FIRE PROTECTION FACILITIES
FOR
PORTS HANDLING HYDROCARBONS

Prepared by

COMMITTEE ON STANDARD ON “FIRE PROTECTION FACILITIES FOR PORTS HANDLING HYDROCARBONS”

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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

The Oil Industry in India is more than 100 years old. Because of various collaboration agreements, a variety of international codes, standards and practices have been in vogue. Standardization in design philosophies and operation and maintenance practices at a national level was hardly in existence. This 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-the-art in designing, operating and maintaining oil and gas installations.

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

The first edition of the document "Fire Protection Facilities for Port Oil Terminals" was prepared on request from the Ministry of Surface Transport that the oil industry should coordinate in preparing requirements of fire fighting facilities at port terminals handling hydrocarbons and published in January, 1992. Based on industry requirements and changing regulations, a functional committee was formed and the standard was revised in October, 2005.

The present document "Fire Protection Facilities for Port Terminals handling Hydrocarbons" is the revised document by functional committee based on the accumulated knowledge and experience of industry members and the various national, international codes and practices.

It is hoped that the provisions of this standard, if implemented objectively, may go a long way to improve safety and minimise consequences of accidents at Ports. Users are cautioned that no standard can be substitute for the judgment of responsible and experienced Engineers.

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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These documents are intended to supplement rather than replace the prevailing statutory requirements.
Where ever BIS standards are referred same relates to the latest version of the standard.
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<tr>
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<td>Shri Gyasuddin</td>
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(Second Edition, October, 2005)

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<tbody>
<tr>
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STANDARD FOR FIRE PROTECTION FACILITIES FOR PORTS HANDLING HYDROCARBONS

1.0 INTRODUCTION

Hydrocarbon Loading/ unloading Port terminals are generally located in the remote areas and/or near ports. Experience shows that these installations over the years get surrounded by residential/ Industrial installations in the absence of any statutory regulations prohibiting their construction. The large quantities of inflammable material handled in these installations pose a great threat to their own safety as well as of the surrounding installations. Therefore, it is necessary to introduce in-built fire protection facilities for Port terminals.

The provisions of this standard shall be considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosion at port terminals handling hydrocarbons. However, it is important to assess & comply with the requirements arising from HAZOP studies/ risk analysis and also considering the availability of the mobile firefighting services from Fire Brigade and nearby industries i.e. mutual aid partners as per contingency plan.

2.0 SCOPE

The document lays down the minimum requirements of the fire protection facilities at Port terminals & related facilities to Port Terminals handling hydrocarbons i.e. oil, gas, LPG, LNG and RLNG etc.

This document does not cover petroleum depots / terminals, LPG/ LNG/RLNG installations/ bottling plants, Group Gathering Stations (GGS), Oil Collecting Stations (OCS), Central Tank Farms (CTF), Gas Processing Plants, single point mooring system etc. for which relevant OISD standards should be referred to. The installations at port area used for storage of petroleum shall be in line with OISD-STD-117 - "Fire Protection Facilities for Petroleum Depot and Pipeline Installations" and OISD-STD-194 for “Storage and handling of LNG”.

Ship firefighting is not under the scope of this standard.

3.0 DEFINITIONS

3.1 PORT TERMINAL

All facilities constructed in the sea in the port area for loading/unloading of hydrocarbons from oil tanker/ships with loading arms, piping manifolds, control facilities or pumping in or out of oil liquefied hydro carbon gas to/from storage terminal facilities constitutes a port terminal.

3.2 OIL TERMINAL

That portion of property where combustible/ flammable liquids are received by tanker, pipelines, tank wagons, tank trucks and are stored or blended in bulk for the purpose of distributing such liquids by tankers pipelines, tank wagons, tank trucks, portable tanks or containers constitutes an oil terminal.

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3.3 LNG FACILITY/Terminal

LNG facility is a group of one or more units/facilities i.e. unloading, storage, receiving facilities for LNG, associated systems like utilities, blow down, flare system, fire water storage and fire water network, control room and administration service buildings like workshop, fire station, laboratory, canteen etc..

3.4 WHARF

The area at the dock basin where ancillary facilities such as crane, warehouse etc. are provided for serving the ship.

3.5 JETTY

The actual frontage of the wharf where the fender system is attached for the vessels to berth.

3.6 FSRU

A Floating Storage and Regasification unit, (FSRU), is an LNG regasification terminal whose main structure is a special ship which is capable of transporting, storing, and regasifying LNG on board. Floating regasification also requires either an offshore terminal, which typically includes a buoy and connecting undersea pipelines to transport regasified LNG to shore, or an onshore dockside receiving terminal.

3.7 FLASH POINT

The flash point of petroleum liquid is the minimum temperature at which the liquid gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid within a container.

3.8 CLASSIFICATION OF PETROLEUM PRODUCTS

I) General Classification:

Petroleum Products other than “Liquefied Petroleum Gas” (LPG) & Liquefied Natural Gas (LNG) which is covered under separate category, are classified according to their FLASH POINTS as per closed cup method as follows:

Class “A” : Liquids which have a flash point below 23 oC
Class “B” : Liquids which have a flash point of 23 oC and above but below 65 oC
Class “C” : Liquids which have a flash point of 65 oC and above but below 93 o C

Excluded Petroleum : Liquids which have a flash point of 93 oC and above.

II) Classification for High Ambient Temperatures and for Heated Products:

At locations where the handling temperatures are higher than the flash point of the product or in circumstances where product handled is artificially heated to above its flash point special consideration should be given in the terminal layout.

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3.9 SHALL

“Shall” indicates a mandatory requirement.

3.10 SHOULD

“Should” indicates a requirement which is non-mandatory in nature.

3.11 HIGH HAZARD AREAS

These are the areas where equipment, piping manifolds, valves etc. handling flammable, combustible and toxic products are located.

3.12 DEADWEIGHT

The weight in tonnes of cargo, stores, fuel, passengers and crew carried by the ship when loaded to her maximum summer load line.

Or

Deadweight (DW) means the difference in metric tons between the displacement of a ship in water of a specific gravity of 1.025 at the load waterline corresponding to the assigned summer freeboard and the lightweight of the ship.

4.0 FIRE PROTECTION FACILITIES

4.1 GENERAL

Layout of Port Terminals handling hydrocarbons should be done in accordance with Standard Engineering Practices/Requirements. A good layout provides adequate access for firefighting, escape routes in case of fire and also provisions for segregation of facilities in the event of emergency.

The following fire protection facilities shall be provided depending upon size and nature of risk of installation:

- Fire Water System
- Foam System
- Clean Agent Fire Extinguishing System
- DCP Protection System
- First Aid Fire Fighting Equipment
- Portable & Mobile Fire Fighting Equipment
- Water borne Fire Fighting Equipment
- Fire / smoke / Gas Detection and Alarm System

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4.2 DESIGN CRITERIA FOR FIRE PROTECTION

I) It is assumed that in case of fire on ship tanker, ship will be towed to open sea and that fire protection for ship tanker will be treated as first aid till towing is done.

II) Fire water system shall be designed for facilities on the basis that city fire water is not available close to the installation.

III) One single largest risk shall be considered for providing fire protection facilities.

IV) All facilities shall be covered with Hydrant System.

V) Tower mounted water cum Foam monitors or water monitors, as applicable, shall be provided for protection to loading / unloading arms/first aid to tankers.

VI) Water curtains shall be provided for segregation of loading / unloading arms/piping manifold and ship tanker in the event of fire on either of these facilities.

VII) Fire-proofing shall be provided for the steel pile structure below the deck of the jetty for oil jetty and jetty handling LPG.

VIII) Common firefighting pumps catering to the requirement for tower mounted monitors as well as hydrant service and jumbo water curtains shall be provided.

However, for existing Port terminals handling ships of 50000 tonnes or more, provision of two different sets of Fire water Pumps for:
   a) Tower mounted water cum foam monitors
   b) Hydrant Service and water curtains
   can be continued.

IX) Clean agent fire extinguishing system should be provided for control room / computer room.

X) Dry Chemical Powder (DCP) protection system shall be provided for LPG/Gas loading / unloading port terminal.

4.3 FIRE WATER SYSTEM:

LNG Firefighting:

I. Basics of Liquefied Natural Gas (LNG) firefighting:

Water is not very effective in controlling or extinguishing LNG fires, as application of water on an LNG liquid surface will increase the vapor formation rate as a result increasing the burning rate with negative consequences on fire control.

Water may be used to mitigate gas releases and protect against radiant heat as it entrains large volumes of air that transfer additional heat, diluting the LNG vapor cloud, enhancing its buoyancy resulting in its dispersion.

In case of fire in LNG, water may be used for cooling equipment and structures which are subject to flame impingement or heat radiation due to a fire. As a result, the risk of escalation of the fire and deterioration of equipment can be reduced by early and
concentrated cooling.

LNG firefighting is different from the other hydrocarbons firefighting because probability of pool formation of LNG is low as it will immediately vaporize (Boiling point : (-) 160 Deg C). Also since in contact with water, LNG shows Rapid Phase Transformation (RPT) phenomenon. Hence, the use of foam in case of LNG is not warranted.

II. **Liquefied Natural Gas (LNG) firefighting design considerations:**

a. **EN-1473:** Installation and equipment for liquefied natural gas - Design of onshore installations. However, Fire water demand shall be designed for two major fires simultaneously anywhere in storage terminal including jetty area.

**NFPA-59A** - Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG). However, Fire water demand shall be designed for two major fires simultaneously anywhere in storage terminal including jetty area.

These standards recommend risk based approach to provide fire protection system at LNG facilities.

EN 1473 suggests hazard assessment should be done considering the LNG flow rate and duration (unloading).

b. **ISGOTT** standard recommends firewater flow at the jetty based on the ship’s capacity.

The flow rates recommended in the ISGOTT are proposed in the OISD-STD-156 for the jetties handling LNG loading/unloading.

c. The risk of fire being dealt with is a point risk as the safety shutdown system exists to cut off the source of supply in such events (ESD-2)

d. Therefore, the proposed firewater application rates for protecting the LNG manifold and overall flow rates for LNG jetty are in accordance with the acceptable international standards on LNG e.g. EN-1473, NFPA-59A and ISGOTT.

For the purpose of firefighting, water turrets, spray and mist/fog may be used effectively against oil fires and for making a screen between the fire fighter and the fire. Water is used for fire extinguishing, fire control, cooling of equipment etc.

Water should be used with discretion in areas of electrical equipment. Provision should be made to prevent inadvertent operation of a water suppression system. When water is used, an adequate drainage system should be provided. Before selecting water for use indoors, it should be determined if the equipment is water tight.

For protection of electrical transformer and other electrical facilities fire protection shall be provided as per OISD-STD-173 on “Fire Prevention and Protection System for Electrical Installations”

The electrical fittings & fixtures at jetty area shall be provided as per Hazardous area classification.

4.3.1 **COMPONENTS OF WATER SYSTEM**

The main components of the system are:

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Design Flow Rate

- Fire water pumps.
- Distribution piping network.

4.3.2 DESIGN FLOW RATE

i) The fire water system at port Terminal shall be designed to meet the fire water flow requirements of a single largest risk at a time (Note-1).

Note-1: Fire water demand for Port Terminal having more than one jetty, shall be designed for maximum fire water demand of any jetty in the port terminal. Fire water demand for Jetty shall be as per Cl. no. 4.3.2 (ii).

ii) Fire water flow rate for Port terminal protection shall be aggregate of the following:

- Water flow for Tower mounted water/ foam monitors for protection of loading / unloading arms/ piping manifold and ship tanker.
- Water flow for area segregation by providing jumbo water curtains between ship tanker and loading / unloading arms and Hydrant service.
- Water flow for spray (application rate of 10.2 lpm/ sq.m. on drain vessel, manifold located at Jetty head.
- Supplementary hose requirement of 144 m$^3$/hr.

iii) Design Flow rate shall vary with type of product and size of ships handled. Refer Table-1 (for POL products), Table – 2 (for Liquefied Petroleum Gas) & Table – 3 (Liquefied Natural Gas) for water flow requirements for fire monitors & jumbo curtain nozzles.
### TABLE-1

**FIRE WATER DESIGN REQUIREMENT FOR PORT TERMINALS HANDLING OIL AND PETROLEUM PRODUCTS (EXCLUDING LIQUIFIED HYDROCARBON GASES)**

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<th>FIRE WATER RATE</th>
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<td>(1)</td>
<td>Barge berth at a wharf or Jetty</td>
<td>Two nos. Fire water/ foam monitor of capacity 500 GPM (1892 lpm or 113.52 M³/hr) each \ Supplementary hose requirement of 144 M³/hr. \ <strong>Total water requirement = 371.04 M³/hr</strong></td>
</tr>
<tr>
<td>(2)</td>
<td>Tanker berth at a wharf or jetty handling ships of less than 20,000 tonnes</td>
<td>Two nos. tower Fire water/ foam monitor of capacity 750 GPM (2840 lpm or 170.4 M³/hr) each \ Supplementary hose requirement of 144 M³/hr. \ <strong>Total water requirement = 484.80 M³/hr</strong></td>
</tr>
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<td>Dealing capacity of 20,000 tonnes and above but less than 50,000 tonnes.</td>
<td></td>
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<tr>
<td>(3)</td>
<td>Tanker berth at a wharf or Jetty Handling ships of 20,000 tonnes and</td>
<td>Two nos. tower Fire water/ foam monitor of capacity 750 GPM (2840 lpm or 170.4 M³/hr) each \ Supplementary hose requirement of 144 M³/hr. \ <strong>Total water requirement = 844.80 M³/hr</strong></td>
</tr>
<tr>
<td></td>
<td>above but less than 50,000 tonnes.</td>
<td>Two nos. Jumbo curtain nozzles of capacity 3000 lpm (180 M³/hr) each \ Supplementary hose requirement of 144 M³/hr.</td>
</tr>
<tr>
<td>(4)</td>
<td>Tanker berth at a wharf of Jetty handling ships of 50,000 tonnes and</td>
<td>Two nos. tower Fire water/ foam monitor of capacity 1500 GPM (5678 lpm or 340.68 M³/hr) each \ Supplementary hose requirement of 144 M³/hr. \ <strong>Total water requirement = 1425.36 M³/hr</strong></td>
</tr>
<tr>
<td></td>
<td>above but less than 100,000 tonnes deadweight</td>
<td>Two nos. Jumbo curtain nozzles of capacity 5000 lpm each (300 M³/hr) \ Supplementary hose requirement of 144 M³/hr.</td>
</tr>
<tr>
<td>(5)</td>
<td>Tanker berth at wharf or Jetty handling ships of 100000 tonnes</td>
<td>Two nos. tower Fire water/ foam monitor of capacity 2000 GPM (7570 lpm or 454.2 M³/hr) each \ Supplementary hose requirement of 144 M³/hr. \ <strong>Total water requirement = 1772.40 M³/hr</strong></td>
</tr>
<tr>
<td></td>
<td>deadweight or larger capacity.</td>
<td>Two nos. Jumbo curtain nozzles of capacity 6000 lpm each (360 M³/hr)</td>
</tr>
</tbody>
</table>

- In case a jetty is handling both liquid petroleum and LPG, the stringent requirement will apply.
**TABLE-2**
**FIRE WATER DESIGN GUIDE FOR PORT TERMINAL HANDLING LIQUEFIED HYDROCARBON GASES**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>INSTALLATION</th>
<th>FIRE WATER RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Tanker berth at Jetty handling ships of less than 10,000 tonnes deadweight</td>
<td>Two no. tower Fire water/foam monitor of capacity 750 GPM (2840 lpm or 170.4 M³/hr) each&lt;br&gt;Two nos. Jumbo curtain nozzles of capacity 3000 lpm each (180 M³/hr)&lt;br&gt;Supplementary hose requirement of 144 m³/hr.&lt;br&gt;<strong>Total water requirement = 844.80 M³/hr</strong></td>
</tr>
<tr>
<td>(2)</td>
<td>Tanker berth at a Jetty handling ships of 10000 tonnes and more but less than 20,000 tonnes deadweight</td>
<td>Two nos. tower Fire water/foam monitor of capacity 1500 GPM (5678 lpm or 340.68 M³/hr) each&lt;br&gt;Two nos. Jumbo curtain nozzles of capacity 6000 lpm each (360 M³/hr)&lt;br&gt;Supplementary hose requirement of 144 m³/hr.&lt;br&gt;<strong>Total water requirement = 1545.36 M³/hr</strong></td>
</tr>
<tr>
<td>(3)</td>
<td>Tanker berth at a Jetty handling ships of 20000 and more but less than 40,000 tonnes deadweight</td>
<td>Three nos. tower Fire water/foam monitor of capacity 1500 GPM (5678 lpm or 340.68 M³/hr) each&lt;br&gt;Three nos. Jumbo curtain nozzles of capacity 6000 lpm each (360 M³/hr)&lt;br&gt;Supplementary hose requirement of 144 m³/hr.&lt;br&gt;<strong>Total water requirement = 2246.04 M³/hr</strong></td>
</tr>
<tr>
<td>(4)</td>
<td>Tanker berth at a Jetty handling ships of more than 40,000 tonnes deadweight</td>
<td>Four nos. tower Fire water/foam monitor of capacity 2000 GPM (7570 lpm or 454.2 M³/hr) each&lt;br&gt;Four nos. Jumbo curtain nozzles of capacity 6000 lpm each (360 M³/hr)&lt;br&gt;Supplementary hose requirement of 144 m³/hr.&lt;br&gt;<strong>Total water requirement = 3400.80 M³/hr</strong></td>
</tr>
</tbody>
</table>

- In case a jetty is handling both liquid petroleum and LPG/RLNG, the stringent requirement will apply.
TABLE-3

FIRE WATER DESIGN GUIDE FOR PORT TERMINAL HANDLING LIQUEFIED NATURAL GAS (LNG)/ Re-Liquefied Natural Gas (RLNG)

<table>
<thead>
<tr>
<th>INSTALLATION</th>
<th>FIRE WATER RATE</th>
</tr>
</thead>
</table>
| Tanker berth at jetty handling "Conventional" LNG carrier of capacity up to 1,45,000 M³ | The fire water flow rate at the LNG jetty irrespective of the LNG carrier size and LNG unloading rate, shall be calculated based on following:
1. Two tower monitors shall be provided @ 1000 GPM |
| Tanker berth at jetty handling "Q-Flex" type LNG carrier of capacity above 1,45,000 M³ up to 2,15,000 M³ | 2. Jumbo curtain nozzles shall be provided at the front side of jetty head between LNG carrier and jetty head having application rate of 70 lpm/meter run of the jetty. |
| Tanker berth at jetty handling "Q-Max" type LNG carrier of capacity more than 2,15,000 M³ | 3. Fire Protection of jetty manifold & drain vessel area @ of 10.2 lpm/m². |
| | 4. Supplementary hose requirement of 144 M³/hr. |

4.3.3 DESIGN FIRE WATER PRESSURE

The fire water pressure system shall be designed for a minimum residual pressure of 7.0 Kg/cm² at the hydraulically remotest point of application in the terminal.

4.3.4 FIRE WATER SOURCE

Sea water which is available in plenty near Port Terminal is normally used for firefighting. However, consideration shall be given to location of fire water source such that it is away from oil leakage source.

4.3.5 FIRE WATER PUMPS

i) Centrifugal type fire water pumps shall be installed to meet the design fire water flow rate and head.

ii) The pumps shall be capable of discharging 150% of its rated discharge at a minimum of 65% of the rated head. The Shut-off head shall not exceed 120% of rated head for horizontal centrifugal pumps and 140% for vertical turbine pump.

iii) At least one standby fire water pump shall be provided upto 2 nos. of main pumps. For main pumps 3 nos. and above, minimum 2 nos. standby pumps of the same type, capacity & head as the main pumps shall be provided.

iv) The fire water pump(s) including the standby pump(s) shall be of diesel engine
driven type. Where electric supply is reliable 50% of the pumps may be electric driven. The diesel engines shall be quick starting type with the help of push buttons located on or near the pumps or located at a remote location. Each engine shall have an independent fuel tank adequately sized for 6 hours continuous running of the pump.

v) Fire water pump shall be located in a covered shed 100 M (Minimum) away from equipment or where hydrocarbons are handled or stored.

vi) Fire water pumps shall be exclusively used for fire fighting purpose only.

vii) The capacity of the jockey pump shall be sufficient to maintain system pressure in the event of leakages from valves etc., The capacity of the jockey pumps shall be minimum 5% of the design fire water flow rate for all new installations or wherever any augmentation is carried out. However, for all the existing installations capacity of the jockey pumps shall continue to be minimum 3% of the design flow rate. The fire water system shall be kept on auto mode at a minimum pressure of 7 kg/cm² at jetties where a tanker is berthed and/or the hydrocarbon lines are kept charged after loading/unloading. At jetties where flushing of hydrocarbon lines are done after each loading/unloading the fire water network need not be kept charged.

4.3.6 FIRE WATER DISTRIBUTION NETWORK

i) The fire water network shall be laid to ensure multi-directional flow in the system where possible. Isolation valves shall be provided in the network to enable isolation of any section of the network. The isolation valves shall be located normally near the loop junctions. Additional valves shall be provided in the segments where the length of the segment exceeds 300 meters.

ii) The fire water network piping should normally be laid above ground at a height of 300 mm to 400 mm above finished grade. However, the fire water network piping shall be laid below ground level at the following places:
   a. Road crossings.
   b. Places where the above ground piping is likely to cause obstruction to operation, vehicle movement and placed where the above ground piping is likely to get damaged mechanically.

iii) The pipe support shall be as per OISD-STD-117.

iv) Where the pipes are laid underground the following protections shall be observed:
   - The main shall have at least one metre earth cushion in open ground and 1.2 metre cushion under the roads.
   - The mains shall be provided with protection against soil corrosion by suitable coating/wrapping.
   - In case of poor soil conditions it may be necessary to provide concrete / masonry supports under the pipe.

v) Where the pipes are laid above ground, the following protection shall be provided:
   - The mains shall be supported at regular intervals not exceeding 6 meters.

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

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

The system shall be designed so that a minimum 7 kg/cm² residual pressure is available at the hydraulically remotest section of the terminal for the designed flow rate at that point.

vii) As per International maritime requirements all marine terminals and berths with a Fire water system should have at least one International Shore Fire Connection (ISFC) through which water could be supplied to a tanker fire main, if required for shipboard fire fighting. The purpose of the International Shore Fire Connection is to connect the fire water supply from shore to the ship fire main or to interconnect the fire mains of two ships. The shore fire connection provides a standardized joint between two systems where each might otherwise have couplings or connections that do not match.

All ships, jetties and apparatus likely to require an emergency source of fire water or to provide it should have at least one shore fire connection.

The flange on the connection should have a flat face on one side and on the other should be a coupling that will fit the hydrant or hose on the ship or shore as appropriate.

The connection should be kept readily available together with a gasket of any material suitable for 1.0 N/mm² services, and with four 16 mm bolts, 50 mm in length, and eight washers.

Fire hose having a shore fire connection on the end is led to its counterpart and the flange joints are bolted together. If the shore fire connection is permanently fixed to a hydrant or pipe then a portable connection for use on a hose must be available in case the opposite fire main has only a fixed connection.

If fixed on a vessel, the connection should be accessible from either side of the vessel and should be plainly marked. The shore fire connection should be ready for use when a ship is in port.

(vii) The water velocity shall not exceed 5 m/s in the fire water distribution network.

(viii) A water curtain shall be provided between loading/unloading arms and ship tanker for segregation of the facilities/hazardous areas.

4.3.7 HYDRANTS

i) Hydrants shall be located bearing in mind the fire hazards at different sections of the premises to be protected and to give most effective service. At least one hydrant post shall be provided for every 30 metre length on the Jetty for high hazard area. Hydrants protecting utilities and miscellaneous buildings may be spaced at 45 metre intervals. The horizontal range & coverage of hydrants with hose connections shall not exceed 45 M.
ii) Hydrants shall be located at a minimum distance of 15 metre from the periphery of tanker or equipment under protection. In case of buildings, this distance shall not be less than 2 meters from the face of building. Provision of hydrants within the building shall be provided in accordance with IS : 3844.

Hydrant/Monitors shall be located along side berths for easy accessibility.

iii) Double headed hydrants with two separate landing valves on 4” stand post shall be used. All hydrant outlets shall be situated 1.2 metre above ground level/operating platform.

4.3.8 WATER CUM FOAM MONITORS

a) Tower Monitors

For protection of ship tank and loading arms long range/ high head foam/water monitor shall be used. This can be effectively achieved by mounting monitor on a steel tower of suitable height. Tower Monitors shall be provided in line with Table-1/ Table-2/ Table-3. These shall be remote operated from control room in addition to remote operation from field control panel located in safe area. Horizontal rotation of tower monitor shall be 340 degree.

The height of the monitor shall be such that it will cover the manifold area of the deck of the largest tanker in the lightest condition at spring tides at the jetty. Tower monitors shall be located minimum 15 Mts. away from the hazardous area it is to protect. Structure of tower monitor shall be provided with fire proofing. Fire resistant cables shall be used for the control cables of tower monitors. However, if existing monitors cannot be relocated then a concrete cover shall be provided over the steel structure so that it is protected against fire. Alternatively, fixed water spray shall be provided to cool the structure.

b) Ground Monitors

Ground Monitors shall be located to direct water on the object as well as to provide water shield to firemen approaching a fire. These monitors also shall not be installed less than 15 M from hazardous equipment.

Connection for fixed water monitors shall be provided on the fire water network. Each of these connections shall be provided with independent isolation valves.

The layout of monitor shall be established based on hazard involved and layout considerations.

4.3.9 MATERIAL SPECIFICATIONS

The piping material specification shall be as given below. In case of sea water service, the fire water main pipes shall be cement lined or poly glass lines or glass reinforced internally.

i) Pipes Carbon Steel as per IS:3589/ IS:1239

ii) Isolation Valves Cast steel (rising stem type).
With indication for close / open positions
iii) Hydrant Stand post
Outlet Valves/ Landing Valves

Carbon Steel / Stainless Steel / Aluminum alloy

iv) Monitors

Aluminum alloy / Gun Metal

v) Fire Hose

Reinforced rubber lined as per IS : 636 Type (B)
/UL or equivalent standard

vi) Foam Piping

Stainless Steel / Galvanized Iron

In case of underground mains the isolating valves shall be located in RCC/brick masonry chamber.

The above fire water mains and the hydrant stand post shall be painted with corrosion resistant "Fire Red" paint as per Shade 641 of IS:5.

Water monitor and hose box shall be painted with luminous yellow paint as per IS:5.

All foam monitors shall be UL/FM/ listed / approved or equivalent standard.

4.3.10 FIXED WATER SPRAY SYSTEM

It is fixed pipe system connected to a reliable source of water supply and equipment with water spray nozzles for specific water discharge and distribution over the surface or area to be protected. The piping system is connected to the hydrant system water supply through an automatically or manually actuated valve which initiates the flow of water.

i) Fixed water spray system (Jumbo curtain type) shall be provided at all jetties handling ships of more than 20000 tonnes deadweight for segregation of loading arms and ship.

ii) Water supply patterns and their densities shall be selected according to need. Fire water spray system for exposure protection shall be designed to operate before the possible failures of any containers of flammable liquids or gases due to temperature rise. The system shall, therefore, be designed to discharge effective water spray within shortest possible time.

4.4 FOAM SYSTEM

For fires in port terminals handling petroleum, use of water as extinguishing agent gets limited to cooling only. In such cases, foam shall be used to cut off oxygen supply from atmosphere to burning surface. AFFF foam compounds are technically superior and compatible with fire fighting agents. Efficient and effective foam delivery system is a vital tool for its usefulness in controlling the fire. The foam system should be designed to create foam blanket on the burning surface in a reasonably short period. Foam shall be applied to the burning hazard continuously at a rate high enough to overcome the destructive effects of radiant heat.

4.4.1 Foam

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Generally, two types of foams are in use. These are low expansion foam and high expansion foam. Low expansion foam has an expansion ratio 1:5 to 1:15 and is used for hydrocarbon oil fire. High expansion foam has an expansion ratio of 1:200 to 1:1000 is used for protection of Hydrocarbon gases stored under cryogenic conditions and for warehouse protection.

High expansion foam systems have special applications and are not commonly used in oil industry. Their requirement may be examined for specific needs. The details of such systems are not covered in this standard.

Foams are classified by producing action of generation and expansion. Foam concentrate to be used shall conform to IS:4989/ UL-162 or equivalent standard.

For details of Fire Fighting Foam Compounds, the OISD guidelines “OISD-GDN-115 – Guidelines on Fire Fighting, Equipment and Appliances in Petroleum Industry” may be referred.

4.4.2 Low Expansion System

For combating large hydrocarbon fires particularly, in contained area like a tanker, foam has proved useful for its inherent blanketing ability, heat resistance and security against burn back. Efficient and effective foam delivery system is a vital tool for its usefulness in controlling the fire.

The process of adding or injecting the foam is called proportioning. The mixture of water and foam liquid (foam solution) is mixed with air in a foam maker for onward transmission to burning surface.

4.4.3 Foam Conveying Systems

The system consists of adequate water supply, supply of foam concentrate, suitable proportioning equipment, a proper piping system, foam makers and discharge devices designed to adequately distribute the foam over the hazard. The system shall have provision for flushing with fresh water after use and testing of the system. At jetties the foam is applied through foam monitors.

4.4.4 Foam Application Rates

Provision of foam facilities and application shall be in line with OISD-STD-117/ 244. For tower monitor the foam solution rate shall match monitor discharge capacity.

4.4.5 Duration of Foam Discharge

The foam equipment shall be capable of operation to provide primary protection at the delivery rates specified for a minimum period of 30 minutes.

4.4.6 Water for Foam Making

Water used for making foam shall be compatible with the foam compound used.

4.4.7 Foam Compound Requirement

i) The foam compound requirement shall be calculated based on two tower mounted monitors operating simultaneously for minimum 30 minutes.

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ii) The quantity required for two portable foam monitors of 2400 LPM foam solution capacity shall be provided.

The aggregate quantity of foam solution shall be sum of (i) and (ii) for a minimum period of 30 minutes for each jetty. From this calculate the quantity of foam concentrate required based on 1% to 6% concentrate.

Requirement of foam compound storage has been indicated in Table 4.

iii) Foam compound requirement for oil Port terminal having more than one oil jetty shall be as below:

a) The foam compound quantity shall not be less than the requirement for the largest jetty and shall be so located that it is available to fight fire at any of the jetties.

iv) For common storage Terminal foam requirement shall be carried out based on minimum 65 minutes.
TABLE 4

FOAM COMPOUND REQUIREMENT

<table>
<thead>
<tr>
<th>INSTALLATION SIZE</th>
<th>BASIS OF FOAM REQUIREMENT</th>
<th>3% FOAM COMPOUND REQUIREMENT (Note: if 6% Foam compound is used the requirement will be twice the quantity shown below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Barge Berth at wharf of jetty</td>
<td>2 x 3000 lpm Foam Monitors</td>
<td>5400 litre</td>
</tr>
<tr>
<td>2. Tanker Berth at wharf of jetty handling ships of less than 20000 tonnes deadweight capacity.</td>
<td>2 x 3000 lpm Foam Monitors</td>
<td>5400 litre</td>
</tr>
<tr>
<td>3. Tanker Berth at a wharf or jetty handling ships of 20,000 tonnes &amp; above but less than 50,000 tonnes dead weight</td>
<td>2 x 3000 lpm tower Foam Monitors + 1 base Monitor 1 x 1500 lpm</td>
<td>5400 litre 1350 litre 6750 litre</td>
</tr>
<tr>
<td>4. Tanker Berth at a wharf jetty handling ships of 50,000 tonnes &amp; above but less than 1,00,000 tonnes dead wt.</td>
<td>2 x 5000 lpm Tower Foam Monitor + 2 x 2400 lpm base Foam Monitor</td>
<td>13320 litre</td>
</tr>
<tr>
<td>5. Tanker Berth at wharf or jetty handling ships of 1,00,000 tonnes dead wt. and larger.</td>
<td>2 x 6000 lpm Tower Foam Monitors + 2 x 2400 lpm base Foam Monitors.</td>
<td>15120 liters</td>
</tr>
</tbody>
</table>

Note: The above foam compound requirement shall be stored in addition to that available in mobile equipment like foam tender, fire float etc.

4.4.8 Foam Compound Storage

Foam compound should be stored in containers of 20-30 litre capacity or 200/210 litre capacity barrels. Foam compound can also be stored in overhead storage tank of suitable capacity for quick filling of foam tender/nurser during emergency. Minimum life of foam compound shall be taken as per manufacturer's data.

Foam compound shall be tested periodically for ensuring its quality and the deteriorated quantity replaced. Acceptable range of pH shall be 6.5 to 7.5. The deteriorated foam compound can be used for fire training purposes for details of type of tests and periodicity refer to OISD-GDN-115 Guidelines for Fire fighting Equipment.

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Appliances in petroleum industry.

Quantity of foam compound equal to 100% of requirement as calculated in 4.4.7 should be stored in the Installation. This quantity may be suitably reduced if mutual aid for foam supply is available.

4.5 CLEAN AGENT (HALON SUBSTITUTE) FOR CONTROL ROOM & SATELLITE RACK ROOM (SRR):

4.5.1 General

Selection of Clean Agent and design of Fire protection system for process control rooms, computer rooms, SRR and pressurized rooms shall follow the Standard on “Clean Extinguishing systems NFPA Standard 2001 (latest edition) including its safety guidelines with Agent respect to “Hazards to Personnel”, electrical clearance and environmental factors in line with environmental considerations of Kyoto & Montreal Protocols and latest Mo&EF regulations.

4.5.2 Each hazard area to be protected by the protection system shall have an independent system. The time needed to obtain the gas for replacement to restore the systems shall be considered as a governing factor in determining the reserve supply needed. 100% standby charge of clean agent containers shall be considered for each protected hazard. Storage containers shall be located as near as possible to hazard area but shall not be exposed to fire. Storage containers shall be carefully located so that they are not subjected to mechanical, chemical or other damage. All the components of the system shall be capable of withstanding heat of fire and severe weather conditions.

4.5.3 QUANTITY AND STORAGE

Each hazard area to be protected by the protection system shall have an independent system.

The time needed to obtain the gas for replacement to restore the systems shall be considered as a governing factor in determining the reserve supply needed. 100% standby containers shall be considered for each protected hazard.

Storage containers shall be located as near as possible to hazard area but shall not be exposed to fire.

Storage containers of system located on storage tank shall be carefully located so that they are not subjected to mechanical, chemical or other damage. All the components of the system shall be capable of withstanding heat of fire and severe weather conditions.

It is important that persons shall be evacuated from the area after the system comes into actual operation.

4.6 DCP PROTECTION SYSTEM

Dry Chemical Power (DCP) is discharged from a fixed system or a portable extinguisher as a free flowing cloud. (It is most effective in dealing initially with a fire resulting from an oil spill on a jetty or on the deck of a tanker but can also be used in confined spaces. It is especially useful for burning liquids escaping from leaking pipelines and joints. It is a non-conductor and suitable agent for dealing with electrical fires).
DCP has negligible cooling effect and gives no protection against re-ignition. DCP of foam compatible type should be used in conjunction with foam.

DCP application rates for fixed systems shall be decided based on risk involved. These are usually based on 1 to 2 minutes discharge & used in short spells of 10, 20 or 40 seconds with DCP release of 25 kg to 50 kg/second.

Minimum Requirements for portable and wheeled Fire extinguishers for marine terminals is given in Table-5 and Table 6. A first aid fire fighting equipment criteria to determine quantity required is also enclosed at Annexure-I.

4.7 FIRE FIGHTING EQUIPMENT

4.7.1 Portable Fire Extinguishers

Portable extinguishers shall be located at convenient locations and shall at all times be readily accessible and clearly visible. The maximum running distance to locate an extinguisher shall not exceed 15 meters.

4.8 MOBILE FIRE FIGHTING EQUIPMENT

4.8.1 Land Based

Mobile fire fighting equipment include foam ‘tenders’, water tender, DCP tenders etc. The requirement of such equipment shall be decided keeping in view the size, nature and location of Jetty. The equipment available at nearby installations and their availability in case of need shall be taken into consideration for deciding the type & no. of mobile fire fighting equipment. The guidelines for selection of fire fighting equipment are covered in OISD-GDN-115.
### TABLE-5

**MINIMUM REQUIREMENT FOR PORTABLE AND WHEELED FIRE EXTINGUISHER FOR TERMINALS HANDLING CRUDE OIL & PETROLEUM PRODUCTS**

<table>
<thead>
<tr>
<th>SL.NO.</th>
<th>INSTALLATION</th>
<th>REQUIREMENT OF FIRE EXTINGUISHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>i) Barge berth at a wharf or Jetty</td>
<td>2 x 9 Kg DCP Extinguisher</td>
</tr>
<tr>
<td></td>
<td>ii) Barge berth at a wharf or Jetty handling ships or less than 20,000 DCP tonnes capacity</td>
<td>2 x 50 kg wheeled DCP extinguishers, 2 x 9 kg DCP Extinguishers.</td>
</tr>
<tr>
<td>2.</td>
<td>Tanker berth at a wharf or Jetty handling ships of 20,000 tonnes and above but less than 50,000 tonnes capacity.</td>
<td>4 x 9 kg DCP Extinguishers 2 x 75 kg wheeled DCP Extinguisher.</td>
</tr>
<tr>
<td>3.</td>
<td>Tanker berth at a wharf or Jetty handling ships 50,000 tonnes upto less than 100000 Tonnes capacity</td>
<td>6 x 9 kg DCP Extinguishers of 4 x 75 wheeled DCP extinguishers.</td>
</tr>
<tr>
<td>4.</td>
<td>Tanker berth at a wharf or jetty handling ships of 100000 Tonnes and larger</td>
<td>do-----</td>
</tr>
</tbody>
</table>

### TABLE-6

**REQUIREMENT FOR PORTABLE AND WHEELED FIRE EXTINGUISHER FOR PORT TERMINALS HANDLING LIQUEFIED HYDROCARBON GAS (OTHER THAN LNG/RLNG)**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>INSTALLATION</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tanker berth at a wharf or Jetty handling ships less than 10,000 tonnes deadweight</td>
<td>4 x 9 kg DCP extinguishers 4 x 75 kg wheeled DCP extinguishers</td>
</tr>
<tr>
<td>2.</td>
<td>Tanker berth at a wharf or Jetty handling ships of 10,000 tonnes to 20,000 tonnes capacity</td>
<td>6 x 9 kg DCP Extinguishers 8 x 75 kg wheeled DCP extinguishers.</td>
</tr>
<tr>
<td>3.</td>
<td>Tanker berth at a Jetty handling ships of 20000 to 40,000 tonnes deadweight</td>
<td>8 x 9 kg DCP extinguishers 10 x 75 kg wheeled DCP extinguishers.</td>
</tr>
<tr>
<td>4.</td>
<td>Tanker berth at a Jetty handling ships of more than 40,000 tonnes deadweight</td>
<td>10 x 9 kg DCP extinguisher 12 x 75 kg wheeled DCP extinguishers</td>
</tr>
</tbody>
</table>

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Table -6A

REQUIREMENT FOR PORTABLE AND WHEELED FIRE EXTINGUISHER FOR PORT TERMINALS HANDLING LIQUEFIED NATURAL GAS (LNG)/ RE-GASIFIED LIQUEFIED NATURAL GAS (RLNG)

<table>
<thead>
<tr>
<th>INSTALLATION</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanker berth at jetty handling &quot;Conventional&quot; LNG carrier of capacity up to 1,45,000 M³</td>
<td>1. Portable DCP fire extinguisher - 9 Kg capacity. The number shall be determined based on the maximum traveling distance of 15 M or at least one fire extinguisher shall be provided for every 250 m².</td>
</tr>
<tr>
<td>Tanker berth at jetty handling &quot;Q-Flex&quot; type LNG carrier of capacity up to 2,15,000 M³</td>
<td>2. Wheeled DCP fire extinguisher - 75 Kg capacity. The number should be determined based on the maximum traveling distance of 50 m or at least one fire extinguisher for every 750 m² area.</td>
</tr>
<tr>
<td>Tanker berth at jetty handling &quot;Q-Max&quot; type LNG carrier of capacity more than 2,15,000 M³</td>
<td></td>
</tr>
</tbody>
</table>

4.9 FIRE PROTECTION AT PORT

A port terminal handling hydrocarbons shall be provided with the fire Water system, foam feed system, Safety equipment, First aid equipment, Mobile equipment etc. to combat emergencies. The facilities required for a large size Port Terminal is given at Annexure-II.

4.10 SAFETY EQUIPMENT IN FIRE STATION

The following Safety equipment shall be provided in Fire Station of each Port Terminal:

(i) HOSES

Fire hoses shall be stored in a central hose station in the oil installation. The hoses shall be of 15 mtrs; standard length and shall be provided with gun metal /stainless steel male and female couplings of instantaneous pattern.

The number of hoses stored in an oil installation shall be 30% of the number of hydrant outlets. The minimum No. of hoses stored in an installation, however, shall not be less than 10. The hose station shall be located at convenient and easily accessible location in the oil installation.

(ii) NOZZLES

Following minimum quantities of fire fighting nozzles shall also be stored in the central hose stations.

   a. Jet nozzles with branch pipe as per IS:903 - 4 nos.

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b. Fog nozzles pipe as per IS:952 - 4 nos.
c. Universal nozzles as per IS: 2171 - 4 nos.
d. Foam branch pipe as per IS:952 - 4 nos.
e) In addition, HAZCHEM nozzle and high flow long range multi purpose nozzles may also be considered.

(iii) ACCESSORIES

Following minimum quantities of accessories shall be provided:

a. Sand Scoops - 4 nos
b. Safety helmets - 10 nos

c. Water curtain nozzles - 2 nos.
d. Stretcher - 2 nos.
e. First Aid Box - 2 nos. (min)
f. 11 KVA rubber hand gloves - 2 pairs
g. Explosive meter - 1 no.
h. Fire Proximity suit - 2 no.
i. Resuscitator - 2 nos.
j. Electrical siren (3 km range) - 1 no.
k. Hand operated siren - 1 no.(min)
l. Water jel blanket - 2 nos.
m. Red/Green flags - 1 set

n. Positive Pressure type self contained breathing apparatus with spare cylinder - 2 no.
o. Low temperature Gloves for handling LPG/ Cryogenic liquids/ gases - 4 nos.
p. H₂S Gas Detectors - As per need

The DCP powder shall be 25 % of the total required for the portable DCP fire extinguishers and also 2000 kg in case of DCP tender.
5.0 FIRE DETECTION, ALARM & COMMUNICATION SYSTEM

5.1 FIRE DETECTION SYSTEM

The most important component of fire protection system for Port Terminals is detection and alarm system. Timely detection of fire at an early stage, will help in early extinguishing the fire, thus prevent it to become major fire.

For the purpose, fire alarm system consisting of manual call points (break glass), automatic gas/ smoke/ heat detectors, release & inhibit switches for fire suppression clean agent. Conventional or micro-processor based data gathering fire alarm & central fire alarm panel, mimic panels & associated equipment are provided.

Fire alarm and detection system shall conform to the latest edition of Indian & International Standards. In addition, all equipment shall conform to the provisions of Indian Electricity rules and other statutory regulations in force from time to time.

Detectors which are below false floors, above false ceiling or generally hidden should have external response indicator sited at prominent places.

Fire alarm and detection system should derive its power from either mains electricity supply (normal supply) or the standby power supply that should be immediately available in the event of failure of normal supply so as to maintain the equipment in ready condition of taking the maximum load.

A flammable gas detectors provided to give a warning of the presence of flammable gases or vapours in air, well before they reach explosive concentrations. Normally, the detector provides audio- visual alarm signals. These signals are further used to control action such as increasing ventilation or shutting off the source of gas. A flammable gas detector can also be used for tracing leaks and checking that vessels or tunnels are gas free before entering.

Following areas shall be provided with Smoke/ Flame / Heat detectors with alarm and/or system to actuate relevant fire suppression system:

- Computers/ Process control rooms
- Unmanned electric substations / MCC rooms
- Cable galleries

5.2 FIRE ALARM SYSTEM

Electrical/hand operated fire siren shall be installed at suitable location in installation. The operating switch buttons shall be located near the Risk Area at a safe, identifiable and accessible location. In case of installations having area over 15 acres, manual call points may also be considered. The fire alarm shall be different from shift sirens.

5.3 COMMUNICATION SYSTEM

Adequate communication system like telephone/Public Address System/Paging System/ intrinsically safe Walkie-talkie system should be considered.
5.4 MANUAL CALL POINT SYSTEM

Manual call points strategic location shall be provided on Jetty for emergency response audio visual alarm at control room.

5.5 GAS DETECTION SYSTEM

Hydrocarbon gas detectors shall be provided along LPG jetty at locations where there is chance of gas leakage. These areas are mainly loading arms/Manifold area etc.

6.0 FIRE SAFETY ORGANISATION/TRAINING

6.1 ORGANISATION

i) Separate fire fighting set up should be available and one of the officers shall be designated for maintenance and inspection of all fire fighting equipment. He shall also co-ordinate the activities during fire fighting. All marine terminals shall have a 24 hrs fire fighting crew coverage.

   The location in-charge shall also prepare detailed organization chart pertaining to the location and shall inform all the concerned about their roles and responsibilities as per the chart.

ii) Designated Fire Officer responsible for fire protection shall be responsible for issue of hot / cold work permit in line with OISD-STD-105 (Work Permit System). The person shall have the authority to check compliance of Fire Safety requirements of various jobs in the operational areas.

iii) Overall responsibility for fire safety in the Port Terminal shall be of the Officer-in-charge.

6.2 TRAINING

The fire fighting shall be compulsory to all officers, operators, and other employees of the marine oil. There shall be regular fire drills, once a month. The record of such drills shall be maintained.

Every employee or authorized persons working at the port terminal should be familiarized with the fire alarm signal and should know the location of the fire alarm point nearest to his place of work. Instructions on the action to be taken in the event of fire and familiarity with these instructions should be ensured and recorded.

7.0 ELECTRICAL EQUIPMENT/ FITTINGS

All electrical fittings/ equipment shall be provided in line with Hazardous Area Classification. For electrical area classification and selection of electrical equipment IS-5571, IS-5572 (Part-1) and OISD-Standard 113 – “Classification of areas for electrical Installations at Hydrocarbon Processing and handling facilities” shall be referred.
8.0 FIRE PROTECTION SYSTEM, INSPECTION AND TESTING

The fire protection equipment should be kept in good operating conditions at all the time and the fire fighting system should be periodically tested for proper functioning and logged for record and corrective actions.

- Inspection of fire fighting equipment should be done in accordance with OISD-STD-142 on 'Inspection of Fire Fighting Equipment and System'.
- Regular inspection shall be carried out to check the corrosion on pipelines, equipment etc.
- Maintenance and inspection of all facilities equipment shall be in line with manufacturer's recommendations.
- Internal audit of facilities shall be carried out by multi-disciplinary team with a structured checklist.

In addition to routine daily checks/maintenance, the following periodic inspection/testing shall be ensured:

8.1 FIRE WATER PUMPS

i) Every pump should be in test run for at least half an hour minimum two times a week.

ii) Once a month each pump should be checked and tested and the shut off pressure observed and logged.

iii) Once in six months each pump should be checked for performance. This may be done by opening required number of hydrants/monitors depending on the capacity of the pump and by verifying that the discharge pressure and the motor load are in conformance with the design parameters.

8.2 FIRE WATER RING MAIN

The ring main should be checked once a year for leaks etc. by operating one or more pumps, with the hydrant points kept closed as required to get the maximum operating pressure.

The ring main, hydrants, valves should be visually inspected every month for any pilferage, defects and damage.

All fire main valves should be checked for operation and lubricated once in 3 months.

8.3 FIRE WATER SPRAY SYSTEM

Fixed Water cooling spray systems or nozzles should be tested at least once in a quarter.
8.4 TOWER MONITOR FOAM SYSTEM

Tower Monitor foam system should be tested once in a year. This shall include the testing of all foam making equipment.

After testing foam system, piping should be flushed with water.

8.5 CLEAN AGENT FIRE EXTINGUISHING SYSTEM

The system should be checked once in 6 months for agent quality and pressure of refillable containers. Detection system should be checked once in 3 months after putting gas release on manual mode to avoid discharge of gas. Smoke detectors should be cleaned once in three months.

8.6 HOSES

Fire hoses shall be hydraulically tested once in 6 months to a minimum water pressure of 10.5 kg/cm²g.

8.7 COMMUNICATIONS SYSTEM

Fire sirens should be tested once a week.

8.8 FIRE EMERGENCY MANUAL

Each oil installation shall prepare a detailed fire emergency manual containing all the actions to be taken in the event of the fire emergency. The key points of this manual shall be displayed at strategic locations in the oil installation to ensure prompt action.
9.0 REFERENCES

i) NFPA 11A - Standard for Medium and high expansion foam systems.

ii) NFPA 13 - Standard for the installation of sprinkler systems.

iii) NFPA 15 - Standard for Installation for water spray systems.

iv) NFPA 20 - Standard for Installation of Centrifugal fire pumps.

v) API-2001 - Fire Protection in Refineries.

vi) Model code of safe practices - The Institute of Petroleum(U.K.)


viii) International safety guide for OIL tankers and terminals.

ix) IS-3844 Hydrants within buildings.

x) OISD-STD-116

xi) OISD –STD-117

xii) OISD-STD-163

xiii) OISD-STD-173

xiv) OISD-STD-244

xv) OISD-STD-194

xvi) International Safety Guide for Oil Tankers & Terminals (ISGOTT)

xvii) NFPA-59A - Standard for the Production, Storage, and Handling of Liquefied Natural Gas

xviii) EN 1473 - Installation and equipment for liquefied natural gas - Design of onshore installations

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ANNEXURE-I

FIRST AID FIRE FIGHTING EQUIPMENT

The first aid Fire Fighting Equipment shall be provided at Port terminal as per scale given below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Norms/criteria to determine the quantity needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Dry Chemical powder fire extinguishers 9 kg capacity.</td>
<td>Locate in Hydrocarbon pump area, LPG/OIL/ LNG manifold area, loading areas, substations, workshops, laboratory, power station buildings etc. The number to be determined based on the travelling distance of 15m in above areas (at least one fire extinguisher for every 250 m² area).</td>
</tr>
<tr>
<td>ii) Dry Chemical Powder fire extinguishers 75 kg capacity</td>
<td>Loading arms areas. The number to be determined based on the max. travelling distance of 50m in above areas (at least one fire extinguisher for every 750 m² area).</td>
</tr>
<tr>
<td>iii) CO₂ extinguishers of 4.5 kg capacity or 6.8 kg on wheels.</td>
<td>Sub stations and power stations. The number to be determined based the max. travelling distance of 15 M (at least one fire extinguisher for every 250 m² area).</td>
</tr>
</tbody>
</table>
EXAMPLE FOR CALCULATION OF FIRE WATER FLOW RATE AND FOAM COMPOUND Note1

1. FIRE WATER DEMAND FOR JETTY HANDLING OIL & PETROLEUM PRODUCTS

Various areas which can be under fire shall be considered and fire water demand for each area shall be calculated based on design basis, as indicated below:

2. Basic Data for Design

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship Size</td>
<td>60,000 DWT</td>
</tr>
<tr>
<td>Nos. of berth</td>
<td>1</td>
</tr>
<tr>
<td>Length of berth</td>
<td>200 m</td>
</tr>
<tr>
<td>Nos. of Loading arms</td>
<td>4</td>
</tr>
</tbody>
</table>

3.0 Fire Water System

3.1 Tower Monitor

Tower mounted Water/ Foam monitor : 2 nos.
Capacity of tower mounted Water/ foam monitor : 1500 GPM = 5678 LPM
Water required for tower mounted water/ foam monitor : 2x 5678 = 11356 LPM

3.2 Jumbo Curtain Nozzles

Jumbo Curtain Nozzles : 2 Nos.
Capacity of each Jumbo curtain nozzle : 5000 LPM
Water required for Jumbo curtain nozzles : 2x 5000 = 10,000 LPM

3.3 Water Spray on drain vessel/ Manifold

Area of drain vessel/ manifold : 100 sqm (Assumed)
Water Application rate : 10.2 LPM/sqm of surface area
Water required for spray on vessel/ manifold : 100x10.2 = 1020 LPM
Fire Water required for Jetty : 11356+10000+1020 = 22376 LPM
Supplementary hose stream : 1342 cum/Hr.
Total Fire Water required at Jetty : 1342+144 = 1486 cum/hr.

Say, Total Water requirement for Jetty = 1500 cum/hr.

Note-1: These are sample calculations only. Calculations on the basis of actual site conditions and dimensions need to be carried out for each installation as per guidelines provided in the OISD-156
Foam Compound Requirement:

Compound requirement for two nos. Tower monitor based on foam range of 1% to 6%

Capacity of 2 nos of Tower monitor : 2x 1500 GPM = 2 x 5678 LPM
                                        = 11356 LPM
Foam concentrate requirement     : 0.03x11356 = 340 LPM
30 minute requirement            : 30x 340   = 10200 LPM
Foam concentrate tank capacity   = 11.0 cum (say) (Based on 3% foam concentrate use)

Note-1 For Jetties handling only LNG/RLNG, Foam monitors are not required only Water monitors shall be provided.
### BROAD SPECIFICATION FOR FIRE FLOATS (OPTIONAL)

<table>
<thead>
<tr>
<th>CLASS</th>
<th>NOTATION</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Water Pumping capacity</td>
<td>820 M³/hr (2 x 410 m³/hr)</td>
<td>1200 M³/hr (2 x 600 m³/hr)</td>
<td>1440 M³/hr (2 x 720 m³/hr)</td>
</tr>
<tr>
<td>2.</td>
<td>No. of pumps</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pumping Head</td>
<td>125 M</td>
<td>140 M</td>
<td>150 M</td>
</tr>
<tr>
<td>3.</td>
<td>Monitors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Capacity per monitor</td>
<td>5000 LPM</td>
<td>5000 LPM</td>
<td>6000 LPM</td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Dual purpose</td>
<td>Water cum foam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>Remote</td>
<td>Remote</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitor Throw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Horizontal</td>
<td>80 M</td>
<td>90 M</td>
<td>100 M</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>40 M</td>
<td>45 M</td>
<td>50 M</td>
</tr>
<tr>
<td>4.</td>
<td>Foam Tanks (nos.)</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Capacity tank</td>
<td>30 minute for 2 monitors</td>
<td>30 minute for 2 monitors</td>
<td>30 minute for 2 monitors</td>
</tr>
<tr>
<td>5.</td>
<td>Foam generation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
</tr>
<tr>
<td>6.</td>
<td>Hydraulic PLTF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>20 M</td>
<td>25 M</td>
<td>30 M</td>
</tr>
<tr>
<td>7.</td>
<td>Power source equipment</td>
<td>440 V</td>
<td>440 V</td>
<td>440 V</td>
</tr>
<tr>
<td>8.</td>
<td>Safety equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Breathing apparatus</td>
<td>2 sets</td>
<td>2 sets</td>
<td>2 sets</td>
</tr>
<tr>
<td></td>
<td>Fire proximity</td>
<td>2 sets</td>
<td>2 sets</td>
<td>4 sets</td>
</tr>
<tr>
<td>9.</td>
<td>Miscellaneous equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hose connections</td>
<td>4</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>10.</td>
<td>Minimum Fuel Oil Capacity, Hrs</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

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Note:

i) Class-I fire floats may be used for jetties handling POL ships of less than 50,000 tonnes deadweight.

ii) Class II fire floats may be used for jetties handling ships of more than 50,000 tonnes deadweight, but less than 100,000 dead weight.

iii) Class III fire floats may be used for jetties handling ships of more than 100,000 + dead weight.

iv) Number of fire floats may be decided on case to case basis. A minimum of 2 fire floats per port and a minimum of one at each geographical jetty area shall be provided.