SRI LANKA STANDARD 1196 : PART 5 : 2000
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CODE OF PRACTICE FOR
TRANSPORT, STORAGE AND HANDLING OF LPG
PART 5 : STORAGE OF FULL AND EMPTY LPG CYLINDERS AND CARTRIDGES

SRI LANKA STANDARDS INSTITUTION

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PART 5 : STORAGE OF FULL AND EMPTY LPG CYLINDERS AND CARTRIDGES

SLS 1196 : Part 5 : 2000

Gr.10

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SRI LANKA

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD
CODE OF PRACTICE FOR TRANSPORT, STORAGE AND HANDLING OF LPG
PART 5 : STORAGE OF FULL AND EMPTY LPG CYLINDERS AND CARTRIDGES

FOREWORD

This standard was approved by the Sectoral Committee on Liquefied Petroleum Gas Industry and was authorized for adoption and publication as a Sri Lanka Standard by the Council, of the Sri Lanka Standards Institution on 2000-09-21.

The objective of this part of the Code of Practice is to give guidance on safe practices to be followed by all dealing with the storage and handling of LPG cylinders and cartridges, whether full or empty, at depots, stockists and all other premises where they are normally stored, to minimise accidents and the action to be taken in the event of an emergency.

The other parts of this Code of Practice are as follows:

Part 1 : General provisions
Part 2 : Design installation and maintenance of bulk LPG storage at fixed installation
Part 3 : LP Gas piping system - Design and installation
Part 4 : Safe filling of LP gas at depots
Part 6 : Use of LP gas in cylinders at residential premises
Part 7 : Transport of LP gas in cylinders by road, rail or on water
Part 8 : Safe handling and transport of LPG in bulk by road

The Sri Lanka Standards Institution gratefully acknowledges the use of the following publications, in the preparation of this code:

a) Code of practice number 7: Storage of full and empty LPG cylinders and cartridges - published by the Liquefied Petroleum Gas Industry Technical Association (UK).

b) Malaysian Standard MS 830 : Code of practice for the storage, handling and transportation of LPG.

1 SCOPE

This part of the Code of Practice recommends minimum safety standards for the storage of full and empty LPG cylinders and cartridges at depots, stockists and all other premises where they are normally stored and to give guidance on the action to be taken in the event of an emergency.

This does not apply to small scale storage (total inventory) below 100 kg keeping of LPG for use in domestic premises.

NOTE

This code does not preclude the use of alternative designs, materials and methods where these could provide equivalent standard of safety as judged by a competent person.

2. REFERENCES

BS 476	Fire tests on building materials and structures
BS 5306	Guide for selection of installed systems and other fire equipment
BS 5345	Parts 1-7: Code of Practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres
SLS 712	Liquefied petroleum gas
SLS 1178	Transportable welded steel gas containers of 0.5L up to 150L water capacity for liquefied petroleum gas

3 DEFINITIONS

For the purpose of this standard the following definitions shall apply:

3.1 cartridge: Non-refillable, disposable container for LPG of less than 2.4 litter water capacity.

3.2 cylinder: A portable, refillable container for LPG of up to 150 litters water capacity.

3.3 element of construction: Any wall, floor, ceiling, roof, door or window, etc. which form part of a building, room or other enclosure.

3.4 flammable liquid: Any liquid with a flash point of less than 55 ^{o}C.

3.5 fire resisting: When applied to an element of construction means that the construction so described would have at least the stated period of fire resistance when tested, from either side, in accordance with the **BS 476 : Part 8.**

3.6 LPG: Commercial butane and commercial propane to SLS 712 and any mixtures thereof.

3.7 highly flammable liquid: Any liquid with a flash point of less than 21 ^{o}C.

3.8 non-combustible material : A material that is capable of being classified as non-combustible when tested for non-combustibility as prescribed in **BS 476 : Part 4.**

3.9 nominally empty: A container from which most of the liquid has been discharged but still contains LPG vapour.

3.10 radiation wall: An imperforate wall, screen or other feature designed to protect cylinders from the radiation effects of a fire at or beyond the separation distance

3.11 separation distance: The shortest distance between the nearest cylinder within the storage area and any specified feature.

3.12 storage: The holding of containers in an area where there is no intention to transfer LPG into or out of the container in that area.

4 GENERAL CONDITIONS AND LOCATION OF STORAGE

4.1 It is preferable that all LPG is stored in the open air in a well ventilated area, but where this is not practicable, the requirement of **6** shall also be met.

NOTE

*For storage of cartridges, appropriate parts of **6** shall be followed.*

4.2 The storage area shall normally not be accessible to the general public or other unauthorised persons. Access of vehicles and mechanical handling equipment into the storage area shall be strictly controlled.

4.3 Refillable LPG cylinders are treated as full whatever the level of their contents, except where adequate provision could be made to ensure that full cylinders are stored separately from nominally empty cylinders. (See **5.2**)

4.4 Whether the LPG cylinders are full or nominally empty, they shall be stored with valves uppermost.

4.5 Particular care shall be exercised when handling LPG cylinders. They must not be dropped or allowed to come into violent contact with one another or with any adjacent object.

4.6 The outlet valves of all LPG cylinders must be kept closed while the cylinders are being stored. If the cylinder valve is such that it is required to have a protective cover, a cap or plug, this must be in place while the cylinder is being handled and stored.

4.7 All weeds, long grass and any combustible material shall be removed from the area within the separation distances set out in Table **1** up to a minimum of 3 meters from the nearest stack of cylinders.

4.8 Any place where LPG cylinders are stored shall be readily accessible to facilitate quick removal.

5 OPEN AIR STORAGE

5.1 General requirements

5.1.1 Open air storage is cylinder storage in the open air or on any open loading platform which may be provided with a roof constructed with non combustible material. The total amount of LPG which may be stored within specific separation distances is shown in Table **1**.

5.1.2 The required minimum separation distance from any building, boundary or fixed ignition source is determined by consideration of the total amount of LPG stored, or the size of the maximum stack in the storage area. Of the two considerations, that resulting in the greater distance is the one to be applied. The distance refer to the horizontal distance in plan between the nearest cylinder and the reference feature.

5.1.3 For the purpose of determining the minimum separation distance required for any building, boundary or fixed ignition source in relation to the total amount of LPG stored, individual storage areas within a single enclosed area may be considered separately provided that the distance from any cylinder in one storage area to any cylinder in an adjacent storage area is not less than the sum of the minimum separation distances appropriate to each area in accordance with Table **1**. The distance in column **2** are the distances across open ground, but provision of radiation walls permits these distances to be reduced to those shown in Column **3**.

5.1.4 To prevent trespassing or tampering, every LPG storage place should be enclosed by an industrial type fence not less than 2 m high unless it is otherwise adequately protected (e.g. within a greater fenced area). Except as provided in **5.2.1** no cylinder shall be placed within 1m of the fence (unless it is a boundary fence, when the distances given in Table **1** will apply). The fence shall have at least two means of exit not adjacent to one

another. Gates shall open outwards, shall not be self locking and shall at all times provide easy means of escape from within. They shall be so sited that, in opening, they do not impede any other escape route.

5.1.5 All storage places including any enclosed places where LPG is temporarily kept e.g. construction sites, shall be clearly marked with notices on each externally visible side and particularly at entrances to the storage area indicating the presence of LPG. These notices shall indicate:

a) a warning notice - 'Highly Flammable LPG'
b) the warning symbol - Flammable Gas
c) the prohibition sign - No smoking or naked flames or any ignition source.

5.1.6 LPG cylinders totaling 50 kg or more shall be separated from other hazardous materials as shown below:

a)	compressed gas cylinders	3 metres
b)	acetylene cylinders	3 metres
c)	tanks containing flammable liquids	3 metres
d)	bunds of tanks containing highly flammable liquids	3 metres
e)	materials and substances whose major risk is toxicity, corrosivity, explosion or combustibility	3 metres
f)	liquid oxygen installations	7.5metres
g)	LPG filling plant buildings	7.5metres
h)	LPG bulk storage 5000 litres or less	3 metres
j)	LPG bulk storage over 5000 litres	7.5metres

These distances may be reduced by the interposition of a radiation barrier.

5.1.7 Notwithstanding **5.1.6 (j),** up to 300 kg of LPG in cylinders which have vertically venting relief valves may be stored adjacent to a bulk LPG vessel and within the compound.

5.1.8 The position chosen for storage shall be at ground level and never below it in cellars or basements and shall be readily accessible.

5.1.9 Drains shall be avoided in the floor of the storage place or in the immediate vicinity, i.e. within 3 m of the storage place. Where a gully or a drain is unavoidable within this distance, the opening must either be securely covered or the drain fitted with a suitable water seal.

5.1.10 Any loading platform, and any roof provided over a storage place, shall be predominantly constructed from non combustible materials.

5.1.11 The floor of the storage area shall be level, free from depressions and compacted or paved with a suitable material.

5.1.12 Suitable hard standing shall be provided for the reception and despatch of cylinders.

5.1.13 Stacks and gangways shall conform to the following requirements:

a) the maximum size of any stack shall not exceed 30,000 kg.

b) the gangway between palletised stacks shall not be less than 2.5 m.

c) the gangway between unpalletised stacks shall not be less than 2.5 m.

d) the maximum height of any unpalletised stack shall not exceed 2.5 m. The maximum number of pallets in any vertical column of a palletised stack shall not exceed seven. The amount of LPG in any column of a stack shall not exceed that shown in Table **2**.

5.2 Storage of nominally empty cylinders

5.2.1 Unless they have been gas-freed, or have never been charged with LPG, empty refillable cylinders shall be treated in the same way as full ones, unless the conditions specified in the **5.2.2** and **5.2.3** are rigorously applied.

5.2.2 The storage areas for empty cylinders shall be clearly identified, and separated from the storage areas for full cylinders. All such storage shall be in the open air and subject to strict supervision.

5.2.3 Provided that the requirements in **5.2.2** is fully met, empty cylinders may be stored within the appropriate safety distances given in **5.1** and Table **1**, provided that, in addition, no such empty cylinder is stored nearer than **1.5** m from any full cylinder, and that a minimum distance of 1 m is maintained between any empty cylinder and a boundary, building, or fixed ignition source.

5.3 Fire resisting walls (radiation walls)

5.3.1 Radiation walls may permit separation distances to be reduced.

5.3.2 Radiation walls must be imperforate, and substantially constructed from brick, concrete, or such other materials so that they have a standard of fire resistance not less than 30 minutes, in accordance with **BS 476 : Part 8**. They shall be at least as high as the height of the highest stack of cylinders stored, but shall be not less than 2.5 metres high. They shall be of such length that the distance from any cylinder to boundary or fixed ignition source, measured around the end of the wall, is not less than the separation distances specified in **5.1** and Table **1**.

5.3.3 Not more than 2 radiation walls shall be provided for any storage area, and the remaining 2 sides shall be so constructed that natural ventilation is not impaired. If the store contains 400 kilograms or less LPG and no cylinder is of greater capacity than 20 kilograms, 3 radiation walls may be provided.

5.3.4 A radiation wall may be built on a boundary, but in such cases, it must be wholly under the control of the occupier of the LPG store.

5.3.5 The radiation wall may be a wall of a building, in which case the following additional requirements shall be met:

a) there shall be no openings in the wall above the cylinders stored or within 2 metres horizontally.

b) there shall be no overhanging eaves or similar projections constructed from combustible materials above any stored cylinder. No external tairway or fire escape shall be positioned above stored cylinders or allowed to terminate in the storage area.

5.3.6 Cylinders of LPG may be stored so that the separation distance from the nearest cylinder to any radiation wall is not less than 1 metre.

5.3.7 Where radiation walls are provided, and there is only one access route to a storage area, one of the radiation walls shall be at one of the sides adjacent to the access route.

5.4 Storage of cylinders on vehicles or trailers

5.4.1 No cylinder of LPG shall be stored in an enclosed vehicle other than a cylinder which is specifically designed to keep fuel for the motive power of the vehicle or is connected to an appliance for use. Such cylinders should not be classed as storage.

5.4.2 Loaded cylinder trailers and flat bed vehicles, scheduled for delivery, may be parked in a distribution depot. They may be parked alongside loaded LPG road tankers with the minimum of clearance required for ease of access. They are not to be considered as constituting part of the total storage, but are deemed to be in transit. Unauthorized movement of such vehicles shall be prevented by the removal of the ignition key.

5.4.3 If there is a requirement to store a loaded cylinder trailer or flat bed vehicle with no immediate plans for movement, it shall be regarded as storage, and such vehicles shall be located in the open air at such separation distances as specified in Table **1**.

5.4.4 Apart from tyres on the wheels and any wooden planking on the bed, no other combustible material may be permitted within the specified separation distances.

TABLE 1 - Minimum separation distances for open air storage

Total LPG Storage **kg** **(1)**	**Minimum separation distance to boundary building or fixed ignition source from the nearest cylinder (with no radiation walls).** **m** **(2)**	**Minimum separation distance to boundary building or fixed ignition source from the radiation wall (where provided)** **m** **(3)**	**Size of stack** **kg** **(4)**
Up to 100	1	nil	-
100 - 400	2	1	400
100 - 1,000	3	1	1,000
1,000 - 4,000	4	1	1,000
4,000 - 6,000	5	1.5	3,000
6,000 - 12,000	6	2	3,000
12,000 - 20,000	7	2.5	7,000
20,000 - 30,000	8	3	9,000
30,000 - 50,000	9	3.5	9,000
50,000 - 60,000	10	4	10,000
60,000 - 100,000	11	4.5	10,000
100,000 - 150,000	12	5	20,000
150,000 - 250,000	15	6	30,000
Above 250,000	20	7	30,000

TABLE 2 - Amount of LPG in columns of stacks

Amount of LPG in any cylinder Kg (1)	amount of LPG in any column Palletised kg (2)	amount of LPG in any column Non-palletised kg (3)
up to 6	35	30
6 - 15	75	45
15 - 20	80	50
20 - 55	110	55

6 STORAGE WITHIN BUILDINGS

6.1 General requirements (in addition to 4)

6.1.1 The quantity of LPG that may be stored within a building will depend on the type of the building, its location, construction and fire resistance and also the type of LPG container (i.e. cylinder or cartridge). The storage place shall be situated on the ground floor only.

6.1.2 While storage of refillable cylinders and cartridges are covered separately, this does not preclude the storage of both within buildings, structures, etc., where the total stored will be not more than the limit imposed for cylinder storage.

6.1.3 Access to storage within buildings shall be strictly controlled. Where storage buildings do not come within a larger, adequately secured area, the separation requirements in **5.1.4** shall be satisfied by an industrial type security fence 2 metres in height. Radiation walls or walls of other buildings may form part of this separation protection.

6.1.4 All storage places in buildings where LPG is kept shall be clearly marked with notices on each externally visible side and particularly at entrances to the storage area indicating the presence of LPG.

These notices shall indicate:

a) a warning notice - 'Highly flammable LPG'
b) the warning symbol - Flammable Gas
c) the prohibition sign - No smoking or naked flames.

Both warning signs and prohibition signs shall comply with requirements in **BS 5378 : Part 1.**

6.1.5 Access of vehicles and mechanical handling equipment into the storage area must be strictly controlled.

6.1.6 The external distance from any aperture in the walls of a building which is used for the storage of LPG to the nearest aperture in any other building, or to the boundary (except where this is an imperforate wall at least as high as the position of the aperture and having at least 30 minutes fire resistance) or to any fixed source of ignition or smoking permitted areas, or to motor vehicles (except those actually collecting or delivering LPG) shall be 1 metre where the quantity stored is not more than 400 kg or the separation distance given in Table **1** in all other cases.

6.1.7 The general principles for ventilation and explosion relief are that not less than 10 per cent of the area of the walls and roof of a building in which LPG is stored shall be used for the purpose, 2.5 per cent for ventilation and 7.5 per cent for explosion relief.

6.1.8 If there is a risk of persons being trapped in the stores in the event of a fire, a second exit must be provided, not adjacent to the first, and one of which preferably leading to the open air. All doors must open outwards, and at all times provide easy means of escape from within.

6.1.9 Only LPG shall be kept in the storage place.

6.1.10 Where practicable, no electrical apparatus shall be installed within the storage place or outside within the horizontal separation distance given in Table **1**. Where installed within this area the requirements of **8** must be adhered to.

6.1.11 Provision must be made for an adequate supply of water and/or fire extinguishers for fire protection purposes. Guidance for this is given in **7**.

6.1.12 For cartridge storage it is essential to ensure that an adequate system of stock rotation is in use and that they are stored in dry, cool conditions; below 50 ^{o}C, and always on ground level only. It is recommended that each consignment received should have a sign indicating the date of receipt, when stored.

6.2 Storage of cylinders in specially designed separate buildings

6.2.1 LPG cylinders may be stored in specially designed separate buildings subject to compliance with **4** and requirement under **4, 6.1** and **6.2.2** to **6.2.7.**

6.2.2 The building shall be at ground level and of single storey construction. It shall be made of non-combustible material and including the doors and roof, have a fire resistance, of not less than 30 minutes.

6.2.3 The quantity of LPG stored in specially designed building or compartment of a building shall not exceed 5000 kg. No building shall have more than five compartments. Individual compartments must be separated from each other by an imperforate wall having a standard of fire resistance of not less than 30 minutes.

6.2.4 The building shall be separated from other buildings or boundary by the separation in Table 1 or by an imperforate wall of not less than 30 minutes fire resistance. One wall of the building may be built on the boundary provided that it does not include any openings. If the capacity of the store is less than 400 kg and no cylinder is of greater capacity than 20 kg, the standards of this paragraph may be reduced, but the separation from other buildings shall be not less than 1 metre.

6.2.5 No drains or openings shall be allowed in the floor of the building.

6.2.6 The building shall have well dispersed ventilation openings at both high level in the walls and roof and particularly at floor level, equivalent to at least 2.5 per cent of the area of the walls and roof. The ventilation openings of the building shall be at least 3 metres from openings into other buildings. The ventilated walls must not discharge directly on to a public pavement. The building shall also have an area equivalent to at least one wall or the roof made of open mesh, or light weight material that could act as relief in the event of an explosion.

6.2.7 Combustible material should not be used for palletizing unless a sprinkle system is installed.

6.3 Storage of cylinders within parts of buildings

6.3.1 A total quantity of LPG in cylinders not exceeding 1000 kg may be stored within rooms or parts of building subject to compliance with **4, 6.1** and **6.3.2** to **6.3.10.**

6.3.2 The storage of LPG in buildings which include residential accommodation is not recommended, and should be avoided.

6.3.3 The storage place shall be situated on the ground floor only, against at least one outside wall of the building. It shall be of robust construction and separated from the rest of the building by a fire resistant wall, doors, ceilings, floors etc. of minimum 30 minutes.

6.3.4 Additional requirements for fire protection are required when LPG is stored within a building of more than one storey construction. The walls and ceiling of the storage place other than provision for ventilation shall be 30 minutes fire resistance, and

this standard of fire resistance shall be extended to 2 m on either side of the outside walls of the store and to a height of a maximum 9 m from ground level. This will require any openings or windows in the 30 minute fire resistant section to be fixed shut and suitably protected.

Buildings below 9 m in total height need this standard of fire resistance to the full height of the building only. No balconies, extended stairs or overhanging combustible roof may surmount the wall or be in the area described above.

6.3.5 Not less than half of the area of an outside wall of the store shall be left open or made of industrial wire mesh or light weight louvered panels. The opening shall extend to the floor of the store.

At least 2.5 per cent of the area of the walls and roof of the storage area shall be provided with dispersed ventilation openings at both high and low level, in the outer walls. These openings shall be at least 3 m from openings into other buildings.

6.3.6 Drains or openings shall not be provided in the floor of the storage area. The floor shall be level, or slope towards the ventilated external wall(s). Doors in to the storage place from within the building shall be provided with a ramp,` or step at least 250 mm high, across the doorway in order to prevent heavy vapour drifting into the building. Doors must open outward from the store and shall not be self locking.

6.3.7 The ventilated exterior wall of a storage place or building shall not discharge directly on to a public pavement. Ventilation shall be located so that the distance between the apertures in the walls of the building and the separation requirements of **6.1.6** are adhered to.

6.3.8 Access to the store shall be restricted to authorised persons only.

6.3.9 Where there is residential accommodation above or in the same building as the store, the elements of construction shall have at least 60 minute fire resistance and a fire detection system associated with a suitable fire alarm system shall be provided and maintained.

6.3.10 The maximum storage of LPG permissible in such circumstances shall not exceed 400 kg, and no cylinder should contain more than 20 kg.

6.4 Storage of cylinders in cabinets and cupboards

6.4.1 A total quantity of LPG in cylinders not exceeding 400 kg may be stored in a cabinet or cupboard subject to compliance with **4. 6.1** and requirements of **6.4.2** to **6.4 3.**

6.4.2 Storage of cylinders is not permitted in multi- storey buildings or those with residential accommodation.

6.4.3 Any cabinet or cupboard used for the storage of LPG cylinders shall be of sound construction and of not less than 30 minutes fire resistance. Well dispersed ventilation openings to a standard similar to that for buildings (**6.2.6**) shall be provided at high and low level. If the volume of cabinet or cupboard exceeds half a cubic metre, it shall be provided with explosion relief equal to half the area of the back of cabinet or cupboard. Such relief must vent to a safe place outside the building.

6.5 Storage of cartridges in specially designed separate buildings

6.5.1 A total quantity of LPG in cartridges not exceeding 5000 kg may be stored in a building, or a structure separated from other buildings, subject to compliance with **6.1** and the requirements of **6.5.2 - 6.5.6.** The total quantity may be increased subject to the additional requirements of **6.5.6.**

6.5.2 The building shall be at ground level and of single storey construction. It shall be made of non-combustible material including the doors and roof and have a fire resistance of not less than 30 minutes.

6.5.3 The building shall be separated from other buildings or boundary by the separation in Table **1** or by an imperforate wall of not less than 30 minutes fire resistance. One wall of the building may be built on the boundary provided that it does not include any openings. If the capacity of the store is less than 400 kg and no cylinder is of greater capacity than 20 kg, the separation distance may be reduced to 1 m.**(6.1.6).**

6.5.4 Drains and holes shall not be in the floor of the building.

6.5.5 The building shall have well dispersed ventilation openings at both high level in the walls and roof and particularly at floor level, equivalent to at least 2.5 per cent of the area of the walls and roof. The ventilation openings of the building shall be at least 3 m from openings into other buildings. The ventilated walls must not discharge directly on to a public pavement. The building shall also have an area equivalent to at least half one wall or the roof made of open mesh, or light weight material that could act as relief in the event of an explosion.

6.5.6 The storage of cartridges may be increased where in addition to the requirements of **6.5.1** to **6.5.6** all the following requirements will also apply:

a) combustible material may be used for packing, but only as much as necessary for efficient handling of the cartridges.

b) no other flammable material is kept in the store.

c) the cartridges are stored in stacks which are not more than 4 m high or 2 m wide.

d) no more than 5,000 kg of LPG may be stored in any single compartment.

e) the number of compartments in any building shall not exceed five.

f) individual compartments shall be separated from each other by an imperforate wall having a standard of fire resistance of not less than 30 minutes.

g) the building is provided with a sprinkler system having a minimum designed discharge density of 12.5 $l/m^2/min$.

6.6 Storage of cartridges within parts of buildings

6.6.1 A total quantity of LPG in cartridges not exceeding 5,000 kg may be stored within rooms, or parts of building, subject to compliance with **6.1** and the requirements of **6.3.2 to 6.3.9** stipulated for LPG cylinders as applicable for LPG cartridges as well.

6.7 Storage of cartridges in cabinets and cupboards

6.7.1 Within buildings, a total quantity of LPG in cartridges not exceeding 400 kg may be stored in cabinets or cupboards subject to compliance with the requirements of **6.7.2** to **6.7.8.**

6.7.2 The cabinets or cupboards used for the storage of LPG cartridges shall be located at ground level, and the building should not be attached to residential property. (For exceptions, refer **6.7.6**).

6.7.3 Where LPG cartridges are stored in cabinets/cupboards the maximum 400 kg capacity includes all LPG in the building including that displayed for sale, heating, lighting or any other purpose.

6.7.4 The cabinet or cupboard shall be of sound construction and of not less than 30 minutes fire resistance and be adequately anchored in position. It shall have strong hinges and door fastenings, with the facility of being locked securely. Ventilation openings shall be provided at both high level and floor level.

6.7.5 If the cabinet or cupboard is more than half a cubic metre capacity, it shall be fitted with an explosion relief equal to half the area of the back or side. The relief must vent to a safe place outside the building.

6.7.6 Where residential accommodation is attached adjoined or included to the building the total quantity of LPG, in cartridges only, which may be stored in a cabinet or cupboard must not exceed 70 kg including any LPG in the retail area. Only one cabinet/cupboard shall be located within the building. The building shall be fitted with an

automatic fire detection and alarm device capable of giving warning throughout the building, in case of fire occurring anywhere in the building.

6.7.7 In a multistory building in which there is no residential accommodation, not more than 400 kg of LPG in cartridges should be stored in a cabinet or cupboard. LPG in cylinders should not be stored in the cabinet or cupboard. However, if there is more than one occupier, the total quantity of LPG stored in the building should not exceed 400 kg.

6.7.8 All cabinets or cupboards used for the storage of LPG cartridges shall be locked closed, and access for loading and unloading shall be under the control of a responsible person.

7 FIRE PROTECTION AND EMERGENCY PROCEDURES

7.1 Fire protection

Unless there is a properly trained fire fighting team on site, it is recommended that major fires be dealt with by the Fire Service under the local authority. The site should nevertheless be equipped with means to deal with small fires at an early stage so that they do not spread to jeopardize the LPG containers. These first aid requirements are set out in **7.1.1.** It is recommended that consultation takes place with the local Fire Service regarding the on-site facilities listed in **7.1.2.**

7.1.1 *First aid requirements*

a) fire fighting equipment should be selected and located to enable incipient fires to be extinguished and so prevent fire spreading to or jeopardizing the LPG containers.

b) either fire extinguishers or hose reels or an equivalent combination of the two types of equipment may be provided.

c) fire extinguishers shall be selected, sized, located and maintained in accordance with **BS 5306 : Part 3** and hose reels, where provided shall be selected and installed in accordance with **BS 5306 : Part 1.**

d) in addition to this general provision, fire extinguishers suitable for extinguishing an LPG fire should be provided at both the LPG storage area, and at any LPG display area. Dry powder extinguishers conforming to **BSEN 3** and rated at 89 B would normally be suitable.

7.1.2 Fire service requirements

Minimum requirements for LPG storage sites are:-

a) telephone and alarm;
b) unrestricted good access for fire service appliances;
c) sound and tested emergency procedures for site operators;
d) adequate water supply;
e) fire hydrants located with agreement with the local fire service; and
f) at particularly remote/isolated sites it may be necessary to install a private hydrant to satisfy fire service requirements.

7.1.3 The following action shall be taken by persons discovering a fire:

a) raise the alarm, including activation of any fire alarm in the premises.

b) all persons not connected with fire fighting must be evacuated from the premises in accordance with the emergency procedure drawn up for the premises in case of fire. The evacuation shall include any person occupying residential accommodation connected with the building.

c) assess the situation, if considered necessary call the Fire Brigade immediately. On arrival, the Fire Officer must be informed of the location of the fire, the LPG containers and any other hazardous material held on the premises.

d) if gas from the valve of a cylinder is alight, and PROVIDED THAT IT IS SAFE TO DO SO, promptly turn off the valve if such a valve is arable; to extinguish the flame. Where possible cool the cylinders by spraying with copious quantities of water, providing it is safe to do so.

e) if the flame from a leak cannot be extinguished by turning off the valve or the fire isolated by removing the cylinder to a safe location, fire-fighting should be left to the Fire Brigade. Otherwise if the flame is extinguished, but vapour continues to escape, there will be the risk of re-ignition of the vapour cloud. If the flame from a burning leak impinges on a cylinder and the flame cannot be removed from the cylinder immediately, the area should be evacuated forthwith.

f) where a fire in nearby materials is threatening LPG containers, they should be removed to a safe place, PROVIDED THIS COULD BE DONE SAFELY.

7.2 Cylinder leakage

7.2.1 If a cylinder is found to be leaking and the leak cannot be stopped by closing the valve or inserting the bung or cap, nearby sources of ignition must be extinguished and the container carefully removed to a well ventilated open space clear of drains and buildings and free from all sources of ignition. It should be left with the leak (usually at the valve) uppermost, marked faulty and notices displayed prohibiting smoking and other naked lights. The supplier of cylinder should be informed immediately. IN NO CIRCUMSTANCES, SHOULD ANY ATTEMPT BE MADE TO DISMANTLE OR REPAIR DEFECTIVE CYLINDER VALVES BY UNQUALIFIED PERSONS.

8 ELECTRICAL REQUIREMENTS

8.1 General

The selection, installation and use of electrical apparatus in hazardous areas shall be in accordance with the recommendations of **BS 5345 : Part 2**.

8.2 Area classification

The areas detailed in this Code of Practice Table **3** and Figure **1** are classified according to the degree of probability that flammable concentrations of gas (or vapour) may arise. The hazardous area definitions are as follows:

Zone 0 — an area in which an explosive gas-air mixture is continuously present, or present for long periods.

Zone 1 — an area in which an explosive gas-air mixture is likely to occur in normal operation.

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.

NOTE

*Storage within buildings and the areas within separation distances shall be designated as Zone 2 as indicated in Table **3.***

8.3 Certification

All electrical apparatus used must have certification for the appropriate zone, gas group and temperature classification as detailed in **BS 5345 : Part 1** to **Part 7**.

8.4 Selection, installation and maintenance

All wiring and cable shall be in accordance with **BS 5345 : Part 1** to **Part 25**. Maintenance shall be in accordance with **BS 5345 : Part 1** to **Part 33**.

9 TRAINING

9.1 Personnel responsible for the storage of LPG must understand the physical characteristics and hazards of the product, and limits and requirement under this code.

9.2 All persons concerned with the storage of LPG should be familiar with the fundamentals of fire-fighting and fire control, with particular reference to fires involving LPG. They should also be familiar with the correct handling of any fire-fighting equipment provided and should be exercised in this respect. Fire drills should be carried out of frequent intervals.

9.3 At storage depots an emergency procedure must be laid down and prominently displayed. Responsibilities shall be adequately defined and personnel trained in handling emergency situations.

TABLE 3 - Area electrical classification

Location (1)	**Extent of classified area (2)**	**Area classification (3)**
Cylinder storage space of the type described in **5**	In the storage space up to a height of 1.5m above the top of the stack, or beneath any roof over the storage space. Outside the storage space or the space covered by any roof up to 1.5m above ground level and within the distance set out for a fixed source of ignition in Table A and as Fig.1.	Zone 2 Zone 2
Cylinder storage within a building of the type described in 6.2	Within the building Outside the storage space or the space covered by any roof up to 1.5m above ground level and within the distance set out for a fixed source of ignition in Table A and as Fig.1.	Zone 2 Zone 2
Cylinder storage within specially designed storage places within buildings of the type described in 6.3	The entire storage space	Zone 2
Cartridge storage of the type described in 6.5 and 6.6	The entire storage space	Zone 2

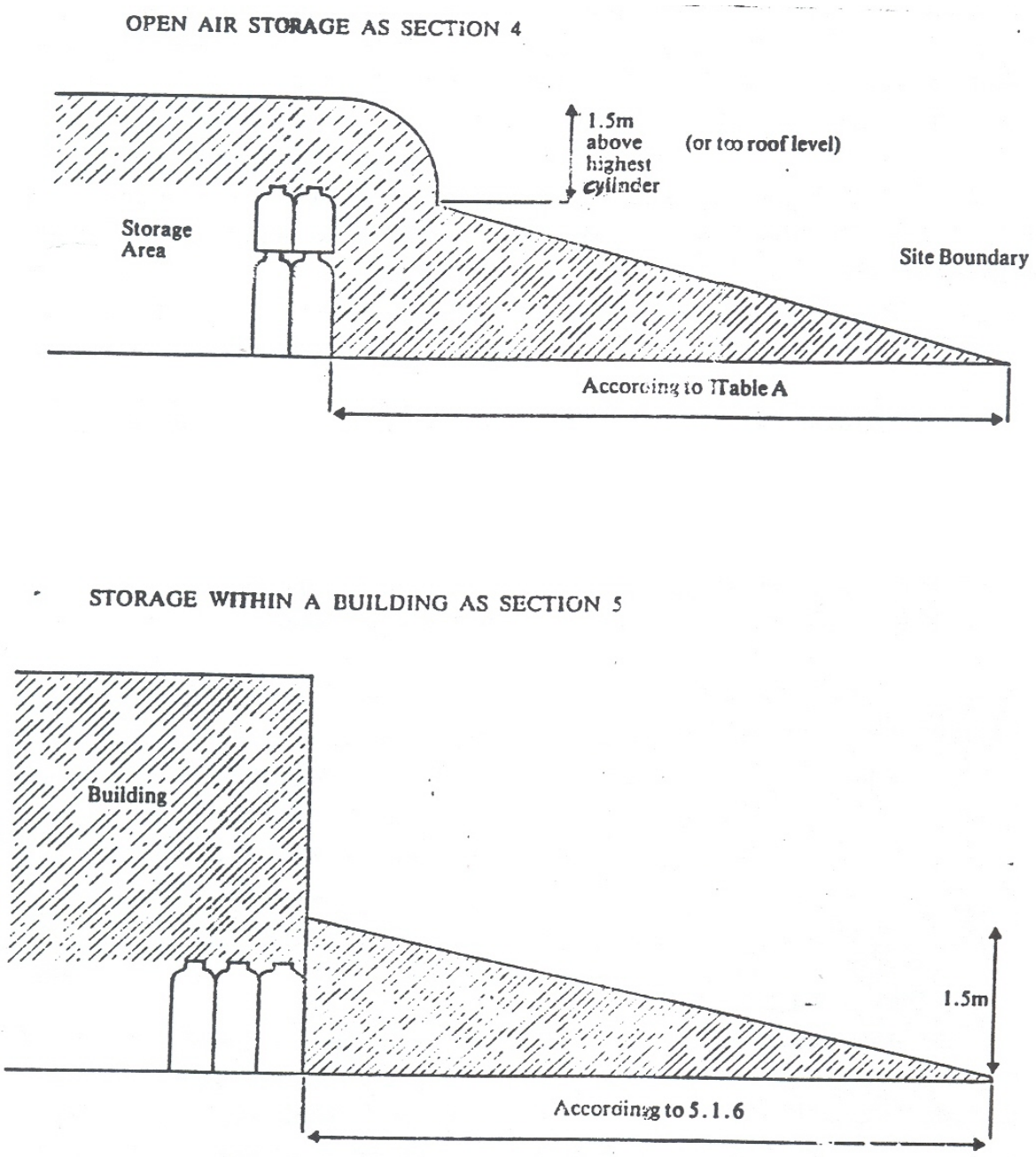

FIGURE 1 - Area electrical classification
Shaded areas indicate Zone 2

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The Sri Lanka Standards Institution is the owner of the registered certification mark shown below. Beneath the mark, the number of the Sri Lanka Standard relevant to the product is indicated. This mark may be used only by those who have obtained permits under the SLS certification marks scheme. The presence of this mark on or in relation to a product conveys the assurance that they have been produced to comply with the requirements of the relevant Sri Lanka Standard under a well designed system of quality control inspection and testing operated by the manufacturer and supervised by the SLSI *which includes surveillance inspection of the factory, testing of both factory and market samples.*

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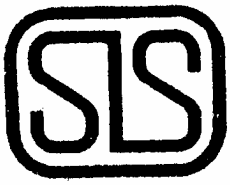

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