



SULTANATE OF OMAN  
DIRECTORATE GENERAL OF CIVIL  
DEFENCE

# FIRE SAFETY REQUIREMENTS

## PART THREE

Transport, Storage, Handling and Installations of  
Liquefied Petroleum G a s

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## **SECTION 1**

### **General Rules**

**Nets for Storage, Transport,  
Handling  
And Installations of Liquefied Petroleum  
Gas**

**SECTION 1**

**General Rules**

**1.1 APPLICATION :**

These requirements are applied to:

- I. I. 1 the storage of LPG portable cylinders for resale by dealers with a maximum number of 500 cylinders.
- i. e. .2 the vehicular transportation of portable cylinders filled with L.P.G. having an individual water capacity not exceeding 108 kg.
- I. I. 3 L.P.G. in fixed storage tanks for use at industrial, commercial and domestic premises.
- I. I. 4 Domestic L.P.G. installations.
- I. I. 5 these requirements shall be applied in accordance with any Omani specification issued for the same purpose.
- I. I. 6 these requirements should be enforced on the first of January 1997. Items 3.1.1. and 3.2 are not applicable for existing vehicles which has been approved before, and should comply with all requirements after two years from the date of issuing this regulation.

**1.2 LICENSING:**

- 1.2.1 No storage, of LPG is permitted, until a license is obtained for this purpose, determining the number of cylinders permitted, and the validity of the license.
- 1.2.2 It is not permitted to use any vehicle for the transportation of L.P.G. cylinders until the following safety requirements are complied and a certificate of license obtained from the appropriate authority, (Directorate General of Traffic and Directorate General of Civil Defense). The license shall be renewed annually after passing the required technical test of the vehicle.

## SECTION 2

### Safety Requirements for Storage of L.P.G. Cylinders

**SECTION 2**  
**Safety Requirements for Storage of L.P.G. Cylinders**

**2.1 GENERAL LOCATION OF STORAGE PLACE**

2.1.2 No storage to take place within the following:

- a) No compound within a residential area.
- b) No resale from shops, stores or supermarkets.
- c) No storage adjacent to other high fire risks.
- d) No storage within a fully enclosed building.

2.1.2 Safety distances should be considered according to the quantity of cylinders in relation with any other construction on neighboring properties.

2.1.3 Access to the storage area should be provided for the approach of Civil Defense appliances, and should facilitate quick removal of cylinders.

**2.2 CONSTRUCTION OF THE STORAGE PLACE :**

2.2.1 All structure should be from non-combustible material.

2.2.2 The storage place should be surrounded by a fence not less than 2m high, and provided with at least two means of exit not adjacent to each other as indicated on attached drawings.

2.2.3 The cylinder storage area should be provided with shade from sunlight, as indicated on attached drawings. The shade shall extend by 2 m on all sides from the boundary of the storage place.

2.2.4 The gates should open outwards and should not be self-locking to provide easy means of escape at all times.

2.2.5 The floor of the storage place should be concrete smooth finish to withstand impact and not contain any drains or openings.

2.2.6 The area surrounding the storage place should be kept free from weeds, grass and combustible materials at all times.

## **2.3 STORAGE OF CYLINDERS:**

- 2.3.1 Cylinders in storage should be so located as to minimize exposure to excessive temperature rise, physical damage or tampering.
- 2.3.2 Total storage of L.P.G. not to exceed the approved number of cylinders according to the areas of storage and distances to the boundary as indicated on attached drawings.
- 2.3.3 No storage other than that of **L.P.G.** cylinders is permitted within the storage place.
- 2.3.4 Where storage is required for 100 cylinders or above, radiation walls to be provided between the stacks of cylinders as indicated on the attached drawings. Radiation walls are to be substantially constructed of concrete bricks or other suitable materials so as to have not less than 2 hours standard fire resisting.
- 2.3.5 Cylinders should be uniformly arranged vertically with their valves uppermost and to be provided with passages permitting easy handling of each cylinder.
- 2.3.6 A place should be assigned for filled cylinders and another for empty cylinders. A notice indicating this shall be displayed.

## **2.4 SEPARATION DISTANCES AND RADIATION WALLS**

- 2.4.1 Minimum separation distances and radiation walls in storage places should be located and spaced in accordance with Table 2.4.1.
- 2.4.2 The required minimum separation distance from any building, boundary or fixed ignition source is determined by consideration of the total amount of LPG stored. The distances refer to the horizontal distance between the nearest point of the storage area and the reference feature.
- 2.4.3 The distances in column 2 of Table 2.4.1 are the distances across open ground, but the provision of radiation walls permits these distances to be reduced to those shown in column 3 of the table.



- 2.4.4 Radiation walls should be substantially constructed of concrete, brick or other suitable materials so as to have not less than a 2 hour standard fire resistance.
- 2.4.5 The radiation walls should extend beyond each end of the storage area so as to secure the distances in column 2 when measured round the ends of the wall.
- 2.4.6 They should not be more than 2.5 m high, should reach to the height of the highest stack of cylinders in the storage area and should be imperforate.
- 2.4.7 To minimize interference with ventilation, radiation walls should generally be permitted only on 2 opposite sides of a storage area.
- 2.4.8 The walls should be at least 1 m and not more than 2 m from the nearest cylinder in the nearest stack.

**Table 2.4.1 Minimum separation distances**

Total LPG storage (1)	Minimum separation distance to boundary, building or fixed ignition source :	
	from the nearest cylinder (where no radiation wall is provided) (2)	from radiation wall (3)
Above 50 - 300 kg	1 meter	Nil
300 - 1,000 kg	3 meters	1 meter
1,000 - 4,000 kg	4 meters	1 meter
4,000 - 6,000 kg	5 meters	1.5 meter
6,000 - 12,000 kg	6 meters	2 meters
12,000 -20,000 kg	7 meters	2.5 meters
20,000 - 30,000 kg	8 meters	3 meters
30,000 - 50,000 kg	9 meters	3.5 meters
50,000 - 60,000 kg	10 meters	4 meters
60,000- 100,000 kg	11 meters	4.5 meters
100,000 - 150,000 kg	12 meters	5 meters
150,000 - 250,000 kg	15 meters	6 meters
Above 250,000 kg	20 meters	7 meters

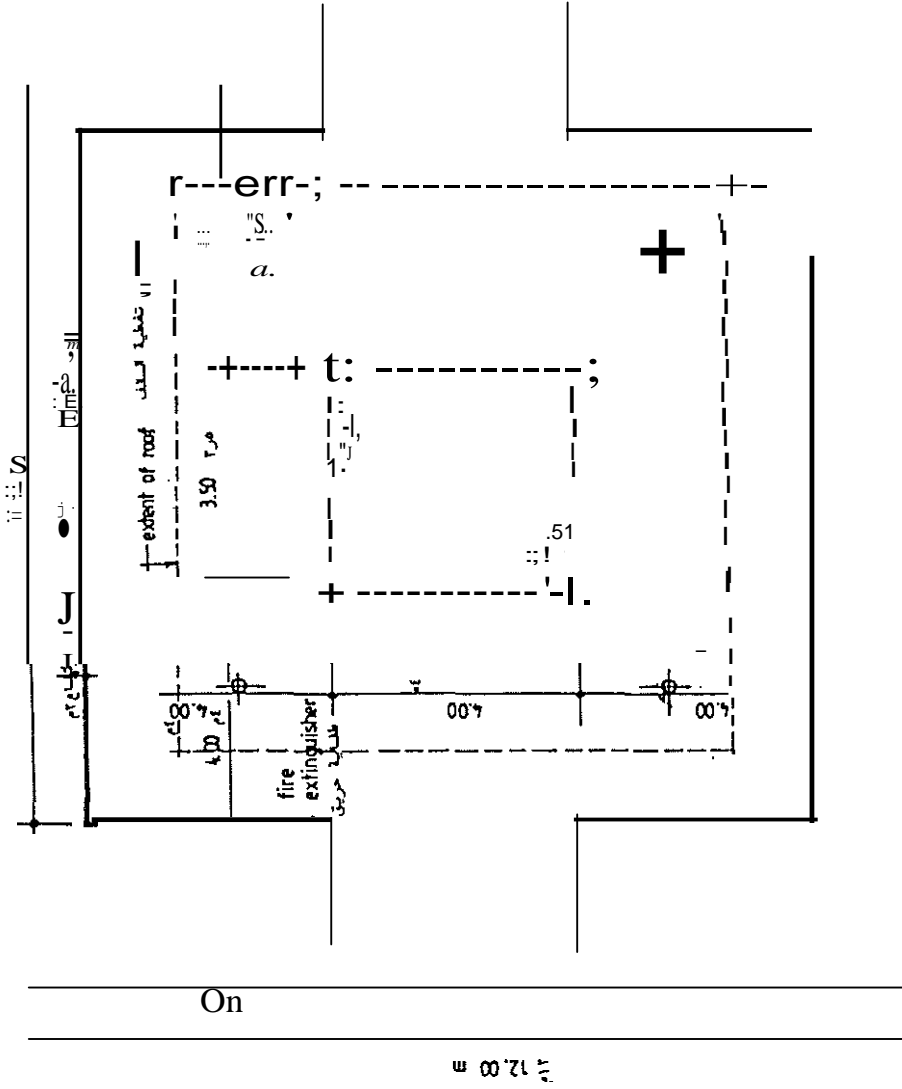
## 2.5 **SOURCE OF IGNITION:**

- 2.5.1 Open flames and other sources of ignition shall not be permitted within the storage place.
- 2.5.2 Permanent conspicuous notices in lettering of the appropriate size bearing the legend L.P.G., Highly Flammable, No Smoking, No Naked Flames, in both Arabic and English languages, shall be fixed on the outside of gates giving access to the storage place and also within the storage place itself.
- 2.5.3 Electrical equipment and wiring should be of an approved type and to be installed according to the safety regulations related to flammable gases, and should not be less than 2m above the floor level. Fire electrical equipment should preferably not be installed within the storage place.
- 2.5.4 Cylinder outlet valves shall be closed and plugged. Outlet valves shall be secured against open position by a thin wire which can be removed when the cylinder is in use only.
- 2.5.5 Portable camping appliances for cooking and lighting should not be filled inside the storage place.

## 2.6 **FIRE PROTECTION EQUIPMENT:**

- 2.6.1 Portable firefighting equipment suitable for dealing with fires involving L.P.G. is to be provided and sited within the storage place.  
  
Dry Powder extinguisher would meet this requirement.
- 2.6.2 Water supplies may be required by Directorate General of Civil Defense, considering the risks surrounding areas.
- 2.6.3 Combustible refuse or rubbish should be regularly removed from storage area.
- 2.6.4 Any person employed in L.P.G. cylinder stores should be appropriately trained on fire fighting and on use of fire extinguishers provided. They should ensure proper care of the stores at all times.

According to the attached drawings which indicate the minimum dimensions of areas required for storage L. P. G. cylinders. (In figures from 1 • 8)



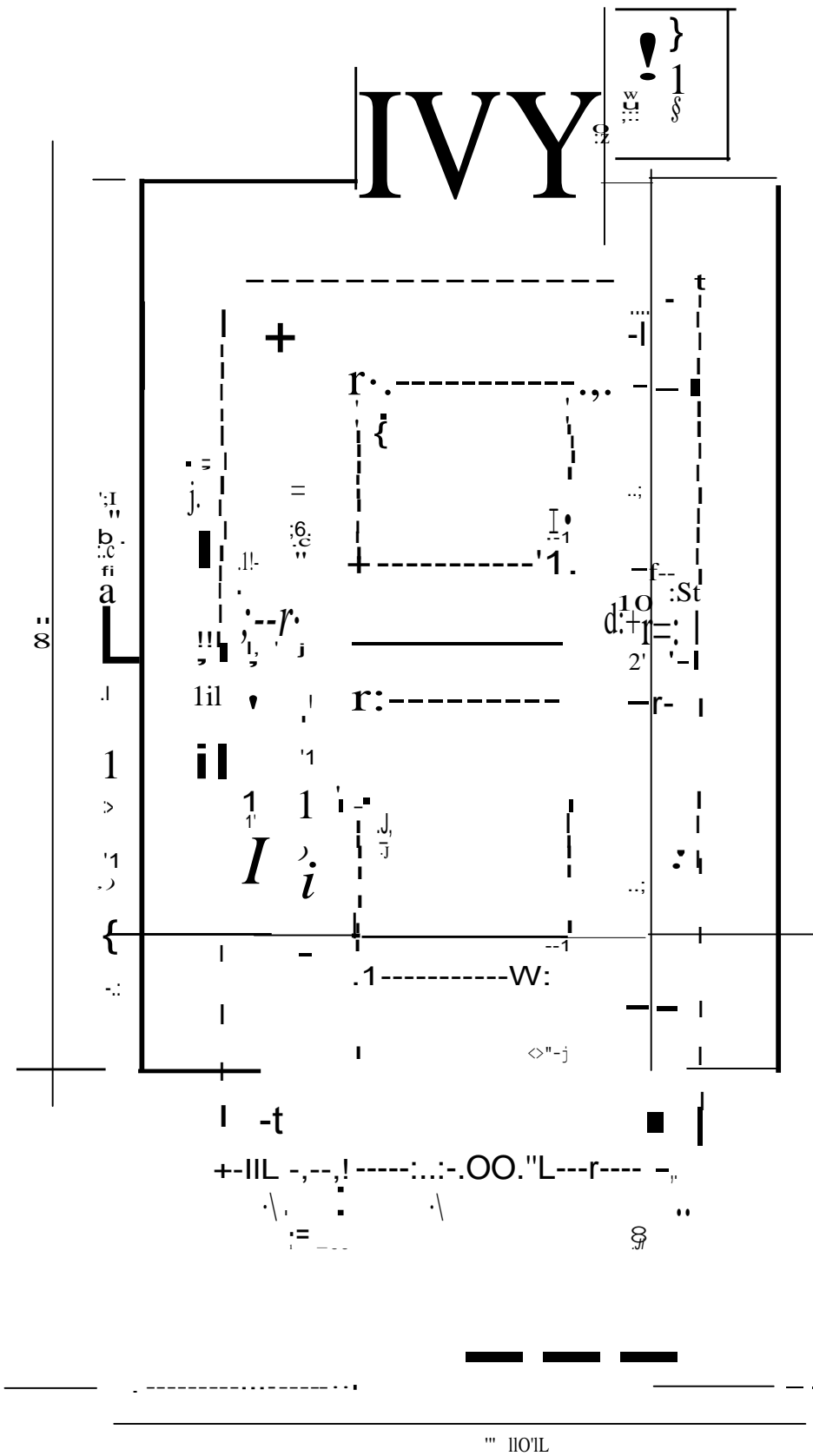
(Figures 1)

MINIMUM DIMENSIONS OF AREA  
FOR STORAGE OF UPTO 50 GAS

الحد الأدنى لأبعاد المساحة المطلوبة لتخزين (٥٠) إسطوانات غاز

مقياس الرسم : ١ : ١٠٠ ١١/١٨ / ١٩٨٩ م

1:100 18.11.89



إسطوانات غاز  
 ١٩٨٩م

OF AREA REQUIRED  
 FOR STORAGE OF UPTO  
 100 GAS CYLINDERS

MINIMUM DIMENSIONS  
 FOR STORAGE OF UPTO  
 100 GAS CYLINDERS

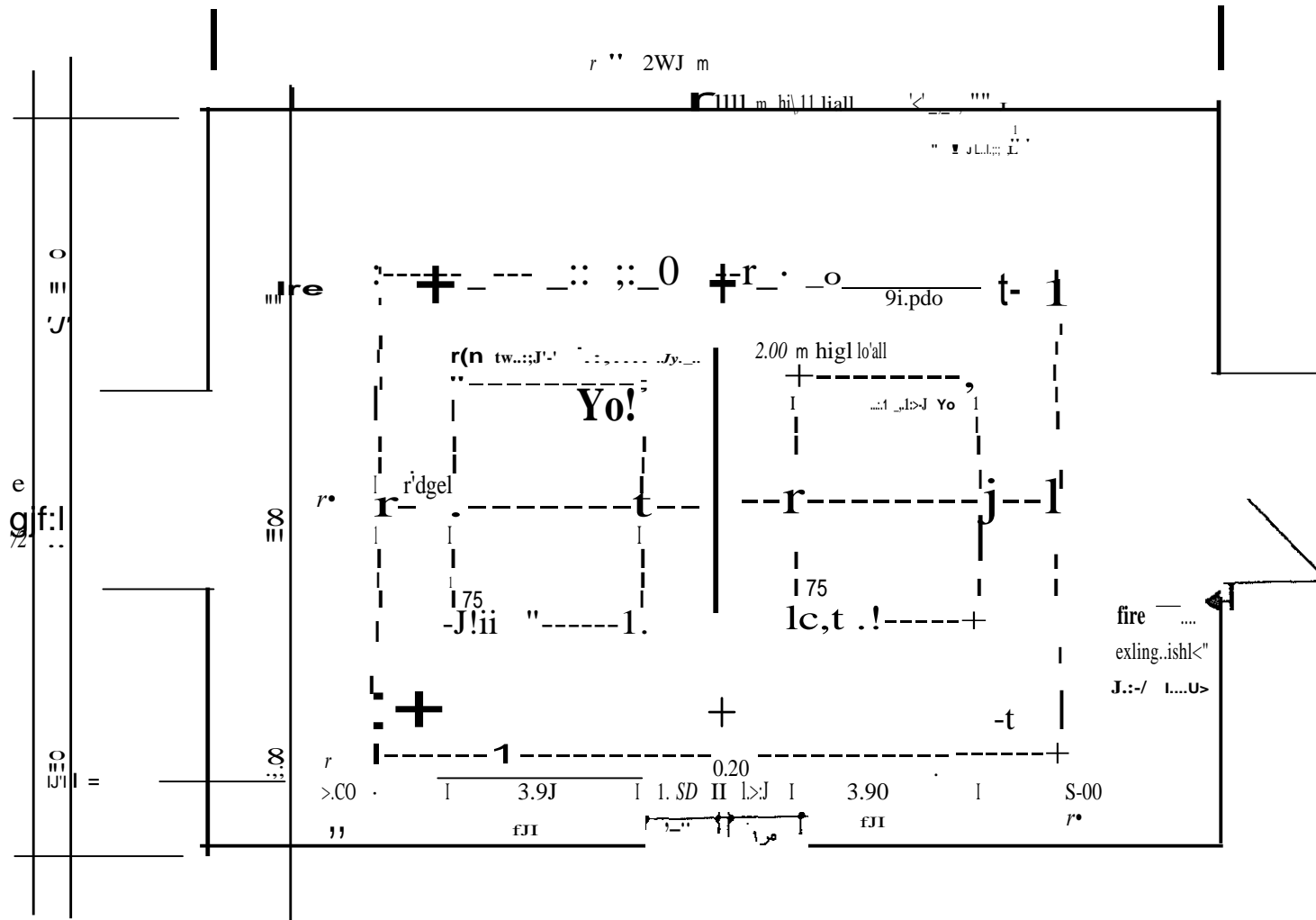
15.11.89 1:100

110'IL

(Figures 2)

liJ

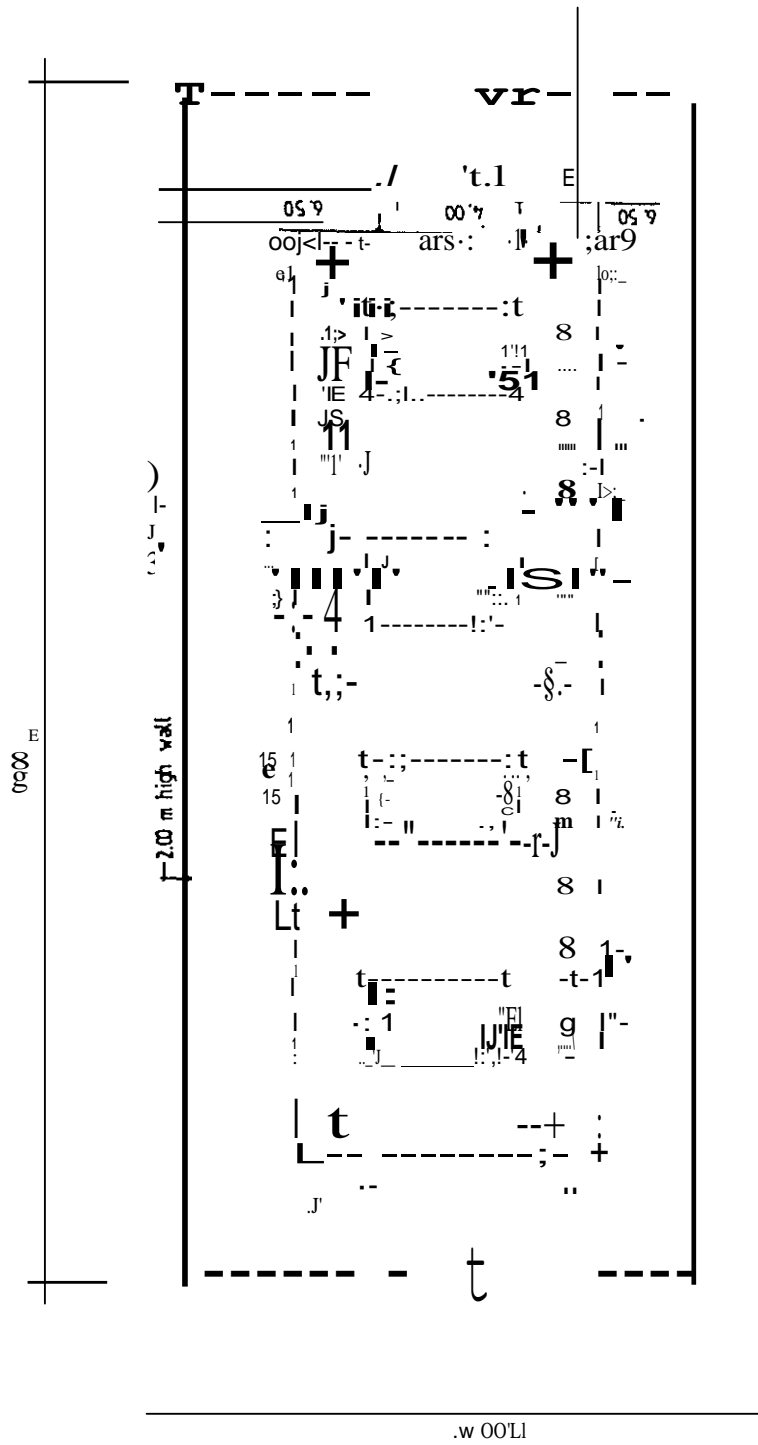
3300



MINIMUM DIMENSIONS OF AREA REQUIRED FOR STORAGE OF UPffi 19J GAS CYLINDERS

1:125 18.11.89

$\rho_{A, L, J, l} (I_o \bullet) \langle f_{r, J} \rangle_{J, hll} t. - UI \rightarrow \{J, j\} : il \dots J-1$   
 $I \setminus A / 1 I / A \quad \setminus Y_o / I : r \rangle l < . f' l, l - o$

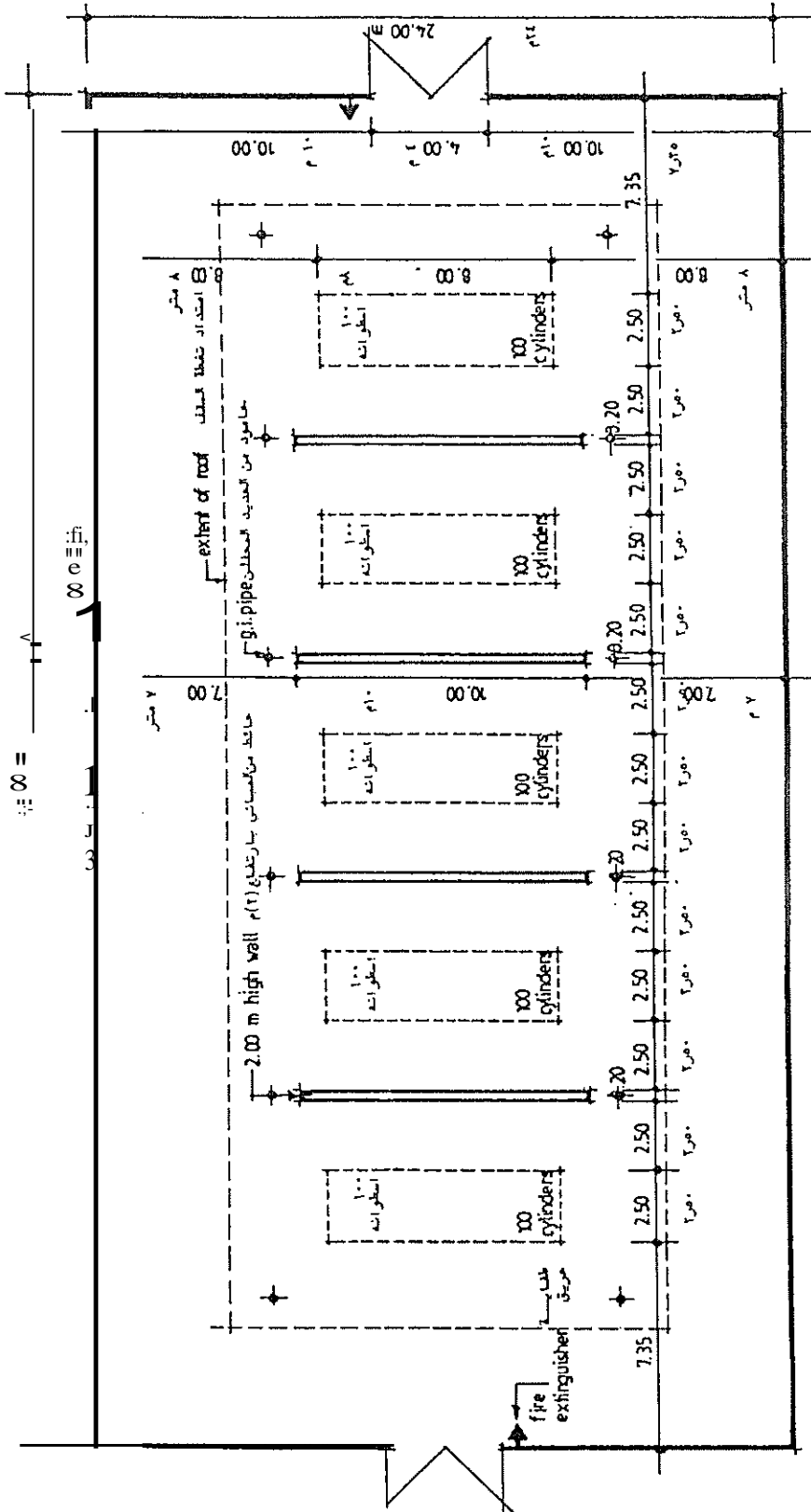


(Figures 4)

**MINIMUM DIMENSIONS OF AREA REQUIRED  
FOR STORAGE OF UPTO 300 GAS CYLINDERS**

1:200 14.11.89

الحد الأدنى للمساحة المطلوبة لتخزين (300) إسطوانة غاز  
مقياس الرسم : ٢٠٠/١ ١٩٨٩/١١/١٤ م



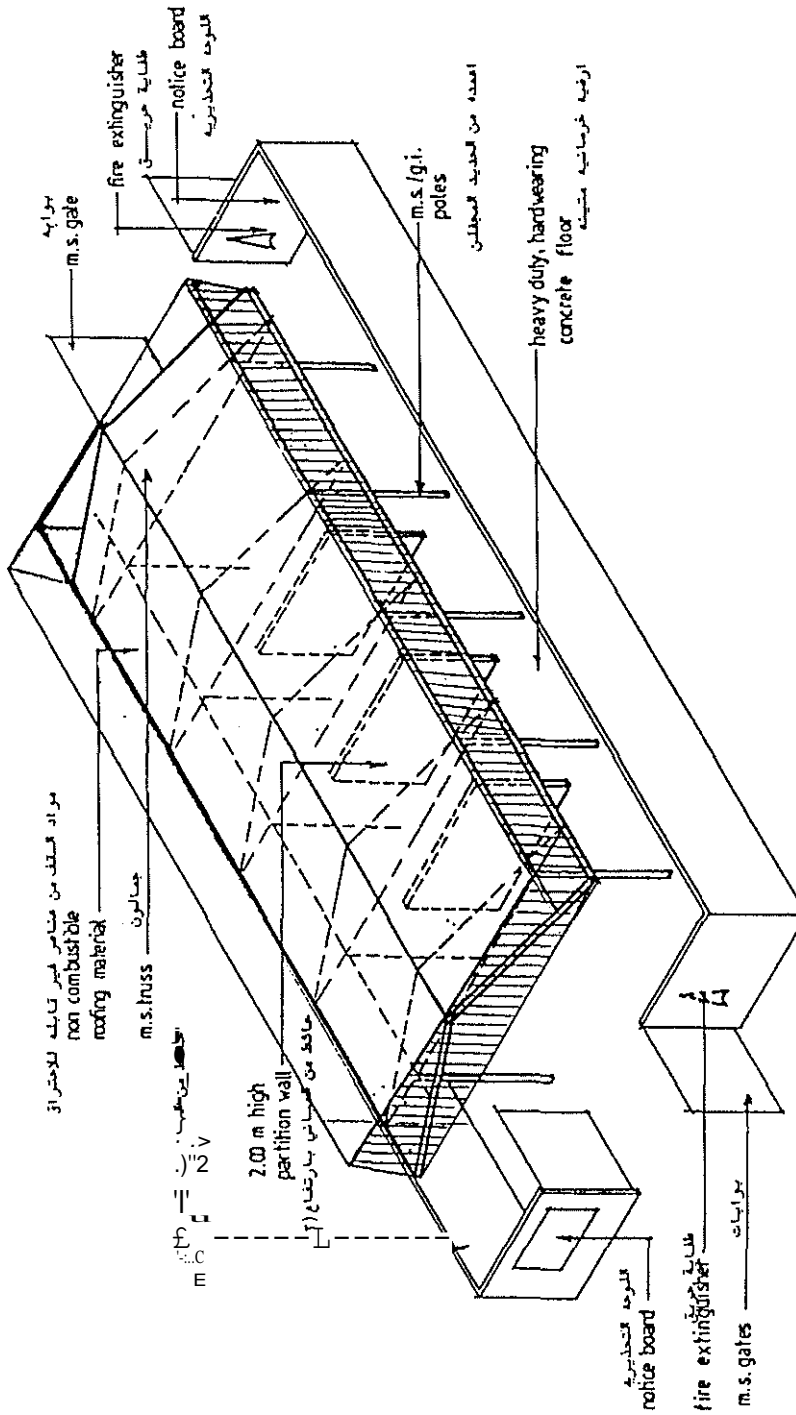
(Figures 5)

المجد الأدنى لإبعاد المساحة المطلوبة لتخزين (٠) إسطوانة غاز  
مقياس الرسم: ٢٠٠/١ / ١٤  
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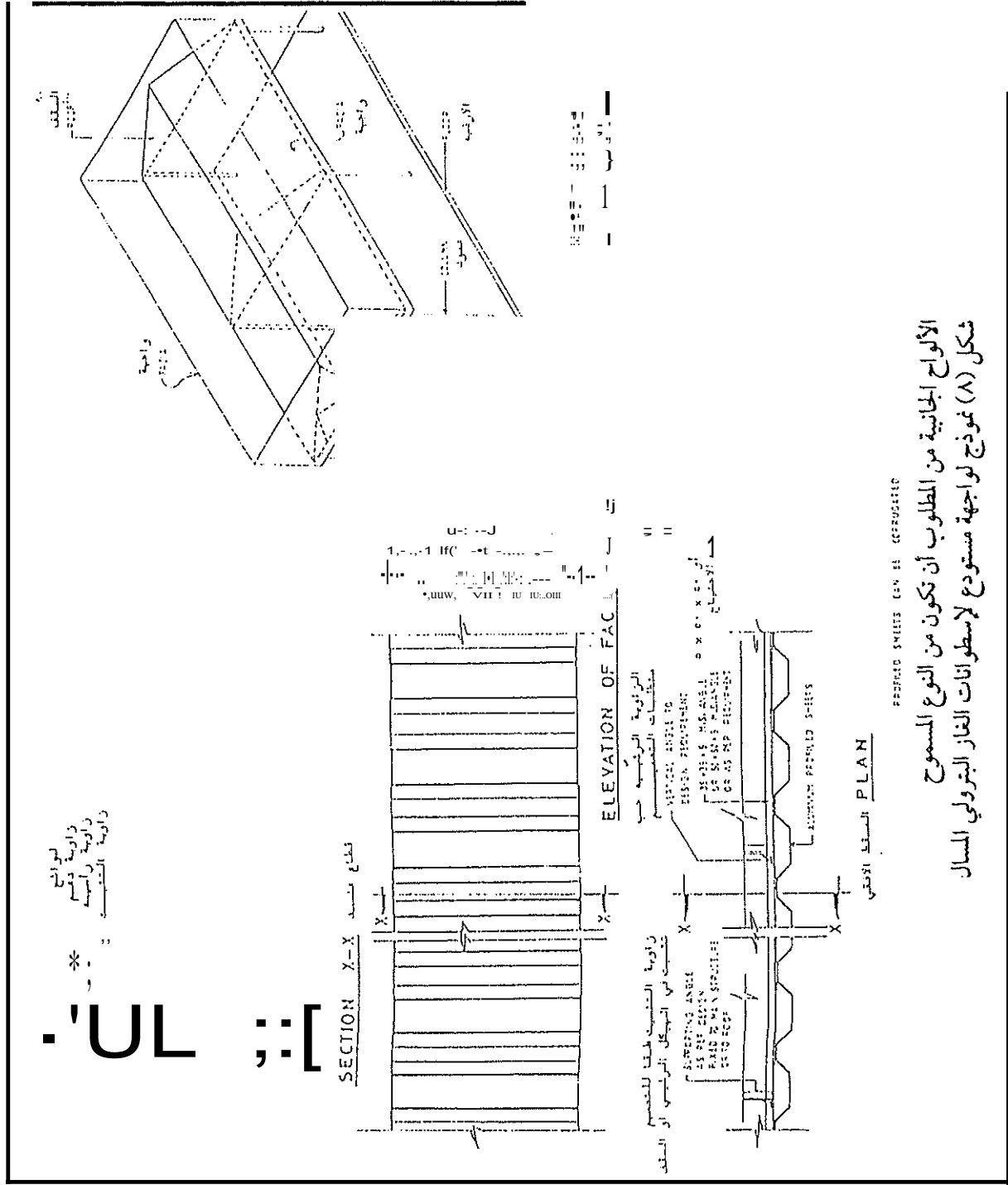




(Figures 7)

رسم مجسم نموذجي لمنطقة تخزين إسطوانات الغاز  
 مقياس الرسم : ١ : ١٢٥  
 ١٩ / ١١ / ٨٩

ISOMETRIC VIEW OF  
 TYPICAL L.P.G. STORAGE AREA  
 1:125 19.11.89



(Figures B)

## SECTION 3

Safety Requirements for  
Transportation of Portable  
L.P.G. Cylinders By Road

## **SECTION 3**

### **Safety Requirements for Transportation of Portable L.P.G. Cylinders by Road**

#### **3.1 SUITABILITY OF VEHICLE:**

3.1.1 The vehicle should be with diesel engine only and suitable for the safe use in transportation of portable cylinders filled with L.P.G.

3.1.2 The companies concerned shall carry out technical checks on their vehicles to ensure that all mechanical and electrical systems are in good condition at all times.

The technical check should include the following:

- a) .Wiring used shall have adequate mechanical strength and current-carrying capacity with over current protection (fuses or automatic circuit breakers), and shall be properly insulated and protected against physical damage, heat and corrosion.
- b) The efficiency of the engine and fuel lines shall be checked before each journey, so also the oil, water coolant and belts. The engine compartment should be clean.
- c) The exhaust, which could give hot gases shall not liable to reach the location of cylinders.
- d) To ensure efficiency and if required adjustment of the brakes.
- e) The air pressure in tyres shall be checked and if necessary adjusted.
- f) Performance of warning signals, lights and mirrors.
- g) The steering system should also be examined during the technical check.

3.2 **VEHICLE'S COMPARTMENTATION:**

The vehicle shall be equipped suitably to carry L.P. Gas cylinders, as follows:

3.2.1 The cargo space used for carrying the cylinders should be covered from above and rear, with open sided to provide ventilation.

3.2.2 The height of the cargo space shall not exceed the roof level of the driver's compartment, and isolated from it, the engine and its exhaust system by a vapor-tight fire resisting separation.

3.2.3 The cargo space, ground-plate, shall be made of Fire Resisting redwood and equipped with means for holding cylinders in upright position. Cylinders shall be securely fastened in position to minimize the possibility of movement, tripping over or physical damage.

The cylinders shall be carried within the cargo space and rest in an upright position, with safety precautions to ensure safety to the cylinders and its appurtenances, as follows:

A- L.P. Gas Cylinders of individual capacity not exceeding 48 kg. Shall be placed in upright position with maximum height for two cylinders.

B- L.P. Gas Cylinders of individual capacity exceeding 48 kg. And not more than 108 kg. Shall be placed in upright position on the floor space with not more than one cylinder in height.

3.2.4 The Cargo Space Capacity is defined by the vehicle owner who should comply with these conditions. The distance between the cylinder head and the roof should not exceed 450 mm, for ventilation and to prevent any loading over cylinders.

3.2.5 The total weight of the cylinders required to be carried (filled cylinders) shall not exceed 90% of vehicle permissible weight determined for safety of vehicle for transportation.

3.2.6 The metal part on which the cylinders are supported shall be covered by an insulated material to prevent friction of cylinders with metal during

Transportation.

3.2.7 The sides of the cargo space should be covered by rigid metal mesh provided with a door ready to be locked.

3.2.8 The vehicle shall be painted in orange color. Write the following phrases in a permanent position "Be ware -cargo vehicle for L.P.G. Cylinders" on the rear, and "The name of the company and its telephone number" on the sides of the driver's cabin, in Arabic and English.

3.2.9 Yellow reflective strips shall be fixed on the back bumper for night warning.

3.2.10 Each vehicle shall be provided with at least two approved portable fire extinguishers having a minimum capacity of 12 kg. Dry chemical powder ABC, which shall be placed ore both sides at the back of the driver's cabin.

3.2.11

The number of L.P.G cylinders needed to be carried on small vehicles used for distribution of cylinders in cities and villages shall be determined according to the size of the cargo space, but not more than 6 cylinders of individual capacity 108 keg or 12 cylinders of individual capacity 48 kegs at any one time. Arrangement shall be made to keep the Cylinders in upright position.

3.2.12

L.P.G cylinders either empty or full should not be allowed to roll on ground at any time.

3.2.13

Each vehicle should be provided with a trolley to be used for carrying the cylinder to the place where it will be used.

3.2.14

The licensed distributors should not sell LPG cylinders to any supermarket or other shops for resale purposes, as these shops do not have the required license for storage of LPG cylinders.

3.2.15

The driver of vehicle carrying LPG cylinders should not leave it out of work vehicle unattended on the main roads. He should drive it to a side road and alert the police to take necessary actions.

3.2.16

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The driver of the vehicle should always possess during transportation the  
*Fire Safety Requirements*

License for carriage of LPG cylinders and the license of vehicle for such carriage.

- 3.2.17 Closed - bodied vehicles such as passenger Cars, Vans and Station Wagons shall not be used for transporting more than two cylinders with 48 kg water capacity for domestic use.
- 3.2.18 In case of vehicles which carry more than 10 cylinders the driver should be accompanied by an assistant.

### 3.3 **GENERAL REQUIREMENTS:**

- 3.3.1 The vehicle shall be under the observation of the driver at all times during transportation.
- 3.3.2 Companies who are concerned with lap. Gas cylinders transportation shall select the best drivers who have experience to drive such cargo vehicles and train them on how to face an emergency situation during transportation.
- 3.3.3 The maximum speed shall not exceed 60 Km/per hour in city areas, and not exceed 90 km/per hour in speedy ways, unless the speed is limited less, than 90 km/hour.
- 3.3.4 Drivers shall stop the engine during loading and unloading.
- 3.3.5 Vehicle drivers and their helpers shall not smoke, or allow smoking around the vehicle on the road.
- 3.3.6 Vehicle shall avoid passing city streets during busy traffic hours, like in the mornings and noon time when employees and student go/return from their businesses/schools respectively.
- 3.3.7 Vehicles shall not be parked in congested areas unless for loading and unloading cases. Such vehicles may be parked off the street in uncongested areas, at least 20 m from any building.
- 3.3.8 Cylinders shall not be dropped and struck against each other. Cylinders shall not be used as rollers, supports or for any other purposes.



- 3.3.9 No cylinder shall protrude from the cargo space limits.
- 3.3.10 No other materials shall be transported with either empty or filled cylinders.
- 3.3.11 Cylinder showing serious denting, bulging, gouging or excessive corrossions shall not be transported. ,,
- 3.3.12 Cylinder should be painted with the approved identification color at all times.
- 3.3.13 All L.P. Gas cylinders and their appurtenances shall comply with the approved standards, accordingly to the Omani specifications (120/1986)
- 3.3.14 Containers and their appurtenances shall be determined to be leak free before being loaded.

## GENERAL SHAPE OF VEHICLE

Shown in the attached figures.

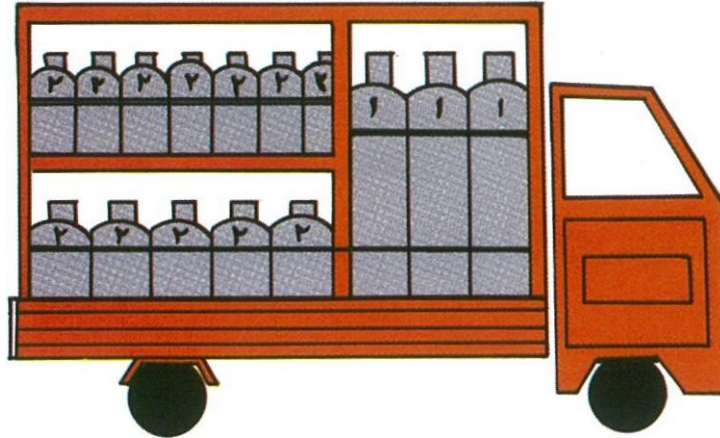
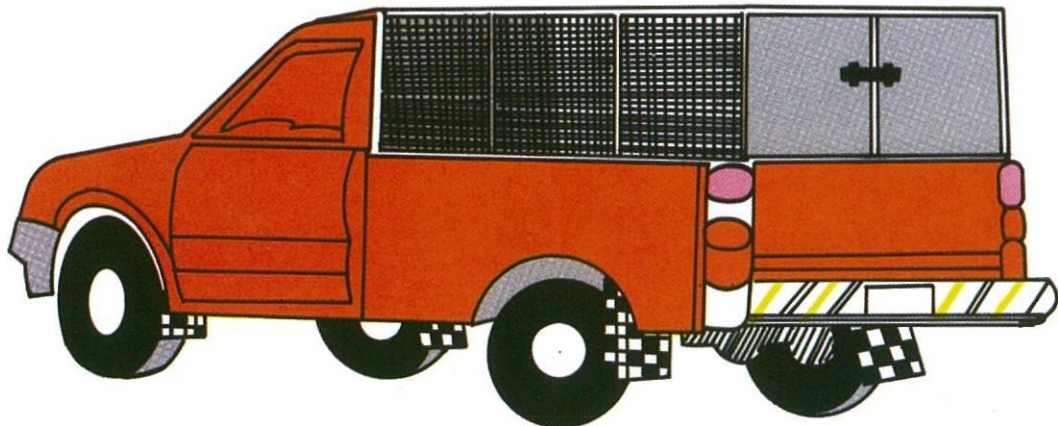


Diagram showing the methods of arranging gas cylinders during transportation in the carriage space of the vehicle (either the 48 keg cylinders or 108 keg cylinders)



A diagram showing the specification of a light vehicle used for the distribution of gas cylinders in cities.



A diagram showing the warning notices which shall be displayed notices which shall be displayed on back side of the vehicle.

## **SECTION 4**

### **Safety Requirements for L.P.G. In fixed storage Tanks at Industrial, Commercial and Domestic Premises**

## SECTION 4

### Safety Requirements for L.P.G. In fixed storage Tanks at Industrial, Commercial and Domestic Premises

#### 4.1 GENERAL:

4.1.1 These requirements cover above ground L.P.G bulk storage tanks which are installed for use at industrial, commercial and domestic premises.

4.1.2 Storage tanks should be designed, fabricated, installed and tested in accordance with approved standards in the Sultanate.

Careful consideration should be given to the materials used for construction, bearing in mind the minimum temperature that the material of the tank will reach in service or in emergency situation.

4.1.3 Only register installers who are approved by General Directorate of Civil Defense and other authorities concern are allowed to carry on the gas work.

4.1.4 Each tank should be provided with all of which should be suitable for use with the LPG at a pressure not less than the design pressure of the tank to which they are fitted and for temperatures appropriate to the characteristic of the LPG and working conditions, these include the following fittings:

- A. pressure relief valve connected directly to the vapor space;
- B. contents gauge or maximum level indicator;
- C. pressure gauge connected to the vapor space;

4.1.5 Each storage tank should be conspicuously and permanently marked to include the following:

- A. the pressure vessel code to which it is made'
- b. the manufactures name and serial number;
- C. the water capacity in liters or cubic meters or gallons;
- D. the maximum safe working pressure;
- E. the year in which the tank was made;

## 4.2 **STORAGE TANK LOCATION AND SAFETY DISTANCES** :

- 4.2.1 The approval of the storage tank location should be obtained from General Directorate of Civil Defense and other concerned Authorities.
- 4.2.2 All tanks should be sited above ground level. Storage tanks and the first-stage pressure regulator should be installed away from buildings and the line of adjoining property, and should be spaced in accordance with table 1 below. The distances refer to the horizontal distance in plan between the nearest point on the storage tank and a specified feature, for example, an adjacent storage tank or building, property line. In certain cases, where radiation walls are provided, the distances may be reduced after consultation and acceptance of General Directorate of civil Defense. Where separation distances are reduced, diversion walls may be necessary to ensure that the path of gas leaking from storage site to a building boundary or source of ignition is not less than that shown in Table 1.
- 4.2.3 The number of storage tanks in one group should not exceed six subject to the maximum total capacity of a group given in Table 1. Any tank in one group should be at least 7.5 m from any tank in another group unless a Radiation wall is erected between the groups.
- 4.2.4 In the case of multiples- tanks should be of similar dimensions and installed to a common level.
- 4.2.5 No LPG storage tanks should be installed nearer than 6 m any tank containing a flammable liquid with a flash - point below 65 C. The minimum distance of separation between an LPG storage tank and the top of the bund of any tank containing a flammable liquid should be 3 m. (In case of storage at refineries and bulk plants for distribution the distances from LPG Tanks and the top of the bund surrounding tanks containing flammable liquids with a flash point below 65 C, should be not less than 15m).
- 4.2.6 LPG storage tanks should be installed well away from tanks containing liquid oxygen or other hazardous substances with a distance determined by General Directorate of Civil Defense.

4.2.7 No LPG storage tank should be located within the bonded enclosure of a tank containing flammable liquid, liquid oxygen or any other hazardous substance.

**(Table 1)**  
**Location and spacing for tanks for industrial, commercial and domestic bulk storage**

Maximum water capacity of any single tank in a group (liters)	Maximum total water capacity of all tanks in a group (liters)	Minimum Separation-n Distance in metres	
		From building boundary, property line or fixed source of ignition	Between tanks
Over 450 to 2250	6750	3	1M
Over 2250 to 9000	27000	7.5	1M
Over 9000 to 135000	450000	15.0	1.5 M
Over 135000 to 337500	1012500	22.5	1.5 M or 1/4 sum of diameter of the two adjacent tanks whichever is the greater
Over 337500	2250000	30	

Above-ground storage tanks should not be installed one above the other.

**4.3 TANK SUPPORTS:**

4.3.1 Tanks should be supported on concrete, masonry or structural steel.

Supports, these supports should be so constructed or protected as to have a standard of fire resistance of at least two hours.

4.3.2 Supports should permit movement of the tank due to changes in temperature

4.3.3 Where piers are used as part of the tank support for horizontal tanks of water capacity exceeding 5000 liter, provision should be made for securing the tank at one end, the other being free to move as required. The end so secured should be that to which the principal liquid and vapor pipelines are attached. Where saddles are not welded to the tank,

Their support should be shaped to conform to the tank shell. *Fire Safety Requirements*



- 4.3.4 Supports for horizontal tanks, normally two, should be located to give minimum moments and deflections to the tank shell. Additional support may be required to meet special circumstances.
- 4.3.5 Tank supports should be designed to prevent or to dry any accumulation of water.
- 4.3.6 The tank should be securely anchored or weighted, or adequate pier height provided, to avoid flotation due to flood water.

#### **4.4 TANK PROTECTION:**

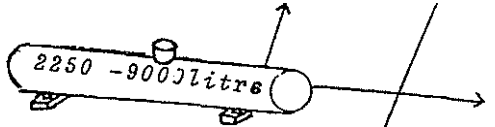
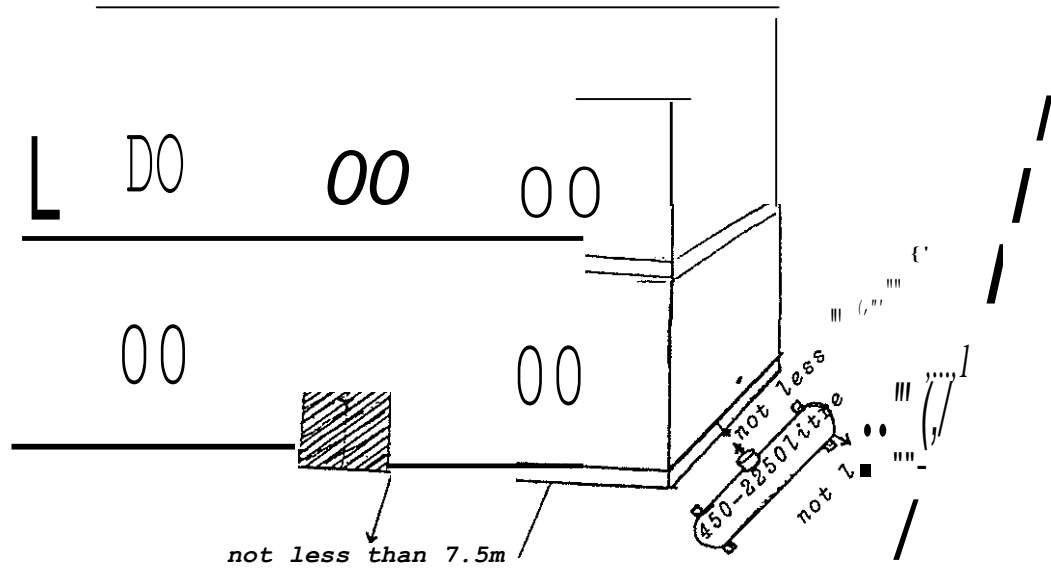
- 4.4.1 Bunds must not be built round any above-ground LPG storage installation.
- 4.4.2 Pits or depressions under or in the immediate vicinity of aboveground LPG Storage tanks and its connections should be avoided.
- 4.4.3 To prevent trespassing or tampering, the area that includes tanks, pumping equipment, loading and unloading facilities should be enclosed by an industrial type fence at least 2.25m high unless it is otherwise adequately protected; for example, if the area is within a greater fenced plant area or is otherwise isolated from the public. Any fence should have at least two means of exit. Gates should open outwards and should not be self-locking.
- 4.4.4 When damage to above-ground tanks from vehicular traffic is a possibility, precautions against such damage should be taken. If a wall is used for this purpose it should be about 38 me in height and should be non-continuous.
- 4.4.5 Storage tanks and their supports should be adequately protected against corrosion, by painting or other means. The finish paint should be silver color to minimize temperature rise of the content.

#### **4.5 FIRE PROTECTION ARRANGEMENTS :**

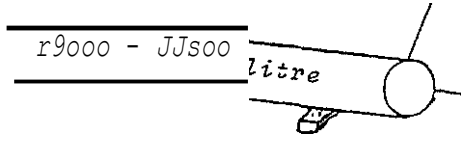
- 4.5.1 The General Directorate of Civil Defense should be consulted with regard to fire-fighting equipment, water supplies, and means of access for fire-



brigade



not less than 15 m



A diagram showing the separation distances between the over ground L.P.G tanks and buildings or property (For illustrative purpose only ) text shall govern.

appliances, protection of fire-fighting personnel and arrangements generally to ensure an early call to the fire brigade in the event of an outbreak of fire.

- 4.5.2 Provision should be made for an adequate supply of water for fire protection connected with suitable pressurized piping system on which pillar fire hydrants can be installed. Hydrants should be readily accessible at all times and so spaced as to provide for the protection of all tanks. Sufficient lengths of fire hose should be provided and be readily available. The outlet of each hose line with a combination jet and spray nozzle.
  - 4.5.3 Mobile equipment, fixed monitors or fixed spray systems should be designed to discharge water at a rate sufficient to maintain an adequate film of water over the surface of the vessel and supports under fire conditions. The recommended drenching density is 7 liters/m<sup>2</sup> minute.
  - 4.5.4 Where large deliveries are made frequently, consideration should be given to the provision of mobile or fixed waterspray systems giving suitable and effective protection for road tanker loading and unloading areas.
  - 4.5.5 A sufficient number of first-aid fire extinguishers of adequate size, suitable for LPG fires, preferably of the dry powder type, should be available at strategic locations. Fire extinguishers should comply with approved standards.
  - 4.5.6 Shut-off valves, which may be automatic or remotely controlled, should be provided at the vessel so that if accidental leakage occurs the supply of LPG can be stopped. Other shut-off valves may be provided at strategic points.
  - 4.5.7 Weeds, long grass and any combustible material should be removed from an area with 6 m of any LPG vessel. If weed killers are used, chemicals such as sodium chlorate which are a potential source of fire danger should not be selected for this purpose.
  - 4.5.8 Electrical apparatus and installations, when used should comply with the approved standards for the use of such installation in dangerous atmosphere where an explosive gas air mixture is continuously present, or present for long periods.
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4.5.9 No Smoking or Naked Light notices in Arabic and English with red letters be firmly fixed to the outer side of the tanks surrounding wall or fence. In cases where no wall or fence is provided, the notices shall be on posts near the storage tank, or on the tank itself. Notices should be visible from points of access to the tank site.

#### 4.6 **INSPECTION AND TEST FOR BULK LPG STORAGE VESSELS AND FITTINGS :-**

All procedure detailed in these schedules must be carried out by, or under the supervision of a person specifically trained and nominated to carry the responsibility.

##### 4.6.1 **Annual Inspections**

- a Ensure that (No Smoking) signs are fixed in a prominent position and are in good condition and the emergency cards are prominently displayed.
- b Check that the storage area and immediate surrounds have no flammable material within 6 m of any vessel. The storage area and immediate surrounds must be maintained free of weeds and any type of vegetation. (Weed killers formulated with sodium chlorate must not be used).
- c Where applicable check condition of fencing surrounding the storage vessels and/or protection kerbs.
- d Note any change in situation from original approved sitting plan.
- e Check external condition of tank, i.e. paint work, transers etc.
- f Check earthing arrangements of tank and pump dispensing systems.
- g Check condition of concrete pad or piers. Check for excessive or differential settlement.

h All joints to be leak-tested with soap and water.

j. Check visually that the pressure and contents gauges are in satisfactory working condition, that all parts of the safety relief valve are free from rust, and that drain holes are clear.

#### 4.6.2 **Five-Year Inspection** :

##### **External Examination** :

a External examinations are commonly undertaken by approved competent personnel, who will decide whether or not the visual examination should be augmented by ultrasonic or other testing aids.

b Replace pressure-relief valves with new or works reconditioned valves.

c Check pressure gauge against test gauge and replace if necessary.

#### 4.6.3 **Ten-Year Inspection** :

The tanks will have a full internal and external examination, which will usually be undertaken by an appropriate authority. Preparation for inspection will be undertaken by approved competent personnel according to the procedure described in the safety code of Liquefied Petroleum Gas, the Institute of Petroleum, U.K.

### **4.7 TRAINING AND EMERGENCY PROCEDURES/PLANS**

4.7.1 All involved with the handling of LPG should understand the characteristics of the product.

Personnel shall be formally instructed respect to the processes and facilities with which they are involved before they have an active role in the operation of the plant. This instruction shall include details of operating procedures and location, function and limitation of instrumenta-

tion and equipment both for normal operation and emergency situations.

- 4.7.2 Plant personnel should be instructed in the fundamentals of fire fighting and fire control with particular reference to refrigerated LPG and the correct handling of the equipment provided for this purpose.
- 4.7.3 Procedures and plans should be developed to handle emergencies arising from leakage, fire or any other circumstance which could give rise to such emergencies. Such plans should include all necessary liaison with the local authorities, neighbouring industry or the general public.
- 4.7.4 Plant personnel should receive regular instruction in their roles in the emergency plan as well as in the practical handling of emergency situations.
- 4.7.5 To ensure the adequacy of the exercises based on simulated incidents should be carried out periodically with the participation of the public emergency services which are available in the area.

#### **4.8 SAFETY PROCEDURES DURING LPG TRANSFERS**

- 4.8.1 Before LPG transferred from a tank to any other tank, whether it is a storage tank or road tanker, the following procedure should be followed :
- a The receiving tank should be checked to ensure that it is in safe working condition and that it is not to be filled with a grade of LPG for which it is not designed.
  - b The receiving tank should be checked to establish the quantity that it can safely receive.
  - c The inter-connection system (i.e. pipe work, fittings, valves, hoses etc) should be checked to ensure that it is in safe working condition.
- 4.8.2 In the case of road tankers, the following procedures should also be followed :
- a The vehicle during the transfer operation the parking brake of a road tanker should be on, and where necessary wheel chock blocks should be used.

- b Any driving unit or electrical equipment not required and not specifically designed for the transfer operation should be stopped and isolated.
- c Any accumulated static electricity on a road tanker should be discharged to earth before any LPG transfer operation is carried out.
- d Before the vehicle is moved the liquid and vapour connections should be disconnected; the electrical bonding connections should then be broken
- e A responsible person should remain in attendance during all transfer operations to ensure that transfer operations are stopped and all valves closed if any of the following occur :
  - 1 - Uncontrolled leakage ;
  - 2 -A fire or a source of ignition in the vicinity;

#### 4.9 **ACTION IN EMERGENCIES** :

4.9.1 In any case of emergency the following procedures should be carried :

- a Summon help and Civil Defence services immediately.
- b Wherever possible, turn off all valves to cut off or reduce the source of gas escape.
- c Evacuate all persons, except those necessary to deal with the emergency, from the danger area, especially from any area which is in the path of the gas cloud.
- d Always approach any fire or gas leak from upwind.
- e Gas fires should normally be controlled but not extinguished until the source can be cut off.

4.9.2 In case of gas leakage without fire, the following procedure should be carried :

- a Every attempt is to be made to isolate or close the leak by



non flammable means :

The cold working of ferrous or aluminium metals is not to be attempted.

- b All persons should be evacuated from within the danger zone, and entry prohibited, except those necessary to deal with the emergency
- c Ignition hazards must be removed by shutting down boilers, extinguishing fires and naked lights, switching off (remote from source of leakage) electrical equipment, and stopping vehicle engines. Vehicles should be abandoned and not driven away. Telephone in the danger zone should not be used.
- d A safe area of at least 30 m should be established around a serious gas leakage, and many times this distance in the event of uncontrolled discharge of large volumes of gas.
- e Where equipment is available and suitable, dispersal of gas may be assisted by water spray, continuing until all liquid gas has been evaporated and vapour adequately reduced below the lower explosive limits.
- f Where vapours are contained in a building, ignition may be avoided by purging with an inert gas or water spray. Alternatively, the contained volumes must be thoroughly vented for several hours or longer, depending on size and construction. Wherever gas release has affected buildings, particularly with underground rooms, a gas detector should be used before the atmosphere is declared safe.

**4.1 0 In case of leakage with fire, the following procedures should be carried:**

- a The first concern should be to examine the possibility of cutting off the source of leakage, and secondly keeping other exposed equipment as cool as possible by water streams or fog curtains.

- b Even where the possibility of fire extinction exists, no attempt should be made to extinguish the flame unless :
- 1 - It is known that the gas supply can then be immediately cut off and such action will be taken.
  - 2 - The existing fire may progress rapidly into an uncontrollable conflagration. In such a case, the ultimate conflagration should be assessed as a larger risk than the possible explosion of unburnt gases.
- c Large tanks - transportable or static - are fitted with relief valves. Providing these containers are not upset so that relief valves are submerged in liquid, excess pressures will be vented. If burning without secondary hazard, vapours may be permitted to burn until the contents are exhausted. The rate of burning can be controlled, often the point of extinction, by water jets playing on exposed tank surfaces.
- d Should tank pressures rise to dangerous levels, the imminent bursting of containers may be judged by the noise and velocity of escaping gases. In such cases fire - fighting personnel should be evacuated immediately.
- e Where tanks are upset so that relief valves are submerged in liquid or damaged, bursting may occur without warning, especially where the tank is directly exposed to flame and intense heat.
- f In all cases of exposure, copious supplies of water in the form of spray or fog will minimize danger of rupture, and will also regulate the rate of gas generation, so reducing the intensity of fire.

**SECTION 5**

**Safety Requirements for Domestic  
LPG Installations**

## SECTION 5

### Safety Requirements for Domestic LPG Installations

#### 5.1 SCOPE OF WORK:

These requirements cover supply and installation of domestic gas equipment, regulators pipe, valves and all associated fittings, and also Gas burning appliances will be quoted within the approved standards in the Sultanate.

Gas cylinders of 48 or 108 liters conforming Romanian standard No 120 Shall be used.

#### 5.2 PIPE LINES:

All line pipes shall conform to the approved standards in the Sultanate and to all referenced standards quoted therein.

#### 5.3 FITTINGS AND FLANGES:

All Pipe fittings shall conform to the approved standards in the Sultanate. Pipe holding tools shall be from forged or cast steel, and welding neck.

#### 5.4 JOINTS:

All welded joints shall be But or Socket weld conforming to the approved standards in the Sultanate.

Joints shall not be allowed where gas pipes cross the route of other services.

#### 5.5 PIPE ROUTING:

Pipes should be laid in service ducts, and protected from water by painting also fixing to side wall of duct above duct invert level, maximum separate- tin required between gas and other services lines to be color according to the approved standards.

5.6 BURIED PIPELINE:

Where pipelines are buried under floors or otherwise built in, (if unavoidable) they shall be suitably protected against corrosion. Where pipes are buried or built in, joints shall not be permitted except by permission of the Engineer in circumstances where a joint is unavoidable.

5.7 VALVES:

All valves shall be Teflon seated rotary ball valves of the following type or similar approved.

- 1) Smith411T
- 2) Worcester series 44 carbon steel PIPE seats.
- 3) Truffle sandwich ball valves.
- 4) Truffle bar sockets ball valves.
- 5) Apollo Ball Valve Carbon Steel series 73- 100/83-500.
- 6) Alco Steel Ball Valve Class - 800.

5.8 PAINTING:

All pipes and fittings, excluding regulators, should be prepared and coated with two coats Red Oxide and final coating color according to the approved standards in the Sultanate.

5.9 FINAL CONNECTION TO APPLIANCES:

Flexible connectors used for final connection to gas appliances shall be fabricated of materials resistant to the action of LPG, conforming approved standards, if wire braid is used it shall be of corrosion resistant material such as stainless steel.

Branch lines serving cooking units or appliance shall include a rotary ball isolating valve to facilitate maintenance of individual appliance. Also a rotary ball valve shall be installed on the main line near cooking appliances island before leading to the individual appliances.

#### 5.10 CONNECTIONS TO GAS CYLINDERS:

Gas cylinders shall be connected to manifolds using stainless steel braid-end pigtailed having a minimum length of 500 mm, "1/4" NB diameter, threaded connections to conform to the approved standards.

#### 5.11 EMERGENCY FIRE SHUT OFF VALVE:

An emergency shut off fire valve if required / advised by the consultants shall be installed in the main gas supply line immediately after the manually operated rotary ball valve up-stream of main high pressure regulator in the bottle storage cabin. This valve shall be activated from the kitchen main exit door. The type of system chosen can be either cable operated or by electric actuators, should actuators be used, motors must be explosion proof.

#### 5.12 REGULATORS:

High or low pressure regulators shall be Color/Rego! Vanaz equivalent make.

Regulators are required at the discharge from the manifold to the main supply pipe and may be fitted in parallel where required. These regulators shall be capable of reducing the gas pressure from bottle pressure to approximately 3.5 bar in the main supply line with all appliances in operation at maximum demand.

Regulators shall be fitted after the isolating valve to each high pressure and low pressure system. Regulators shall be adjustable and capable of reducing the gas pressure from approximately 34.5 bars to the required appliance operating pressure at the required appliance flow rate of maximum demand.

#### 5.13 SYSTEM PRESSURE TESTS:

Prior to connecting gas bottles cooking equipment and regulators, the piping system shall be pressure tested, this shall be set at 1.5 times maximum delivered Butane bottle pressure. Testing medium shall be dry

Nitrogen. All welded joints shall be soap tested, those found to be defective shall be cut out and new section of line prepared, aligned and welded, no regrinding or back gouging to the existing defective joints and re-welding will be permitted. The test duration shall be 4 hours at maximum test pressure with no drop in pressure acceptable.

5.14 COMMISSIONING:

All regulators shall be adjusted to the manufactures recommended initial setting detailed on the pressure/flow performance graphs. The complete system shall be tested ensuring all items of equipment are operating at maximum capacity, system test time shall be for minimum of two hours, during this time visual inspection of the complete installation covering all aspects will be made, and defects shall be noted and corrected on completion of test period. Should a defective item of equipment warrant the immediate shut down of the system, this will be? Carried out, system corrected and test re-scheduled.

5.15 FIRE FIGHTING:

Firefighting equipment shall be as per recommendation Royal Oman Police, Directorate General of Civil **Defense**.

The main reference of these requirements is:	
At	The Institute of Petroleum code Part (9) vole (1), Bulk storage of LPG, UK
B	Health and safety Executive U.K., Chemical Safety (5). The Storage of LPG at fixed installations.
C	The National Fire Protection Association, U.S.A. Fire codes No. 58 Storage and Handling of LPG.