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OISD GUIDELINES
ON
SMALL LPG BOTTLINGS PLANTS
(DESIGN AND FIRE PROTECTION FACILITIES)

Prepared by:

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PREAMBLE

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 by Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than three decades of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self- regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of International and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate
FOREWORD

Oil Industry in India is more than 100 years old. Over years a variety of practices have been in vogue because of collaboration/association with different foreign companies and governments. Standardization in design philosophies, operating and maintenance practices was hardly in existence at a national level. This lack of uniformity, coupled with feedback from some serious accidents that occurred in the recent past in India and abroad, emphasized the need for the industry to review the existing state of art in designing, operating and maintaining oil and gas installations.

With this in view, the Ministry of Petroleum & Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorates (OISD) for formulating and implementing a series of self-regulatory measures aimed at removing obsolescence, standardizing and upgrading the existing standards to ensure safer operations. Accordingly, OISD constituted a number of functional committees comprising of experts nominated from the industry to draw up standards and guidelines on various subjects.

In pursuance to workshop held at OCC, New Delhi on 16th March 1993, a committee was constituted by OISD to draw the guidelines for small LPG Bottling Plants to facilitate private parties for importing/storing, bottling and marketing of LPG. These guidelines are developed based on the anticipated hazards of small LPG bottling plants. The essential contributors for hazards are stated as below:

(i) Inventory of LPG Bulk/packed
(ii) Number of operational activities involved.

The recommendations made herein are applicable to bottling plants having a bulk inventory not exceeding 100 M.Tonnes of LPG with minimum two storage vessels and also bottling a total quantity not exceeding 20 M.Tonnes of LPG per shift of 8 hrs. While it is recognized that number of filling operations vary with the capacity of the cylinders, it is essential that the net LPG contents in the cylinders is in the range of 10 - 20 Kg. Note 3

The addendum was provided vide Section 5 as approved in the 26th Safety Council Meeting held on 25th July, 2008 that lays down the additional minimum safety requirements on design, layout, storage, loading/unloading, operation at LPG installations having Bulk Storage (a) exceeding 100 MT but limited to 300 MT for aboveground storage and also for (b) 450 MT in mounded or in combination of aboveground and mounded storage of LPG with total bottling quantity not exceeding 35 MT per shift of 8 hrs.

The addendum provided vide Section 5 has been further amended as approved in 34th Safety Council held on 14th Sept’2017. Total bottling quantity has been increased to 50 MT per shift. of 8 hrs. while introducing additional minimum safety requirements e.g. heat detection based auto operated sprinkler system with deluge valve, vapour extraction system at strategic locations etc.

For all the plants exceeding above limits, OISD-STD-144 shall be applicable.

We, at OISD, are confident that the provisions of this standard, when implemented in totality, would go a long way in ensuring safe operation of the target group of locations.

Needless to mention, this standard, as always would be reviewed periodically based on field level experience, incident analysis and environment scanning. Suggestions from all stake holders are fervently solicited.
NOTE

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The figures and annexures used in the document are representative in nature.

These documents are intended only to supplement and not to replace the prevailing statutory requirements.

Where ever BIS standards are referred same relates to the latest version of the standard.

"Note 3," in superscript indicates the modification/ changes/ addition based on the amendments approved in the 19th Safety Council meeting held in September, 2001

Section 5 i.e. Addendum to OISD Guidelines on Small LPG Bottling Plants (Design & Fire Protection Facilities) in this document has been added as approved in the 26th Safety Council Meeting held on 25th July, 2008.

Section 5 i.e. Addendum to OISD Guidelines on Small LPG Bottling Plants (Design & Fire Protection Facilities) in this document has been amended as approved in the 34th Safety Council Meeting held on 14th Sept, 2017.
(Amended Edition – October 2017)

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<td>Sh. Mahesh K. Goyal</td>
<td>Oil Industry Safety Directorate, Noida</td>
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## OISD GUIDELINES ON
SMALL LPG BOTTLING PLANTS
(DESIGN AND FIRE PROTECTION FACILITIES)

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SCOPE: This standard does not cover Mounded or Refrigerated Storage
1.1 STATUTORY RULES/ REGULATIONS AND OTHER RECOMMENDED GUIDELINES

Construction and operation of LPG Bottling Plants, storage, transportation and distribution of LPG are required to be carried out in accordance with various prevailing Statutory Rules and Regulations. This section covers the features in brief w.r.t. following regulations which are in force. For complete details with regard to the various provisions, original notifications/documents may be referred to.

1.2 STATUTORY RULES/REGULATIONS (AS AMENDED/ REVISED FROM TIME TO TIME)

a) Gas Cylinder Rules – 2016 (Under Indian Explosives Act, 1884)
b) Static & Mobile Pressure Vessels (unfired) Rules - 2016 under Indian Explosives Act 1884.
c) The Factories Act – 1948 (with latest amendments)
d) Electrical Installation under Indian Electricity Rules – 1956 (with latest amendments)
e) The Legal Metrology (General) Rules, 2011 under Legal Metrology Act, 2009. (With latest revisions and amendments)
f) Legal Metrology (Packaged Commodities) Rules, 2011 (With latest revisions and amendments)
g) Liquid Petroleum Gas (Regulation of Supply & Distribution) Amendment Order dated 25th Oct2012 (With latest revisions and amendments)
h) The Motor Vehicles Act – 1988 (With latest revisions & amendments)
i) Environmental Regulations:
   • Water (Prevention & Control of Pollution) Act-1974 (With latest revisions & amendments)
   • Air (Prevention & Control of Pollution) Act- 1981 (With latest revisions & amendments)
   • "The Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016"

1.3 RECOMMENDATION OF COMMITTEES

In addition to the above statutory regulations, there are various recommended guidelines emerging out of the various Committees set up by the Government of India from time to time for streamlining/improving the safety standards of LPG Bottling/Distribution.

c) Sudha Joshi Committee for better services to LPG users – 1987, Ministry of Petroleum & Natural Gas (Deprt. Of Petroleum).

For further details, the original documents may be referred to.

1.4 SALIENT FEATURES OF VARIOUS RULES/REGULATIONS

(The salient features from various statutory regulations are as at the time of preparation of the guidelines. Any changes subsequently notified after the publication of these guidelines shall also

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be complied with)

(i) GAS CYLINDER RULES – 2016

These rules have been framed under the Indian Explosives Act, 1884 to regulate the possession, delivery, storage, handling examination/testing of gas cylinder limited up to capacity of 1000 liters.

Under these rules, prior approval from Chief controller of Explosives is required to be taken before constructing any new facility or altering the existing facility for filling cylinders and storage area etc. Before commissioning/operating of LPG filling plant following licenses are required to be obtained from CCE after furnishing the details in specified formats:

License to import cylinders (form D) Application is to be submitted in form B (Under rules 57/61)

License to fill/possess cylinders (form E&F). Application is to be submitted in form C (under rules 57, 61 and 62)

Generally, license for import of cylinders (Form D) is valid up to one year (Maximum) whereas other licenses in Form E/F granted or reviewed remain in force till 31st March of the year subject to validity of maximum 3 years. Application for renewal should reach CCE, Nagpur at least 30 days prior to expiry of the current license.

Cylinders should conform to specified design, fittings, markings, identification color and should have approval from CCE before use of the same.

Cylinders in use are required to be inspected and hydrostatically tested as specified in the BIS code (IS:5845) or as per procedure/frequency approved by CCE. Rejected cylinders are to be destroyed by flattening/cutting into pieces.

(ii) STATIC & MOBILE PRESSURE VESSELS (UNFIRED) RULE - 2016

These rules in conjunction with Gas Cylinder Rules have been framed under the Indian Explosives Act to regulate the construction, fitment, storage, loading/transport and inspection of unfired vessels in service of compressed gas like LPG with capacity exceeding 1000 liters.

As per these rules it is obligatory to obtain approval and licenses from CCE prior to construction/alteration and commissioning/operation of any LPG storage vessel and allied facilities. Vessels are required to be designed, constructed and tested in accordance with BIS-2825 as amended from time to time or such code/standard as approved by CCE.

APPLICATION/ LICENSES UNDER THESE RULES ARE:

License to store LPG in bulk issued in Form-III - Application is to be submitted in Form-1 (under rules 49, 54 & 55).

License to transport LPG in bulk issued in Form – IV - application is to be submitted in Form-1 (Under rules 49 & 54)

The licenses will remain in force till 31st of March of the year and are generally valid for the period of 3 years (max). Application for renewal must reach CCE, Nagpur at least 30 days prior to expiry of the current license.

Inspection/hydro testing of vessels is required to be carried out once in 5 years or as specified by a Competent Agency duly approved by CCE. Frequency of inspection/testing of safety valve is once in a year.

(iii) FACTORIES ACT-1948 (AMENDED AS FACTORIES (AMENDMENT) ACT, 1987).

The act aims at regulating working conditions in the factories and lays down minimum requirements for ensuring the safety health and welfare of the workmen, it is applicable to all establishments/factories employing more than 10 employees.

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As per the First schedule of the amended Act (1987), installations handling highly flammable liquids and gases come under Hazardous process/operations. Salient provisions to be complied with rules framed by the State Government under the Factories Act are given below:

- Approval of initial location or expansion of existing installation by the site appraisal committee constituted by the State Government.

- Approval of the plan, specification. Drawings for construction of the Factory. Installation by the Chief Factory inspector and also registration license for operating factory. License is to be renewed every year or as specified.

- Disclosure of information by the occupier regarding hazards/danger including health hazards and measures to overcome such hazards to workmen and general public living in the vicinity of the factory.

- Declaration of written safety policy w.r.t. health and safety of workmen.

- Ensuring proper fencing/provision of safety guards on equipment/machinery. Fire/accident prevention facilities etc.

- Examination/testing of machinery/vessels, tools/Tackles etc. at specified frequency.

- Maintenance of up-to-date Disaster Management Plan.

- Specific responsibility of the occupier in relation to:
  (a) Maintenance of health records of persons likely to be exposed to harmful toxic substances.
  (b) Deployment of qualified persons to handle hazardous substances/equipment.
  (c) Appointment of Safety Officer.

(iv) **STATUTORY REQUIREMENTS OF ELECTRICAL INSTALLATIONS (UNDER INDIAN ELECTRICITY RULES, 1956)**

For supply of power, license is required from the designated authority of the State Government after submitting the application with details of premises drawing/maps of the proposed area of supply, electrical installation, nature and amount of supply etc.

The installation must be inspected and approved by Electrical Inspector of the State Government before commissioning. Subsequent inspection/testing shall be required at intervals not exceeding five years or as specified. Only licensed contractors/agencies holding the certificate of competency should be engaged for any installation work.

All earthing system in the installation shall require to be tested for resistance during the dry season not less than once a year or as specified by the authorities’ record of every earth test shall be maintained by the occupier in charge of the installation and shall be produced as required before the inspector or authorized officer.

Suitable fire extinguishers for dealing with electrical fire like CO2, DCP type extinguishers should be placed in electrical installations.

**NOTE:**

a) For appropriate area classification, guidelines, contained in IS: 5572 (Part-I) 1978 should be followed.

b) For selection of electrical equipment, guidelines contained in IS: 5571-1979 & IS/IEC 60079-20-1: 2010 as revised from time to time should be followed.

(v) **(a) THE LEGAL METROLOGY (GENERAL) RULES, 2011 UNDER LEGAL METROLOGY ACT, 2009.** (With latest revisions and amendments)

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Approval/certification of measuring Appliances:

Weighing equipment like weigh scales, weigh bridges etc. before installation shall have approval and certification by the Regional Director/designated authority of Weights & Measures. In case, the equipment is imported, the same shall have certification of appropriate authority of the country where it is manufactured in accordance with recommendations of international organization of Legal Metrology. Such models shall be tested, if required, and shall be duly certified by the Indian authorities to verify the accuracy.

VERIFICATION/ STAMPING

Weighing equipment shall require re-verification by the designated Inspector at prescribed intervals. Certificates in prescribed intervals. Certificates in prescribed form shall be obtained or stamping indicating there in the particulars of verified measures shall be made. Test weights used for regular checking the accuracy of weighting equipment shall also require stamping of Weights & Measures.

SITE INSPECTION

Weights & Measure Authorities within their area of jurisdiction can visit the premises for inspection, testing of any measuring equipment in use apart from checking the relevant records/documents.

(b) LEGAL METROLOGY (PACKAGED COMMODITIES) RULES, 2011 (With latest revisions and amendments)

- LPG shall be marketed/sold on weight basis in packaged form i.e. cylinders of approved design.
- Declaration shall be required on every cylinder about name/address of Manufacturer/packer common or generic name of the commodity, net quantity in terms of standard weight, size/dimensional details of the containers etc.
- Maximum permissible error on net quantities declared by weight or by volume shall be as below:

<table>
<thead>
<tr>
<th>Declared quantity</th>
<th>As % of</th>
<th>gm or ml</th>
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</thead>
<tbody>
<tr>
<td>1000–10,000</td>
<td>1.5%</td>
<td>-</td>
</tr>
<tr>
<td>10,000–15,000</td>
<td>-</td>
<td>150</td>
</tr>
<tr>
<td>More than–15,000</td>
<td>1.0%</td>
<td>-</td>
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</table>

(vi) LIQUID PETROLEUM GAS (Regulation of Supply & Distribution) Amendment Order dated 25th Oct'2012 (With latest revisions and amendments)

This order was brought into force w.e.f. August 1993 by the Ministry of Petroleum & Natural Gas. Salient features are out lined below:

- No person shall be granted by a Govt. Oil company more than one gas connection and the same shall not be used for purposes other than cooking unless specified by a general or special order.
- No transporter or delivery person shall deliver LPG gas either in Cylinders or bulk to any person other than the consumer for whom the LPG is meant for.
- The weight of the liquefied petroleum gas contained in a cylinder shall not vary by a difference of 1.5% or maximum permissible limit to the net weight of the respective cylinder as indicated on it by the Govt. oil company.
- No person shall – supply or sell filled or empty cylinders, gas cylinder valves and pressure regulators to any person other than a Govt. oil company or parallel marketer.
- Unless authorized by a Govt. oil company or a parallel marketer, supply or sell empty cylinder,
gas cylinder valve and pressure regulator to any person other than a consumer.
- Possess filled or empty cylinder, gas cylinder valve or pressure regulator unless he is a consumer and the same has been supplied by a distributor a Govt. oil company or a parallel marketer.
- Schedule ‘B’ of the above order lays down the guidelines with respect to cylinder size, shape, design and weight for the parallel marketing system in addition to those for Gas cylinder valve and pressure regulator.

(vii) THE MOTOR VEHICLES ACT – 1988
- Some relevant features w.r.t. safety provisions in the Motor Vehicle Act – 1988 are as below:
  - Grant of driving license for transport vehicles used for hazardous goods like LPG and other petroleum products is restricted. The person must have some minimum educational qualification as prescribed by Central/State Government apart from other conditions like medical fitness, driving competence certificate, minimum driving experience etc.
  - Registered laden weight/axle weight as per notification for particular model should not exceed the permissible value.
  - Use “TREM CARD” or other safety guidelines issued for particular hazardous commodity as prescribed by Central/State Government authorities. This covers specified arrangement of maintenance/repairs, emergency handling procedures in case of road accidents.

(viii) ENVIRONMENTAL REGULATIONS
(a) WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974
Under the main provision of this Act:
Prior consent of State Pollution Control Board by applying in prescribed format is require for:
Establishing any industry, operation or process or any treatment and disposal system or any extension or addition thereto which is likely to discharge sewage or effluent into a stream or on land. Using any new or altered outlet for discharge of sewage or effluent.
Application for renewal of consent, which is generally valid for one year should be made at least one month in advance.
Occupier has to ensure the compliance of the directions or stipulations laid down by the Board while granting the consent. Returns for the amount of water consumed along with payment of cess must be submitted in manner as prescribed in the Water (Prevention & Control of Pollution) Cess Act – 1977.

(b) AIR (PREVENTION & CONTROL OF POLLUTION) ACT – 1981
The objective of this act is to provide for prevention, control and abatement of air pollution (*) caused by any operation or process.
- Under the main provision of this Act prior consent of the State Pollution Control Board is required regarding discharge or emission of air pollutants for operation of an industry as specified in schedule which includes Petroleum Industry.
- Strict compliance with standards/conditions laid down by the board or specified in the consent order must be ensured.
- Application for renewal of consent must be submitted at least one month prior to expiry of the current consent order which is generally valid for one year.

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- (*) : Air Pollution means presence in the atmosphere, of any solid, liquid or gaseous substances including noise in such concentration/intensity that may be injurious to human being or other living creatures or plant or property or environment.

Several rules for the specific areas have been/are in the process of being notified under this Act. This also includes issuance of various standards for effluent water, atmospheric emissions/air quality, storage/handling of hazardous chemicals, solid, waste

(c) ENVIRONMENT (PROTECTION) ACT-1986

The Water Act-1974 and Air Act-1981 deal specifically with water and air pollution while this act deals with environment as a whole including prevention of hazards to human beings, other living creatures, soil, plants and property.

This act empowers Central/State Government to take all such measures, it may deem fit for protecting and improving the quality of environment.

(d) ENVIRONMENTAL CLEARANCE FOR NEW LPG BOTTLING PLANTS

(i) GUIDELINES FOR SITING INDUSTRY

Ministry of Environment has laid down certain guidelines for Siting of Industries which includes LPG installation. While selecting a site, enough care should be taken to minimize the adverse impact of the neighborhood and natural life sustaining systems.

Letter of intent of the industry can be converted to the Industrial License only after the following conditions are fulfilled:

The State Director of Industry confirms that the site of the project has been approved from the environmental angle by the concerned state authorities.

- The Project Authorities commit to State and Central Governments to install the appropriate equipment and implement the measures prescribed for prevention and control of environmental pollution.

(ii) PROCEDURE FOR OBTAINING ENVIRONMENTAL CLEARANCE

Firstly, No objection Certificate (NOC) has to be obtained from concerned State Pollution Control Board by submitting application in the prescribed form along with detailed project report.

Final clearance from environmental angle is to be obtained from DOE. Government of India. The following documents will have to be submitted for obtaining clearance:

- Detailed Project Report (PDR)
- Response to questionnaire (Prepared by DOE).
- Environmental Management Plan.
- Risk Analysis Study Reports.
- Disaster management Plan – Master Rehabilitation Plan, duly approved by State Government (Where required).
- Green Belt Development Plan.

The Department of Environment, after considering these documents and presentation by the industry member will give clearance with/without special conditions to be complied with. A six monthly report on the progress of the facilities being provided for pollution control is to be submitted.

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to DOEn, till the completion of the report.

Finally, before commissioning of the plant, consent has to be obtained from the State Pollution Control Board for the discharge of liquid effluent and atmospheric emission under Water (Prevention and Control of Pollution) Act, 1974 and (Air Prevention and Control of Pollution) Act-1976.

1.5 SUMMARY OF RECOMMENDATIONS OF SUDHA JOSHI COMMITTEE – 1987

Ministry of Petroleum & Chemicals had set up a committee headed by Mrs. Sudha Joshi, the then M.P. and Marketing Directors of Oil Companies with a view to provide better services to LPG users with due regard to safety.

Brief summary of important recommendations w.r.t. safety aspects are outlined below:

- Streamlining of registration/release of LPG connections, issuing booklet like ration card to each consumer etc.
- Use of auto-driven vehicles to be encouraged for delivery of refills.
- Consumers to use only BIS marked hot plates.
- Distributors to check weight of at least 10% of cylinders before accepting deliveries Oil companies to ensure pre-delivery checks by the Distributors.
- Caging of trucks carrying filled LPG cylinders.
- Oil companies to use only aluminum/PVC seals with different color code of filling plant embossed.
- Periodic safety inspection of equipment at consumer premises.
- Regular training of delivery boys by the Oil companies.
- Emergency and complaint cells to be operated by Oil companies in LPG marketed towns.
- Consumer education in LPG Safety through TV media and curriculum of high school.
- Oil companies to strengthen the inspection system of LPG Bottling Plants and working of the distributors.
- Establishment of Mini Bottling Plants near the consuming center to the extent possible.
PLANT LAYOUT

2.0 SCOPe:

The general layout principles of LPG storage, bottling and bulk handling facilities have been detailed in this chapter. The various facilities within LPG storage and bottling premises shall be located based on Table-I and Table-II.

2.1 LOCATION & SAFETY DISTANCES

2.1.1 LOCATION:

While assessing the suitability of any site for location of LPG storage facilities, the following aspects shall be considered:

a) In addition to the requirements for safety the plant should be located in such a manner so as not to be contiguous to any industry having open flame. Property line of the plant shall be away from the central line of the road/railways as per statutory requirements and overhead high tension wire shall not traverse through the battery limit of the plant.

b) Adequate availability of water from a nearby reliable source should be ensured.

c) The topographical nature of the site with special reference to its effect on the disposal of LPG, in the event of its escape, if any, shall be considered.

d) The access for mobile firefighting equipment to the storage vessels under all foreseen circumstances, preferably from two sides and upward prevailing wind direction is an important parameter.

e) For any expansion beyond the specified limit, all provision under OISD-144 shall be applicable.

f) Predominant direction of wind and velocity shall be considered.

g) Longitudinal axis of horizontal vessels (Bullets) shall not point towards other vessels, vital process equipment and other facilities.

h) Storage vessels shall be located downward of processing units, important building and facilities.

i) Storage vessels shall be laid out in single row within a group.

j) Storage vessels shall not be located one above the other.

2.1.2 SAFETY DISTANCES:

The safety distances as given in Table-I and Table-II are the distances in plane between the nearest point on a vessel other than the filling/discharge line and a specified feature, e.g. adjacent vessel, site boundary etc.

2.2 TYPE OF STORAGE VESSELS:

2.2.1 HORIZONTAL CYLINDRICAL VESSELS:

Horizontal bullets with the total volumetric capacity up to 235 Cu. M. shall be used for storing LPG.

2.3 LAYOUT:

The following aspects shall be considered while establishing layout of LPG storage vessels.

2.3.1 LPG STORAGE FACILITIES:

a) GRADING:

Area below the storage vessels (Bullets) shall be free from vegetation, property graded with the
slope of 1.100 (towards one side) away from the pipeline manifold.

b) PIPING:

I. Piping manifold shall be away from the shadow of the vessel.

II. Spring loaded quick closing valve with fusible link or ROV to facilitate immediate closure in the event of emergency, if any, shall be provided in the LPG liquid line of each vessel between excess flow check valve (EFCV) and pipeline manifold.

c) SURFACE DRAINAGE

In order to prevent the escape of spillage into the main drainage system, surface water from the storage area and from the manifold area shall be directed to the main drainage through a water seal designed to avoid the spread of hydrocarbon.

d) GROUPING:

Vessels shall be arranged in a group and total volumetric capacity of the group shall be, limited to 235 Cu. M. Note 3 Inter-distances as specified in Table-I and Table-II shall be maintained.

Top surfaces of all the vessels installed in a group shall be on the same plane so that the safety blowouts from them do not affect each other.

2.4 LPG BULK HANDLING FACILITIES:

2.4.1 LPG tank lorry loading/unloading gantry shall be located in a separate block and shall not be grouped with other petroleum products.

2.4.2 Space for turning with a minimum radius of 20 meters for tank lorries shall be provided commensurate with the capacities of the tank trucks.

2.4.3 LPG tank Lorries up to the maximum of 2 No’s, at a time should only be taken for unloading.

2.4.4 Adequate permanent protection for TLD Pipeline Island shall be provided. The minimum width of such pipeline island shall be 1 meter.

2.5 LPG BOTTLING FACILITIES:

2.5.1 LPG Bottling facilities should be located a safe distance from other facilities with minimum ingress of trucking traffic and downward wind direction with respect to bulk storage. There shall not be any deep ditches in the surrounding area to avoid settling of LPG.

2.5.2 Bottling section shed (Refer Annexure-I) shall be of single story having asbestos roofing and open from all sides for adequate ventilation to ensure quick dissipation of LPG Vapour in the event of leakage, if any, RCC roofing shall not be used. Anti-static mastic flooring conforming to IS-8374 shall be provided in the LPG filling shed/cylinder storage shed to avoid frictional sparks. Anti-static mastic coating up to 1.5 meters height from bottom of the supporting columns in the shed shall be provided.

2.5.3 Stacking area for empty and filled cylinders shall be marked specifically. Cylinders shall always be stacked vertically in two lines. For details of cylinders stacking pattern refer Annexure-II. Plant should have one shed each for filling and storing of filled / empty cylinders.

2.5.4 Valve changing operation should be carried out in a demarcated place within the filling shed itself.

2.5.5 Cylinder storage shall be kept on or above grade and never below grade in cellar or basement.

2.5.6 Filled cylinders shall not be stored in the vicinity of cylinders containing other gasses or hazardous substances.

2.5.7 Escape routes shall be specified in LPG sheds for evacuation of employees in emergency.

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2.5.8 There shall not be any trapping of personnel in LPG sheds by conveyors, cylinders and other facilities. If such trapping cannot be eliminated, it should be kept to the minimum. In such places sufficient arrangements for escape routes to be provided.

2.5.9 Adequate lighting shall be provided in the cylinder filling area.

2.5.10 Water drains from cylinder filling areas to outside drainage system shall be provided with water seals (near the plant boundary)

2.6 PROTECTION OF FACILITIES:

2.6.1 There shall be road all around the various facilities within the bottling plant areas for accessibility of firefighting operations.

2.6.2 There shall be proper industry type boundary wall all around the Bottling Plant.

2.7 UTILITIES

Utilities consisting of Fire Water Pumps, Admin. Building, Motor Control Center, DG Room, Air Compressors, Dryers etc. shall be separated from other LPG facilities and to be located as per the area classification as specified in Table-I.
### TABLE – I

**INTERDISTANCES FOR LPG FACILITIES**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. LPG STORAGE VESSEL</td>
<td>2</td>
<td>T-11</td>
<td>T-II</td>
<td>15</td>
<td>T-II</td>
</tr>
<tr>
<td>2. BOUNDARY/PROPERTY LINE/GROUP OF BLDGS. NOT ASSOCIATED WITH LPG PLANTS.</td>
<td>T-II</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>3. LPG SHED</td>
<td>T-II</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>4. TANK TRUCK GANTRY</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>NA</td>
<td>30</td>
</tr>
<tr>
<td>5. FIRE WATER PUMP HOUSE</td>
<td>T-II</td>
<td>*</td>
<td>30</td>
<td>30</td>
<td>-</td>
</tr>
</tbody>
</table>

**NOTES:**
1. ALL DIMENSIONS ARE IN MTS.
2. NOTATION
   - T-II: REFER TABLE II
   - *: ANY DISTANCE FOR OPERATIONAL CONVENIENCE
3. MAXIMUM PACKED STORAGE LIMITED TO 20000 KGS.

### TABLE – II

**INTERDISTANCES BETWEEN LPG STORAGE VESSELS, FILLING SHED, STORAGE SHED AND BOUNDARY / PROPERTY LINE / GROUP OF BUILDINGS.**

<table>
<thead>
<tr>
<th>CAPACITY OF EACH VESSEL (CU. MTS. OF WATER)</th>
<th>DISTANCES (MTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 – 20</td>
<td>15</td>
</tr>
<tr>
<td>20 – 40</td>
<td>20</td>
</tr>
<tr>
<td>41 – 235 Note 3</td>
<td>30</td>
</tr>
</tbody>
</table>

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DESIGN CRITERIA

3.0 DESIGN CRITERIA FOR LPG BOTTLING PLANTS

3.1 GENERAL

The section describes the broad process design and safety features required in a typical LPG Bottling Plant. For design details about the plant layout reference should be made to section 2 of this standard.

3.2 DESIGN BASIS

3.2.1 For safety reasons, the operation of facilities should be restricted to maximum two shifts operation. Facilities to include the following:

i. Stationary Filling Machines: For filling Cylinders.
ii. Check Scale: To countercheck the quantity of LPG filled.
iii. Compact Valve Tester: To check valve/"O" Ring leakage.
iv. Test Bath: To check the body / bung leak cylinders.
v. Evacuation Rack: For evacuation of cylinders.
vi. Purging Manifold: For purging of cylinders.

3.2.2 STORAGE CAPACITY

The maximum bulk storage (of all vessels) shall be restricted to 100 MT.

3.2.3 LPG LOADING/ UNLOADING FACILITIES

LPG loading/unloading facilities through tank truck are recommended.

3.2.4 CYLINDER FILLING FACILITIES

(A) FILLING MACHINES:

a) The filling machines should preferably be provided with auto cut-off system be ensure that LPG supply is cut-off after filling the desired quantity of product. The filling pressure shall not exceed the design pressure of the cylinders.

b) Filling machines shall not have weighment error more than +/-1% of the net LPG filled in the cylinder.

c) It is recommended that in-line check weigh scales with a minimum graduation of 50 gms be installed and all cylinders after filling should be counterchecked for correct weight.

3.2.5 CYLINDER STORAGE

Maximum cylinder storage of filled cylinders shall be restricted to a total of 20,000 Kgs.

3.3 LPG STORAGE VESSELS

3.3.1 MECHANICAL DESIGN

The mechanical design of storage vessel shall be based on the following:

(a) DESIGN CODE:

ASME SEC, VIII or IS-2825 or BS-5500 or equivalent duly approved by CCE.

Design shall take into account the Static and Mobile Pressure Vessels (Unfired) Rules, 1981 also.

(b) Design Pressure: Vapour pressure of LPG at 55 deg C.
3.3.2 FITTINGS:

Bullets shall have a single nozzle at the bottom for inlet as well as outlet. The nozzle shall be fully welded; stress relieved along with the vessel and shall extend minimum 3 meters from the shadow of the bullet. Excess Flow Check Valve (EFCV) shall be provided on these bottom nozzles to ensure immediate stoppage of the flow of LPG in the event of downstream leakage rupture, if any. There shall not be any other manhole, instrument tapping on this nozzle up to the EFCV.

High level gauge should be provided to ensure safe filling of vessels and slip tube or Roto/Gauge/Rochester gauge should be provided for gauging of the vessels.

All the fittings shall be suitable for use at not less than the design pressure and temperature appropriate to the worst operating conditions of the bullet.

3.3.3 INSTRUMENTS

a) The storage vessel shall have minimum 2 different type of level indicators as stated below:

b) High Level Gauge.

c) Slip Tube Gauge/Roto Gauge/Rochester Gauge.

d) Each vessel shall have at least two safety valves, each set at not more than 110% of design pressure of the vessel and having the relieving capacity adequate for limiting the pressure build-up in the vessel not more than 120% of design pressure. The relieving capacity shall be based on fire condition.

3.4 SAFETY/ SECURITY SYSTEM

The features of safety/security system for the different areas in the LPG Bottling Plants shall be as follows:

a) The hand operating/electrical siren should be provided to sound the alarm in case of fire/emergency, if any.

b) Manual push button should be provided at 2-3 strategic locations to bring to halt all the operational activities in the event of any emergency.

3.5 OTHER EQUIPMENT/ SYSTEM

3.5.1 BOTTLING PUMPS

Two pumps including one stand-by shall be provided with suction and discharge pressure gauge, a high point vent to safe height/flare, suction strainer and mechanical seal shall be provided. Pumps shall be designed to build a discharge pressure to ensure 5 Kg/CM2 pressure above the vapour pressure at the operating temperature at the filling machines.

3.5.2 LPG COMPRESSOR

Gear driven compressor shall preferably be used. However, belt driven compressors can be used provided the belts used are anti-static type and fire resistant.

There shall be minimum of two compressors including one as a standby.

The operating parameters shall be decided on a case to case basis. However, typical operating conditions may be as follows:

Suction Pressure: 10.0Kg/cm2 abs (max) during unloading.

2-11.8kg/cm2 abs. during vapour recovery.

Discharge Pressure: 13.0 kg/cm2 abs.
During unloading 11.5 kg/cm² abs. during vapour recovery.
Compressor shall be provided with the following features:

- Pressure gauges in suction and discharge.
- Temperature gauge in discharge.
- Discharge safety valve and a vent valve, their outlets leading to cold flare at a safe height outside the shed.
- Suction and discharge block valves (lock open type).
- Suction strainer.
- Check valve in discharge.
- A discharge to suction recycle valve for achieving capacity turndown during startup.
- Besides these, other indications/protections can also be provided along with those recommended by compressor vendor.

3.5.3 EVACUATION FACILITIES FOR DEFECTIVE CYLINDERS
Proper cylinder evacuation facility with cold flaring arrangement shall be provided to evacuate the defective cylinder before undertaking cold repairing job.

Cylinders shall be evacuated and depressurized to near atmospheric pressure. The residual LPG in the cylinder shall be cold flared in the atmosphere at a vent outside the shed at 1.0 M height above the roof of the shed.

3.5.4 PURGING OF NEW CYLINDERS
Proper facility shall be provided to disperse the air from newly/hydro tested cylinders before commissioning.

3.5.5 ELECTRICAL AREA CLASSIFICATION
For electrical area classification refer to IS-5571 and IS-5572 (Part-I).
SAFETY AND FIRE PROTECTION

4.0 FIRE PROTECTION FACILITIES

4.1 INTRODUCTION:

LPG Bottling plants are generally located away from the populated areas in view of hazardous nature of product. In the absence of statutory regulations prohibiting their construction of residential/others civil structures, they start mushrooming in and around these plants and with the passage of time these plants get surrounded by such civil structures.

A large quantity of highly inflammable product stored at the Bottling Plants pose safety risk to the plant as well as to the surrounding environment. Therefore, it is essential that adequate Fire Protection Facilities are installed at the LPG Bottling Plants.

4.2 SCOPE:

The standard lays down the minimum requirements of Fire Protection Facilities at small LPG Bottling Plants.

4.3 DESIGN CRITERIA

Following should be considered while designing the Fire Protection Facilities:

a) City fire water supply/facilities not available for these LPG Bottling plants.

b) One single largest fire risk situation shall be considered.

c) All LPG storage vessels, cylinder filling/storage shed, tank lorry loading gantry, LPG pump/compressor shall be covered by fixed water spray sprinkler system.

d) Fire protection facilities shall have firefighting access, means of escape in the event of fire. Whole area should be segregated depending upon the risk involved and each segregated area should have independent system.

Layout shall permit access from at least two directions.

4.4 FIRE WATER SYSTEM

Water to be used for fire extinguishment/ fire control/cooling of vessels/equipment and protection of equipment and personnel from heat radiation.

4.4.1 COMPONENTS OF FIRE WATER SYSTEM

The main components of the system are:

a) Fire water storage

b) Fire water pumps

c) Fire Hydrant/distribution piping network

d) Water Sprinkler.

4.4.2 FLOW RATE DESIGN

The fire water pumping requirement shall be calculated based on spray density as given below:

LPG Storage Vessels : 10.2 LPM/Sq. M. (R + 15)
LPG Shed : 10.2 LPM/Sq. M

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LPG Unloading Gantry : 10.2 LPM/Sq. M
LPG Pump & Compressor Facility : 20.4 LPM/Sq. M

a) i) LPG STORAGE VESSELS:
Fixed water system with manually operated isolation valve located at a safe distance of 15 meters shall be provided. For water flow calculations adjoining vessels within distance of R + 15 Mts. (Where R is the radius of the LPG Vessels) shall be considered.

ii) SHED:
Fixed water spray system with isolation valve to be operated manually and placed at a safe distance of 15 meters from the shed shall be provided.

iii) TANK LORRY GANTRY:
For tank lorry unloading gantry, fixed spray system with manual operating valve located at 15 meters distance from the gantry shall be provided.

iv) LPG PUMP & COMPRESSOR FACILITY:
Fixed water spray system with isolation valve to be operated manually and placed at a safe distance of 15 meters from the LPG Pump & Compressor Facility shall be provided.

b) WATER REQUIREMENT:
The fire water system in the plant shall be designed to meet the highest fire water flow requirement of a single largest risk of any of the above cases at a time plus 72 Cu. M per hour for operating 2 hydrant points.

4.4.3 FIRE WATER SYSTEM DESIGN:
a) Fire water ring main always charged with water (atmospheric pressure at a normal condition) shall be provided all around perimeter of the LPG plant facilities, with hydrants/monitors conveniently placed to combat the fire protection system.

b) Fire water ring main shall be designed for a minimum residual pressure of 7 Kg/cm2 quake at the farthest point of application in the plant.

c) Fire hydrant network shall be in closed loops to ensure multidirectional flow in the system. Isolation of any section on the network without affecting the flow in the rest. The isolation valves shall be conveniently located near the loop junction for ease of operation.

4.4.4 FIRE WATER STORAGE:
a) Water for the hydrant service shall be stored preferably in above ground tanks for availing the advantage of flooded suction to enable easy start of fire water pump. The effective storage capacity shall be for two hours aggregate working capacity of fire water pumps.

b) Storage tank/reservoir shall be 2 in Nos. Interconnected with suitable valve to facilitate cleaning/repairs.

4.4.5 FIRE WATER PUMPS:
a) Centrifugal type fire water pumps shall be installed to meet the designed fire water flow rate and head.

b) At least one fire water pump shall be of diesel engine driven type.

c) Pumps shall be capable of discharging 150% of its rated discharge at a minimum of 65% of the

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rated head.

d) Fire water pumps shall be exclusively used for firefighting purposes only. No. of fire water
pumps of appropriate capacity shall be provided as per the following criteria:

i. Normal operation - 1 No.

ii. Standby - 1 No.

4.4.6 FIRE HYDRANT NETWORK:

a) Fire hydrant ring main should normally be laid above ground. Following precautions should be
taken:

i. Pipe line should be laid at a height of 300 mm to 400 mm above finished ground level.

ii. The mains shall be supported at regular intervals not exceeding 6 meters.

iii. The system for above ground portion shall be analyzed for flexibility against thermal
expansion and necessary expansion loops where called for, shall be provided.

iv. The portion of fire water hydrant above ground and within 15 M of the LPG storage vessels
shall be fire proofed.

b) However, the ring main shall be laid underground at the following places:

i. Road crossings.

ii. Place where above ground piping is likely to cause obstruction to operation and vehicle
movement.

iii. Place where above ground piping is likely to get damaged mechanically particularly in the
LPG storage area where water supply lines are laid for feeding sprinkler deluge system.

c) Fire water ring main laid underground the following precautions shall be taken:

i. The ring main shall have at least one meter earth cushion in open ground and 1.2 meters
cushion under the road crossings.

ii. The ring main shall be provided with protection against soil corrosion by suitable coatings/
wrappings.

iii. In case of poor soil conditions, it may be necessary to provide concrete/masonry supports
under the pipeline.

iv. Fire water ring main shall be sized for 120% of the design water rate. Design flow rates shall
be distributed at nodal flow rates shall be distributed at nodal points to give the most realistic
way of water requirements in an emergency.

d) Hydrants/monitors shall be located bearing in mind the fire hazards at different sections of the
premises to be protected and to give most effective service.

e) Connections for fire water monitors shall be provided with independent isolation valves.

f) Hose boxes with 2 No’s, hoses and a nozzle shall be provided by the side of each hydrant points.

g) Considering radiation levels in the event of a fire, Hydrant/Monitors/Control valves shall be
located at a safe distance from hazardous equipment / buildings.

4.4.7 FIXED WATER SPRAY/ SPRINKLER SYSTEM:

Fixed, water spray / sprinkler system shall be installed in LPG storage area. Tank lorry unloading
area, LPG shed and in the pump/compressor shed, if any.

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4.5 FIRE AID FIRE FIGHTING EQUIPMENTS

4.5.1 PORTABLE FIRE EXTINGUISHERS

a) Portable fire extinguishers (only ISI approved) shall be located at convenient locations and shall at all times be readily accessible and clearly visible.

b) The max. running distance to locate an extinguisher in working areas shall not exceed 15 mtrs.

c) The top surface of the extinguishers shall not be more than 1.5-meter high.

d) The fire extinguishers shall be provided at various as under:

<table>
<thead>
<tr>
<th>AREA</th>
<th>PORTABLE FIRE EXTINGUISHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPG storage Vessels (each)</td>
<td>2 Nos. 10 Kg. DCP</td>
</tr>
<tr>
<td>LPG Cylinder Filling/storage</td>
<td>2 Nos. 10 Kg. DCP per 200 sq. M area</td>
</tr>
<tr>
<td>Tank Truck loading/ unloading gantries</td>
<td>1 No. 10 Kg. DCP Fire Extinguisher in each Bay and 1 No. 50 Kg. Mobile DCP Unit/gantry.</td>
</tr>
<tr>
<td>Office/Canteen/Stores</td>
<td>At least 2 Nos. 10 Kg. DCP Extinguishers in Each Bldg</td>
</tr>
<tr>
<td>MCC/DG Room/HT Room</td>
<td>Min 2 No’s. 4,5 kg. CO Extinguishers in each Room /100 Sq. M area and 4 sand buckets with a stand</td>
</tr>
</tbody>
</table>

100% spare CO2 cartridges and 50% spare Dry Chemical Powder i.e. DCP shall always be stored in the plant.

4.5.2 MOBILE FIRE FIGHTING EQUIPMENT:

The Dry Chemical powder used in the extinguishers shall be potassium/Urea based or Sodium Bicarbonate as per IS: 4308. The expellant gas i.e. CO2 should be of food quality.

4.5.3 HOSES, NOZZLES AND ACCESSORIES:

a) Reinforced rubber lined hoses confirming to IS: 636 (Type A or B) shall be provided.

b) The hoses of 15 meters standard length shall be provided with gun metal/ Aluminum allow male & female couplings of instantaneous pattern.

c) 50% spare hoses shall be stored in the LPG Plant.

d) In addition to the nozzles provided in the hose boxes, 4 Nos. triple purpose nozzles shall be provided.

e) Fire Hoses: 50% of no. of Hydrant points.

f) Sand drums with scoops: 20 Nos.

g) Hose boxes: 1 No. for each hydrant point

h) First aid box: 2 Nos. each

i) Explosimeter: 2 Nos.

j) Siren: 1 No.
k) Red/Green Flag: 1 No. each

l) Hand gloves:
   i. Leather lined asbestos hand gloves for cold working: 2 pairs.
   ii. Rubber hand gloves: 2 pairs for MCC room.

4.6 FIRE/ ALARM / COMMUNICATION SYSTEM.

4.5.4 FIRE ALARM SYSTEM:
   a) Electricity operated Fire Siren shall be audible to the farthest distance in the plant.
   b) Manually operated fire sirens shall also be provided at strategic places.

4.7 INSPECTION AND TESTING:
   The fire protection equipment shall be kept in good operating condition all the time.
   The firefighting system shall be periodically tested for proper functioning and logged for record and corrective actions. In addition to routine daily checks/maintenance periodic inspection/testing shall be ensured.

4.7.1 FIRE WATER PUMPS:
   a) Every pump shall be subjected to test run for at least 10 minutes minimum twice a week.
   b) Once in a month each pump shall be checked and tested and the shut-off pressure observed should be logged. Also the pump performance shall be ascertained.

4.7.2 FIRE WATER RING MAIN:
   a) The ring main shall be inspected for any visual leaks, defects, Damages and corrosion.
   b) All valves on the ring main/hydrant/monitor valves shall be checked for leaks/operation and lubricated once in a month.

4.7.3 FIRE WATER SPRINKLER SYSTEM
   a) The sprinkler system in the sheds shall be tested once in a month.
   b) The strainer provided in the fire water sprinkler records maintained. System shall be cleaned once in a quarter and record maintained.

4.7.4 FIRE WATER RESERVOIR:
   In case of a reservoir the same shall be cleaned once in 6 months or whenever needed so that there shall not be any foreign particles/fungus/vegetation in the reservoir.

4.8 MAKE UP WATER:
   Facilities to receive make up water during firefighting shall be provided.
5.0 ADDENDUM TO OISD GUIDELINES ON SMALL LPG BOTTLING PLANTS (DESIGN & FIRE PROTECTION FACILITIES)

5.1 SCOPE

This addendum lays down the additional minimum safety requirements on design, layout, storage, loading / unloading, operation at LPG installations having Bulk Storage (a) exceeding 100 MT but limited to 300 MT for above ground storage and also for (b) 450 MT in mounded or in combination of above ground and mounded storage of LPG with total bottling quantity not exceeding 50 MT per shift, of 8 hrs.

For all the plants exceeding either of the above limits, OISD Std.144 shall be applicable.

5.2 CAPACITY OF HORIZONTAL CYLINDRICAL VESSELS:

There shall be minimum of 3 no’s vessels in either of the following case:

a) The total volumetric capacity of the LPG storage vessels shall not exceed 705 cum (300 MT of LPG) if the entire bulk storage is in above ground bullets.

OR

b) The total volumetric capacity of the LPG storage vessels shall not exceed 1058 cum (450 MT of LPG) if the entire bulk storage in the plant is in mounded bullets.

OR

c) If there is combination of above ground bullets and mounded storage vessels, the total volumetric capacity of above ground bullets in the combination shall not exceed 235 cum (100 MT of LPG) and the total volumetric capacity of combined storage shall not exceed 1058 cum (450 MT of LPG).

5.3 SEGREGATION OF VESSELS AT DIFFERENT PLANE

It is to be ensured that the top surface of all the vessels connected to common manifold are on same plane. Alternatively fail safe interlock like 3-way valve shall be provided so as to avoid any chances of over filling of adjacent vessel(s) due to gravitation.

5.4 CONFINEMENT/GRADING -

Kerb wall shall be provided around all sides of the storage vessel with concrete flooring of the ground under vessel and extending up to minimum distance of D/2 or 5M whichever is higher and at least 5 M (min.) from the edge of the storage vessel with a slope of 1:100 (min.). Grading of the ground underneath should be leveled and directed to an area connected with water seal away from the storage vessel.

Kerb wall height shall be minimum 30 cm but shall not exceed 60 cm otherwise evaporation of spilled LPG may get affected. Spillage diversion area shall be located at a distance where the flames from fire will not impinge on the vessel. This distance shall not be less than the diameter of the nearest vessel or minimum 15 M. No accumulation of LPG should be possible underneath the storage vessel in any condition.

5.5 FITTINGS

For above ground bullets and mounded storage shall have a single nozzle at the bottom or liquid inlet as well as outlet. The nozzle shall be full welded pipe; stress relieved along with the vessel and shall extend minimum 3 meters from the shadow of the sphere/ bullet. A remote operated shutdown valve (ROV) shall be provided on this bottom nozzle at a distance of at least 3 meters from the shadow of bullet. Pipe shall have a minimum slope of 1.5 o.

There shall not be any other flanges, manhole, and instrument tapping on this nozzle up to the

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ROV or on bullet bottom.

5.6 INTER DISTANCES:
As per table 1 & 2 of OISD-GDN-169 and for mounded storage OISD- STD- 150

5.7 FILLING FACILITY
For safety reasons, the operation of facilities should be restricted to maximum two shifts operation. Facilities to include the following:

a) Filling Machines (Stationary or Carousel): With not more than 10 filling units.
b) Check Scale: To countercheck the quantity of LPG filled.
c) Correction scale with Auto cut off Facility.
d) Compact Valve Tester or any other proven device: To check valve/”O” Ring leakage.
e) Test Bath: To check the body / bung leak cylinders.
f) Evacuation Rack: For evacuation of cylinders.
g) Purging Manifold: For purging of cylinders.
h) Vapour extraction system at strategic locations near carousel/manual filling machines, cylinder evacuation unit, valve changing unit and at locations where leaking LPG is expected to accumulate shall be provided. Further, it shall be interlocked with carousel if provided so that filling does not start without vapour extraction unit being functional.

5.8 FILLING MACHINE
The filling machines shall be provided with auto cut-off system to ensure that LPG supply is cut-off after filling the desired quantity of product. The filling pressure shall not exceed the design pressure of the cylinders.

5.9 INSTRUMENTATION:
The storage vessel shall have minimum 2 different types of level indicators. One of them shall be High Level switch with alarm interlocked to close ROV of liquid line and the other may be - Slip Tube Gauge/Roto Gauge/Rochester Gauge/Servo Gauge/Radar Gauge/ or any other proven gauge developed through advancement in technology.

5.10 SAFETY & FIRE PROTECTION
All LPG storage vessels, LPG Sheds, TLD and LPG Pump & Compressor House shall be provided with heat detection based auto operated sprinkler system with deluge valve as explained below:

5.9.1 AUTOMATIC FIRE PROTECTION SYSTEM
a) Automatic fire protection (Fixed) system based on heat detection through thermal fuses or quartz bulbs or EP detectors or any other detector with proven technology shall be employed. Sensors shall be installed at all critical places wherever medium velocity spray system has been installed as described below:

i) In LPG storage area, such detectors shall be provided encircling each vessel, equi-spaced with a maximum horizontal spacing of 1 meter at an elevation of about 1.5 to 2.0 meter from bottom of vessel. Also minimum 2 nos. detectors shall be provided at the top of the vessel and at least one near the liquid line ROV to take care of failure of flanges. In case of an automatic thermal fuse based fire protection system the instrument air supply pressure to thermal fuses shall be maintained through a pressure control valve and a restriction orifice.

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ii. Heat Detectors shall be placed at critical location in LPG Sheds, TLD and LPG Pump & Compressor house, cold repair sheds etc.

b) In case, Quartzoid Bulbs are used for detection, the same shall be designed to blow at 79 deg. centigrade (max.) and Quartzoid Bulb network shall be maintained with plant air at a pressure not more than 3.5 kg/sq.cm.g and shall be such that the discharge of air through one Quartzoid Bulb will depressurize the system to actuate the deluge valves.

c) In case of Electro pneumatic (E.P) heat detectors, it shall actuate the deluge valve in any of the following conditions:
   i. Rate of rise - 10 °C/min of temp.
   ii. At 79 deg. C (max.)

   The EP detectors shall be divided in groups and alternate detectors shall be connected in one circuit. Two detectors from two different groups shall function/operate for actuation of sprinkler system.

d) Water spray nozzles and heat detection system shall be of approved type and duly certified for the performance.

e) The actuation of detectors shall initiate the following:
   i. Opening of deluge valve of the affected zone as well as adjacent zones.
   ii. Audio-visual alarm indicating the affected zone at the fire pump house and manned control panel. The control panel shall also have status indications for deluge valves with facility for actuation.
   iii. Fire siren of 1 km range
   iv. Closure of all Remote Operated Valves in affected facility.
   v. Tripping of main power supply barring the emergency power
   vi. The water spray from all nozzles within 30 seconds.
   vii. The fire water pump(s) shall start based on their set pressure to supplement/to maintain the fire water pressure in the ring main.

5.11 HYDRANT MAIN

Fire water ring main always charged with water maintain residual pressure of 7 Kg /sq. cm at farthest point with the help of Jockey Pump.

5.12 The requirements under this section are additional requirements and all other provisions of OISD-GDN-169 shall be applicable for the installations covered under this addendum.
Annexure - II

STACKING ARRANGEMENT OF LPG CYLINDERS

Each lot: 25 x 4 x 2 (High) (Nos.)

Section A-A
Vertical Stack - 2 High

(Refer Section 2.5.3 for Details)

"OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines."