

CHAPTER III STORAGE

21. General -

- (1) All vessels meant for storage of compressed gas shall be installed entirely aboveground, that is to say, no part of the vessel shall be buried below the ground level.
- (2) Vessels and first stage regulating equipment shall be located in the open.
- (3) Vessels shall not be installed one above the other.
- (4) Vessels within a group shall be so located that their longitudinal axes are parallel to each other.
- (5) No vessel shall be located within the bonded area of petroleum or other flammable liquid storages.
- (6) Sufficient space shall be provided between two vessels to permit fire-fighting operations.
- (7) Two or more vessels installed in batteries shall be so installed that the top surface of the vessels are on the same plane.
- (8) Vessels with their dished ends facing each other shall have screen walls in between them.
- (9) Notwithstanding anything contained in sub-rules(1) to (8) above, vessels for storage of liquified petroleum gas can be placed underground or covered by earth in such manner and subject to such conditions as may be specified by a notifications by the Central Government.

Notification no.so.705(e). In exercise of powers conferred by subrule 9 of rule 21 of SMPV (U)R 1981 the Central Government here by specified the manner and conditions for the vessel for storage of liquefied petroleum gas , placed underground or covered by earth(mound) namely;

- (1) The underground vessels shall be placed within concrete or brick masonry pit with a gap of 1.0 metre between the walls of the pit and the vessel as well as in between the vessels.
 - (2) The underground vessels shall be installed on a firm foundation and firmly secured to the foundation so as to prevent movement of floatation.
 - (3) The udnerground vessels or above ground vessels covered by earth (Mound) shall be a designed to withstand external pressure due to load of the earth cover.
 - b) provided with external anti-corrosive coating or cathodic protection to prevent corrosion ;
 - c) covered by earth, sand or any other non-corrosive material free from abrasive particles likley to damage the anti-corrosive coating of the vessel-the thickness of the covering material above the top surface of the vessel shall not be less than 0.5 metre;
 - d) having the discharge level of the safety relief valves at least 2 meters above the top surface of the vessel, but in any case not less than 3 meters from the ground level;
 - c) fitted with the necessary pipings, fittings, valves and other mounting on top of vessel in such a manner that they can be operated and maintained without disturbing the earth cover. In case of above ground vessel with earth cover (mound), liquid outlet pipe at the bottom may be allowed provided the control valve and emergency valve of this line is just outside the earth cover for the purpose of operation and maintenance from outside.
 - 4) The above ground vessels to be covered by earth (mound) shall be installed on concrete foundation or compacted sand.
 - 5) Unless inherently resistant to erosion, the earth cover (mound) of above ground vessel shall be provided with mechanisms to prevent erosion of covering soil (mound)
- (10) Aboveground vessel for storage of corrosive, flammable or toxic gas in liquefied state shall be provided with enclosure wall all around the ground. The minimum distance between vessel and enclosure wall shall be the diameter of the vessel or five meters, whichever is less. The ground shall be graded to form a slope away from pumps, compressors or other equipments. The height of the enclosure wall shall be thirty centimeters on the upper side and gradually increasing to maximum sixty centimeters on the lower side, at the end of which a shallow sump for collection of the spilled liquid, if any, shall be provided. The minimum separation distance between the vessel and the sump shall be , -
- (a) diameter of the vessel, in case of vessels with water capacity not exceeding forty thousand litres,

(b) fifteen metres, if the water capacity of the vessels exceeds forty thousand litres .”

22. Locations of Pressure Vessels.—

(1) Each vessel shall be located with respect to the nearest building or group of buildings or line of adjoining property which may be built on and with respect to other vessels and facilities in accordance with the distances specified in the Tables below:-

TABLE 1

Minimum safety distances for corrosive , toxic or permanent flammable gases

Sl. Nos	Water capacity of vessel(in litres)	Minimum distance from building or group of buildings or line of adjoining property	Minimum distance between pressure vessels
(1)	(2)	(3)	(4)
(i)	Not above 2000	5 metres	1 metre
(ii)	Above 2000 but not above 10,000	10 metres	1 metre
(iii)	Above 10,000 but not above 20,000	15 metres	1.5 metres
(iv)	Above 20,000 but not above 40,000	20 metres	2 metres
(v)	Above 40,000	30 metres	2 metres

TABLE 2

Minimum safety distances for non-corrosive, non-flammable or non-toxic gases

Sl. Nos	Water capacity of vessel(in litres)	Minimum distance from building or group of buildings or line of adjoining property	Minimum distance between pressure vessels
(1)	(2)	(3)	(4)
(i)	Not above 2000	3 metres	1 metre
(ii)	Above 2000 but not above 10,000	5 metres	1 metre
(iii)	Above 10,000 but not above 20,000	7.5 metres	1.5 metres
(iv)	Above 20,000 but not above 40,000	10 metres	2 metres
(v)	Above 40,000	15 metres	2 metres

TABLE - 3**Minimum safety distances for liquefied flammable gases**

Sl. No	Water capacity of vessel (in litres)	Minimum distance from building or group of buildings or line of adjoining property		Minimum distance between vessels	
		Above ground level	Underground or aboveground vessels covered with earth(mound)	Above ground level	Underground or aboveground vessels covered with earth(mound)
(1)	(2)	(3)	(4)	(5)	(6)

(i)	Not above 2000	5 metres	3 metres	1 metre	1 metre
(ii)	Above 2000 but not above 75,00	10 metres	3 metres	1 metre	1 metre
(iii)	Above 75,00 but not above 10,000	10 metres	5 metres	1.5 metres	1 metre
(iv)	Above 10,000 but not above 20,000	15 metres	7.5 metres	2 metres	1 metre
(v)	Above 20,000 but not above 40,000	20 metres	10 metres	2 metres	1 metre
(vi)	Above 40,000 but not above 3,50,000	30 metres	15 metres	2 metres or $\frac{1}{4}$ th of the sum of the sum of diameter of adjacent vessel or $\frac{1}{2}$ the diameter of the two adjacent vessels, whichever is greater	1 metre
(vii)	Above 3,50,000 but not above 4,50,000	40 metres	15 metres		1 metre
(viii)	Above 4,50,000 but not above 7,50,000	60 metres	15 metres		1 metre
(ix)	Above 7,50,000 but not above 38,00,000	90 metres	15 metres		1 metre
(x)	Above 38,00,000	120 metres	15 metres		1 metre

TABLE – 4

Minimum Safety distances (in meters) between facilities associated with storage of liquefied flammable gas in petroleum refinery, gas processing plants, storage terminals and bottling plants.

(A) FOR TOTAL STORAGE ABOVE 100 TONNES

From/To	Storage Vessel	Property line/ buildings not associated with storage and operation	Sheds for filling storage, evacuation of cylinders	Tank Truck loading/ unloading gantry	Tank Wagon gantry	Pump/ compresor Shed	Fire Water Pump room
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Storage vessel	Table -3	Table - 3	30	30	50	15	60
Property line/ buildings not associated with storage and operation	Table -3	-----	30	30	50	30	--
Sheds for filling storage, evacuation of cylinders	30	30	15	30	50	15	60
Tank Truck loading/ unloading gantry	30	30	30	30	50	30	60
Tank Wagon gantry	50	50	50	50	50	30	60
Pump/compressor Shed	15	30	15	30	30	---	60
Fire Water Pump room	60	---	60	60	60	60	---

(B) FOR TOTAL STORAGE NOT ABOVE 100 TONNES

From/To	Storage Vessel	Property line/ buildings not associated with storage and operation	Sheds for filling storage, evacuation of cylinders	Tank truck unloading/ loading gantry	Fire Water Pump room
Storage Vessel	Table-3	Table 3	Table - 3	15	30
Property line/buildings not associated with storage & operation	Table-3	-----	15	15	--
Sheds for filling storage, evacuation of cylinders	Table - 3	15	15	15	30
Tank truck unloading/loading gantry	15	15	15	15	30
Fire Water Pump room	30	--	30	30	--

TABLE - 5

Minimum Safety distances (in metres) between facilities associated with storage and dispensing of liquefied petroleum gas in liquefied Petroleum gas dispensing station as automotive fuel to motor vehicles.

To/ From	Liquefied Petroleum LPG Storage Vessels	Fill point of LPG Storage vessel and Centre of LPG Tank-Truck unloading hard stand	LPG Dispenser	Property line	Petroleum Class A or B service Station licensed in Form XII of Petroleum Rules 1976		
					Fill point of petroleum class A/B tanks	Vent pipe of petroleum class A/B tanks	Petroleum Class A/B dispensing pump
Petroleum Class A/B dispensing pump	Table-3	9 (aboveground/ mounded vessels exceeding 7500 litres capacity) 6 (aboveground/ mounded vessels not exceeding 7500 litres capacity) 3 (underground vessel)	9 (aboveground vessels not exceeding 20,000 litres capacity or underground/ mounded vessels) 15(aboveground vessels exceeding 20,000 litres capacity) 6	Table-3	9	9	9
Fill point of LPG Storage vessel and Centre of LPG Tank-Truck unloading hard stand	9 (aboveground/ mounded vessels exceeding 7500 litres capacity) 6 (aboveground/ mounded vessels not	--	--	9	6	6	6
		6		6	6	6	6

LPG Dispenser	exceeding - 3 (underground vessel)						
Property line	9 (aboveground vessels not exceeding 20,000 litres capacity or underground/mounded vessels) 15 (aboveground 6 -- 6 6 6 vessels exceeding 20000 litres capacity) Table-3	9	6	--	3	4	6

TABLE 6

Minimum safety distances for non-flammable non toxic cryogenic liquids

Water capacity of vessel in litres	Between Two vessel	Between vessel and any building or adjoining property line or pedestrians passage	Between vessel and flammable structure, naked flame, pipeline, containing flammable fluids, electric installation or places of public assembly or drain
Not exceeding 10,000	1 metre	3 metres	5 metres
Exceeding 10,000	1 metre	3 metres	7.5 metres

TABLE 7

Minimum safety distances for liquid carbon-dioxide

Water capacity of vessel in litres	Between Two vessel	Between vessel and any building or adjoining property line or pedestrians passage or places of public assembly
Not exceeding 50,000	1 metre	2 metres
Exceeding 50,000	2 metre	4 metres

2. If the aggregate water capacity of a multi-vessel installation is 40,000 litres, the minimum safety distances from any vessel to the property line/group of buildings shall not be less than –

- a) Thirty metres for corrosive, toxic or flammable gases ;
- b) Fifteen metres for non-corrosive, non-toxic or nonflammable gases ;

3. The number of above ground storage vessels in one group shall not exceed six. Spherical and cylindrical vessels shall be installed in separate groups. Minimum separation distance between two such groups of vessels shall be the distance from the vessel to property line in accordance as mentioned in Tables 1,2,3, as the case may be , or thirty metres whichever is less. Each such group of vessels shall be covered under separate licence under these rules.

4. The distances specified above may be relaxed by the Chief Controller in cases where he is of the opinion that the additional safety measures have been provided. Explanation : - The distances specified above are required to be measured from the nearest point on the periphery of the vessel.”

23. Foundations for pressure vessels.—

(1) General – The materials, principles, methods and details of design and construction of foundations and supports of vessels shall comply with approved specifications, standards or codes.

(2) Ground conditions – A thorough knowledge of the ground condition shall be obtained by the person installing the vessel with particular reference to establishing an allowable bearing pressure, total and differential settlements expected, risk of floatation and possible deterioration of original conditions.

(3) Materials.—

(i) The choice of materials for construction shall be determined by the ground conditions, loading and detailed design constructions.

(ii) The materials may be of –

- (a) brick-work masonry;
- (b) re-inforced concrete; or
- (c) steel plate, steel pipe or structural steel.

(4) Loading.—The greatest combined effect of static and imposed loading shall be used for design as under:-

- (a) Static loading : weight of vessel and its contents;
- (b) test loading if tested by water;
- (c) wind loading;

(d) operational loading such as vibration or thermal (natural and operational).

(5) Settlement.—Any particular differential settlement shall be limited to prevent excessive stress in the connected pipe work and vessel shell.

(6) Vessel supports.—

- (i) the design of supports for vessels shall follow the standard or code to which the vessel is constructed;
- (ii) the spacing of vessel support shall be decided after close consideration of vessel-shell stressing and transmission of the loading to the ground;
- (iii) the design of supports for vessels shall provide flexibility to allow for movement of the vessel as a result of pressure and thermal expansion.
- (iv) the vessel shall be securely anchored or weighed or provided with adequate pier height to avoid floatation due to flood water;
- (v) in case of structural steel supports such supports, excluding vessel saddles or supporting feet 45 cm or less in height, shall be encased in fire-resisting materials of adequate thickness.

24. Fencing.—

- (1) The area where vessels pumping equipment, loading and unloading facilities and direct fired vaporisers are provided, shall be enclosed by an industrial type fence at least 2 metres high along the perimeter of the safety zone.
- (2) Every fence shall have at least two means of exit and the gates of such exits shall open outwards and shall not be self-locking.

25. Cleanliness.—An area of three metres around the vessel shall be kept free from readily ignitable materials, such as weeds and long dry grass.

26. Earthing.—

- (1) All vessels used for storage of flammable liquefiable gases shall be electrically connected with the earth in an efficient manner.
- (2) Pipelines conveying flammable liquids shall be adequately prepared for electrical continuity and connected with the earth in an efficient manner.

27. No Smoking.—A permanent notice with letters at least 5 cms in height prohibiting smoking and naked lights shall be fixed to the fence surrounding the area where flammable or oxidising gases are stored and the notice shall be visible from outside.

28. Fire protection.—All vessels used for the storage of flammable compressed gases shall be protected against fire hazards as under,—

(i) provision shall be made for an adequate supply of water and fire protection in the storage area in accordance with the provision of the Rules and the regulation applicable in that area. The application of water may be by hydrants, hoses and mobile equipments, fixed monitors or by fixed spray systems which may be automatic. Control of water flow should be possible from outside any danger area. The fire water system shall be designed with medium velocity sprinklers for above ground storage vessels, filling sheds, loading or unloading area, and pump the single largest risk area and with additional requirements for hydrant points. In plants referred to in Table 4-A of rule 22, the quantity of water available shall be sufficient for four hours of fire fighting, and in plants referred to in Table 4-B of rule- 22, the same shall be for two hours of fire fighting. For other installations not covered under Tables 4-A and 4-B, the fire water storage shall be as approved by the Chief Controller.”,

(ii) hydrants, where provided, shall be readily accessible at all times and so spaced as to provided for the protection of all vessels;

(iii) sufficient length of fire hose shall be provided and be readily available. The outlet of each hose line shall be equipped with a combination jet and fog nozzle. The hoses should be maintained well and periodically inspected;

(iv) mobile equipment , fixed monitors or fixed spray systems shall 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;

(v) consideration shall be given to the provision of mobile or fixed water spray systems giving suitable and effective protections for vehicle loading and unloading areas;

(vi) at least two dry chemical powder type fire extinguishers of 9 kg. Capacity each shall be installed at each point of access to the installations.

(vii) In liquefied Petroleum Gas dispensing station for fuelling motor vehicles, having only underground or earth covered (mounded) liquefied petroleum gas storage vessels, two numbers seventy kilograms dry chemical type fire extinguishers shall be provided. In dispensing stations having above ground liquefied petroleum gas storage vessels, hydrants with minimum water pressure of seven kilograms per square centimetre shall be provided at convenient positions for

around coverages of storage vessels and handling area, and water sprinklers with spray density of ten litres per minute per square metre shall be provided. The fire water pump shall be preferably diesel engine driven with capacity to deliver water at the rate and pressure specified above. The minimum fire water storage at the premises shall be that needed for fighting fire atleast for one hour.”

29. Loading and unloading facilities. –

(1) Pumps.—

(i) pumps may be centrifugal or positive displacement pumps;

(ii) design materials and constructions of pumps shall be suitable for the type of gas to be handled and they shall be designed for the maximum outlet pressure to which they will be subjected to in operation;

(iii) positive displacement pumps shall have a by-pass valve or other suitable protection against over pressure.

(2) Compressors.—

(i) the design, material and construction of compressors shall be suitable for the type of gas which they are to handle and they shall be designed for the maximum outlet pressure to which they will be subjected to in operation;

(ii) compressors other than multi-stage compressors shall take suction from the vapour space of the vessels being filled.

(3) Transfer systems.—

(i) transfer systems shall be so designed that the risk of a gas of a higher vapour pressure being transferred to equipment designed for gas of a lower vapour pressure is minimised;

(ii) there shall be positive means of rapidly shutting off flow, located at a safe distance from the vessel which is being filled or emptied;

(iii) automatic alarm device to indicate the approach to maximum permissible height or automatic shut-off valves shall be used to prevent over filling.

(4) Hoses.—

(i) the hoses for liquid transfer shall be designed to withstand not less than four times the maximum operating pressure they will carry in service;

(ii) the hoses shall be mechanically and electrically continuous.

(5) In the tank-truck loading or unloading gantry, number of bays for parking tanktrucks shall not exceed eight, and number of such gantries in a premises shall not exceed two.

(6) Rail tank wagon loading or unloading shall be restricted to a maximum of half a rake (six hundred tonnes). If full rake handling is required, it shall be placed in two separate gantries with fifty meters distance in between them.

(7) All valves on the vessel and pipelines in the premises shall be permanently marked in a manner clearly indicating the direction of opening and closing.”

30. Transfer operations.—

(1) Before transfer of gas,—

(i) every vehicle shall be carefully examined at the installation to ensure that it complies in all respects with the requirements of these rules and shall be completely emptied before it is passed for filling;

(ii) a visual check shall be made of the surroundings for unusual or dangerous situations before any filling or discharging procedure is commenced;

(iii) warning notices, as necessary, shall be displayed;

(iv) the receiving vessel shall be checked to ensure that it has sufficient ullage to receive quantity of gas being transferred to it;

(v) the inter-connecting system, that is pipework-fittings, valves or hoses, shall be checked to ensure that it is in safe working condition and that only valves and other fittings required in the transfer operations or any other operations proceeding simultaneously, are open.

(2) During transfer the receiving vessel shall be checked to ensure that it is not being filled above its safe filling capacity or beyond its design pressure.

(3) On completion of transfer before the vehicle is allowed to leave the licensed premises it shall be weighed over a weigh-bridge to ascertain the quantity of the compressed gas filled therein if the vehicle is filled with a liquefiable gas.

(4) When filling the vessels on vehicles with compressed gas, the following procedure shall be complied with in addition to the other requirements, namely:--

- (i) the place where the vehicle is parked shall be properly levelled;
- (ii) the vehicle shall be prevented from accidental movement during the transfer operation. The parking brake of the vehicle shall be on and the engine shall remain stopped, except when it is necessary to drive the pump. Where necessary, wheel chock blocks shall be used;
- (iii) any driving units or electrical equipment not required and not specifically designed for the transfer operation shall be stopped or isolated;
- (iv) the vessel mounted on a vehicle shall be electrically bonded to the fixed installation before any flammable liquefied gas transfer operations is carried out;
- (v) before a vehicle is moved, the electrical and the liquid and vapour connections shall be disconnected care being exercised to avoid spillage. Where wheel chock blocks have been used they shall be removed. The vehicle shall be checked to ensure that it is in safe working order and the surrounding areas checked to ensure that any liquefied flammable gas that may have leaked or has to be vented has safely dispersed.

(5) For keeping attention during operations—

- (i) a competent person shall remain in attendance during all the operations connected with the transfer and ensure that all the requirements of these rules are complied with;
- (ii) if it is necessary to discontinue a vehicle loading operation temporarily, the loading hose, shall be disconnected from the vehicle for the period of such discontinuance.

(6) The person in charge of transfer operations shall ensure that transfer operations are stopped in the event of –

- (i) any leakage;
- (ii) a fire occurring in the vicinity;
- (iii) a severe electrical storm occurring in the vicinity in the case of an operation which involves venting of flammable gas.

30A Dispenser for liquefied petroleum gas dispensing station - The dispenser and connected fittings used for dispensing liquefied petroleum gas in motor vehicles provided in the liquefied petroleum gas dispensing station shall be designed, constructed, tested and maintained in accordance with the requirement laid down in Schedule II of these rules and be of a type approved in writing by the Chief Controller.

30B. Special Provisions for filling fuel tanks of motor vehicles and unloading of tank-truck in liquefied petroleum gas dispensing station –

- (i) Liquefied Petroleum Gas shall not be filled in fuel tank of motor vehicle while the engine of the vehicle is running.
- (ii) During the period of unloading of liquefied petroleum gas from tank-truck to the storage vessels, operation of dispensing liquefied petroleum gas to motor vehicles shall not be carried out.”

31. Electrical apparatus and installations.—

- (1) No electrical wire shall pass over any storage vessel.
- (2) All electrical wires installed within the safety zone of any storage vessel for the storage of flammable compressed gases shall consist of insulated cables of approved type. The cables shall be mechanically continuous throughout and effectively earthed away from the vessels.
- (3) For pump rooms used for pumping flammable compressed gases –
 - (i) all electrical meters, distribution boards, switches, fuses, plugs and sockets shall be of flame-proof construction complying with the requirements of IS:2148 : 1968 and the frames shall be effectively earthed;
 - (ii) all electrical fixed lamps shall be enclosed in a well glass flameproof fitting conforming to IS:2206 (Part I) : 1962.
- (4) All electrical portable hand lamps shall be of a type approved by the Chief Controller.

31A. Classification of hazardous area for flammable gases

- (1) A hazardous area for flammable gases shall be deemed to be –
 - a) A division ‘0’ area if inflammable gases of vapours are expected to be continuously present in the area ;
 - b) a division ‘1’ area, if inflammable gases of vapours are expected to be continuously present in the area under normal operating conditions; or

c) a division '2' area, if inflammable gases or vapours are expected to be continuously present in the area only under abnormal operating conditions or failure or rupture of an equipment.

2. If any question arises as to whether hazardous area is a division '0' area or a division '1' area or a division '2' area, the decision thereon of the Chief Controller shall be final.

31B. Extent of hazardous area – The extent of hazardous area for liquefied petroleum gas dispenser shall be as under –

(i) Entire space within the dispenser enclosure cabinet and forty six centimeters horizontally from the exterior of enclosure cabinet and upto an elevation of one hundred and twenty two centimeters above dispenser base and the entire pit or open space beneath the dispenser shall be division '1'

(ii) Upto forty six centimeters vertically above the surrounding ground level and horizontally beyond forty six centimeters upto six meters on all sides of the dispenser enclosure cabinet shall be division '2'

32. Lighting of storage and operating areas.—operations shall not be carried out during the night unless adequate artificial lighting of approved type are available and used.

33. Certificate of safety.—A certificate of safety in the proforma prescribed by the Chief Controller and signed by a competent person shall be furnished to the licensing authority before any vessel is used for the storage of any compressed gas or whenever any addition or alteration to the installations or foundations for the vessel is carried out.