameter hosepipe and water connection shall be sited near the storage compound.

A minimum of two 9.1 kg BC rating BPS certified fire extinguishers shall be located near the LPG storage area mounted 1 m above ground near the exit gate(s)

b. Dispenser

One 9.1 kg BC rating BPS certified fire extinguisher shall be positioned near each dispenser.

6 Safety management system

A safety management system that at least covers the operation, maintenance, and emergency response of the facility shall be prepared and implemented. The PLPGA Safety Code and other appropriate Codes may be used for the purpose of compliance with this requirement.

7 Other requirements

Unless otherwise provided in this standard, please refer to Fire Code of the Philippines and the Occupational Safety and Health Standards as applicable

Annex A

Notices, signs and instructions (Normative)

A.1 Tank systems

A.1.1 Valve indicators and marking

A quarter-turn valve shall be provided with indicators and marking in accordance with the following requirements:

a) a means for indicating clearly the open and closed position shall be provided. Where a lever valve is fitted with a fixed handle, the valve shall be open when the handle is in the direction of the pipe. Where a valve handle is removable, a separate metal plate shall be provided, and this plate shall be clearly and indelibly marked to indicate the open and closed positions of the valve;
b) globe and angle valves shall have hand wheels permanently marked with the direction to open; and
c) any valve other than for a safety valve, pressure gauge or fixed liquid level gauge shall be marked to indicate whether it connects to liquid or vapor space.

A.1.2 Direction of flow

A manual isolating valve that is subject to tank pressure shall be installed so that the valve gland is not subject to direct tank pressure when the valve is shut.

NOTE Compliance with this requirement necessitates the mounting of valves in certain locations such as a tank inlet isolating valve contrary to any direction-of-flow marking on the valve.

A.2 Tank installations

A.2.1 Emergency shut-down system marking every actuation point for the emergency shutdown system except the provision on the valve itself shall be provided with a sign-

a) marked 'LPG EMERGENCY STOP' in red letters not less than 40 mm high on a white background.
b) giving instructions on how to actuate the system, in red or dark lettering not less than 20 mm high on a white or light contrasting background.

A.2.2 Tank or tank storage area placard / signage

A tank or tank storage area shall be provided with a placard in accordance with A.2.3. Where the tank is underground, the placard shall be adjacent to the tank and pump.

A.2.3 Placard

The placard shall display the following information:

a) Phone number of the organization having ownership of the equipment. The nominated phone number shall provide contact with 24-hour specialist advice via the supply company or a contractor;

b) Standard symbols of at least 100 mm diameter for 'flammable gas' and 'no smoking' or a warning notice in letters not less than 50 mm high prohibiting smoking and ignition sources. Where the area is isolated by a fence, the sign shall be visible from outside the fence and also from points of access; and

c) Emergency information panel.

NOTE Suitable wording for such signs would be as follows:

1. No smoking, No Open Flame
2. Highly Flammable - LPG
3. Emergency Procedures
4. Emergency Contact Nos.
5. No Unauthorized Entry

A.2.4 Construction of signs

Signage should be installed in appropriate and accepted workplace for the safety of staff and client information in the overall management and occupational safety and health in the facility as mandated the OSH Standards and should be made of all weather resistant materials.

Class labels shall have a minimum of 250 mm square.

A.3 Automotive filling stations – Vehicle filling area

A.3.1 Precautionary sign

Standard symbols of at least 100 mm diameter for 'stop engine-no smoking' shall be displayed at the filling area or adjacent to it and readable from the filling area. Alternatively a prominent sign reading 'STOP ENGINE-NO SMOKING' in red or dark lettering not less than 50 mm high on a white background may be substituted.

A.3.2 Driver instructions

The signs specified in Annex B shall be displayed on, or adjacent to and readable from, each dispenser.

A.3.3 Emergency procedures – A notice reading as shown in Figure A.1 shall be prominently displayed outside the principal building or office and another such notice shall be displayed inside and at the focal point of the building or office.

The notice shall have a white background; the heading 'LPG Emergency Procedure' shall be in red letters not less than 40 mm high; subheadings 'Gas Leak' and 'Fire' shall be in red or dark lettering not less than 10 mm high; and the text shall be in red or dark lettering not less than 7 mm high.

NOTE Where the tank or dispenser is not associated with any specific office or building, e.g. in a depot or an industrial location, the notice should be displayed in a location appropriate for the particular installation.

LPG EMERGENCY PROCEDURE
(Provide the address of the site on or adjacent to the notice)

GAS LEAK

1 Shut emergency stop.
2 Close all valves of tank.
3 Keep bystanders away.
4 No smoking. No naked lights.
5 No engine to be started.
6 Phone fire brigade *(insert telephone number of local station, or general emergency number).*
7 Phone *(insert LPG distributor's name and all-hours number).*
8 Isolate electricity *(by supply authority if main switchboard is unsafe).*

FIRE

1 Shut emergency stop.
2 Phone fire brigade *(insert telephone number of local station).*
3 Phone *(insert LPG distributor's name and all-hours number).*
4 Close all valves of tank.
5 Keep bystanders away.
6 Isolate electricity *(by supply authority if main switchboard is unsafe)*
7 Follow firefighting instructions.

Figure A.1 – LPG emergency procedure notice

Annex B

Driver instruction signs
(Normative)

B.1 Driver instruction signs

Driver instruction signs of a minimum size of 125 mm wide by 270 mm high and printed on a white background shall be displayed in a readily visible location on LPG dispensers.

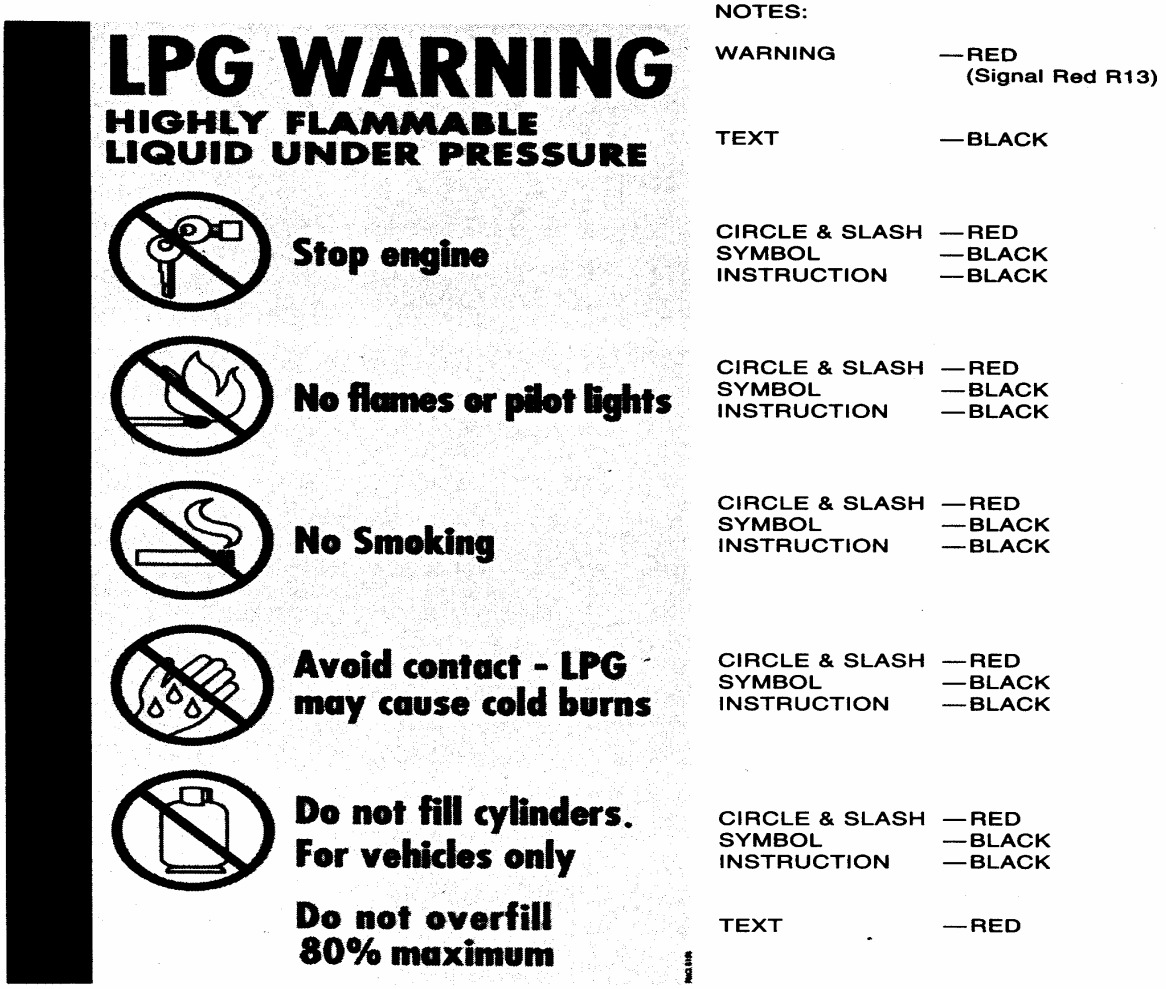
B.2 Warning signs

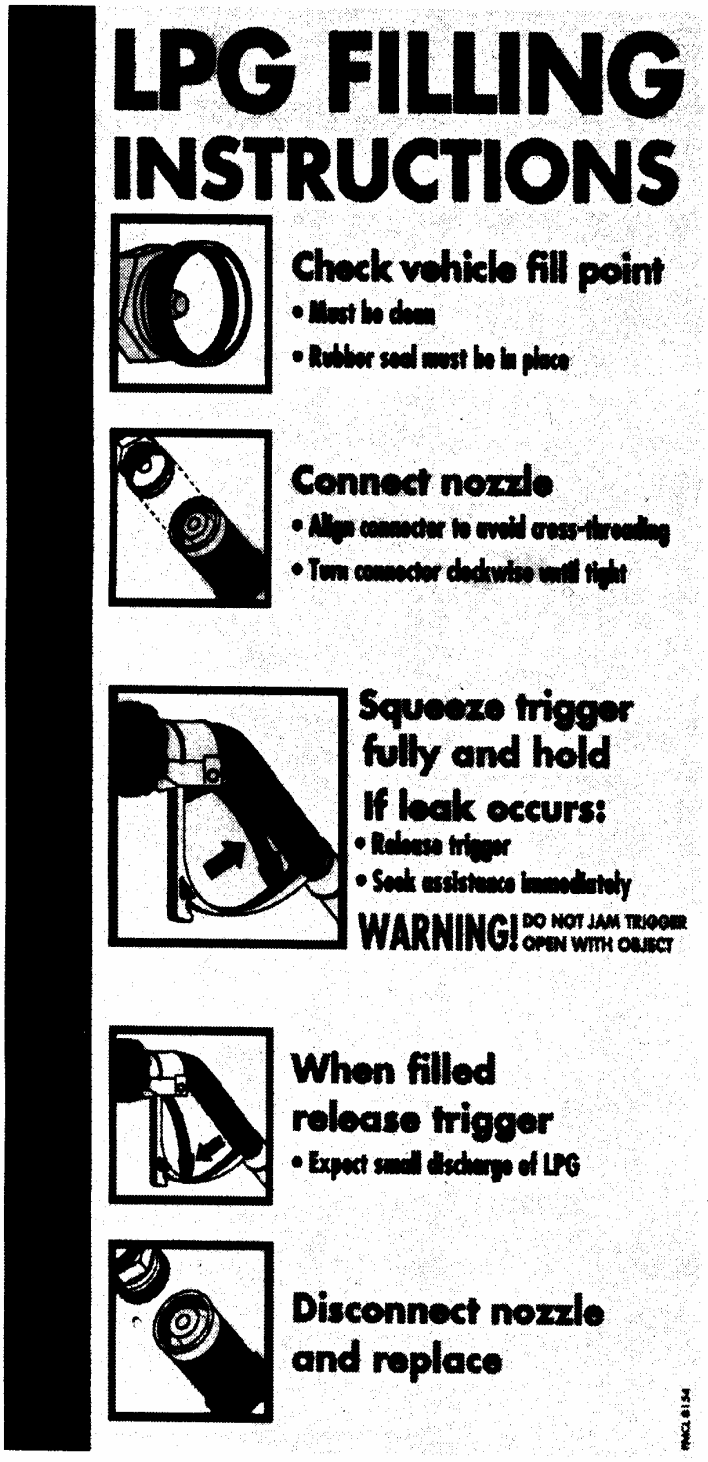
The warning signs shall take substantially the form indicated in Figure B.1.

B.3 Filling instructions

The filling instruction sign shall take substantially the form indicated in Figure B.2.

NOTE Liquefied petroleum gas may be abbreviated to LPG.





NOTES:

INSTRUCTIONS —BLUE
(Bright Blue B23)
(Signal Red R13)

SQUARE & INSTRUCTION—BLUE
SYMBOL AND TEXT —BLACK
GASKET —RED
(Signal Red R13)

SQUARE & INSTRUCTION—BLUE
SYMBOL AND TEXT —BLACK
GASKET —RED

SQUARE & INSTRUCTION—BLUE
SYMBOL AND TEXT —BLACK
TRIGGER AND ARROW —RED

WARNING AND TEXT —RED

SQUARE & INSTRUCTION—BLUE
SYMBOL AND TEXT —BLACK
TRIGGER AND ARROW —RED

SQUARE & INSTRUCTION—BLUE
ARROW —RED

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8 Ma. Irme B. Aureo*
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11 Lito Roco
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14 Michael Rudolph E. Servito
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15 Generoso B. Cruz
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Petron Corp.

Invitees:

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Unioil Petroleum Phils., Inc.

TCPPF - TWG for Auto-gas

Chair

1. Alvin David T. Lim
Oil Industry Management Bureau
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Co-Chair

2. Victor I. Marinas
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*** members to TWG**

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7. Gerry Quisumbing
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8. John Dale O. Tubale
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