# ENGINEERING STANDARD

# FOR

# OFFSHORE INSTALLATION

# FIRE FIGHTING AND FIRE PROTECTION

## ORIGINAL EDITION

## MAY 1993

**This standard specification is reviewed and updated by the relevant technical committee on July 1998(1) and Jan. 2012(2). The approved modifications are included in the present issue of IPS.**

**FOREWORD**

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS are based on internationally acceptable standards and include selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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**GENERAL DEFINITIONS**

Throughout this Standard the following definitions shall apply.

**COMPANY :**

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

**PURCHASER :**

Means the “Company" where this standard is a part of direct purchaser order by the “Company”, and the “Contractor” where this Standard is a part of contract document.

**VENDOR AND SUPPLIER:**

Refers to firm or person who will supply and/or fabricate the equipment or material.

**CONTRACTOR:**

Refers to the persons, firm or company whose tender has been accepted by the company.

**EXECUTOR :**

Executor is the party which carries out all or part of construction and/or commissioning for the project.

**INSPECTOR :**

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

**SHALL:**

Is used where a provision is mandatory.

**SHOULD:**

Is used where a provision is advisory only.

**WILL:**

Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor.

**MAY:**

Is used where a provision is completely discretionary.

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## 0. INTRODUCTION

"Fire Fighting and Fire Protection Systems" are broad and contains variable subjects of paramount importance therefore, a group of engineering standards are prepared to cover the subject.

This group includes the following engineering standards:

| STANDARD CODE | STANDARD TITLE |
|---|---|
| IPS-E-SF-120 | Engineering Standard for Off-Shore Installations Fire Fighting and Fire Protection |
| IPS-E-SF-140 | Engineering Standard for Foam Generating and Proportioning Systems |
| IPS-E-SF-160 | Engineering Standard for $Co_2$ Gas Fire Extinguishing Systems |
| IPS-E-SF-180 | Engineering Standard for Dry Chemical Extinguishing Systems |
| IPS-E-SF-200 | Engineering Standard for Fire Fighting Sprinkler Systems |
| IPS-E-SF-220 | Engineering Standard for Fire Water Distribution and Storage Facilities |
| IPS-E-SF-260 | Engineering Standard for Automatic Detectors and Fire Alarm Systems |
| IPS-E-SF-300 | Engineering Standard for Application of Breathing Apparatus in Safety and Fire Fighting |
| IPS-E-SF-340 | Engineering Standard for Fire Fighting Hose Box and/or Shelter |

## 1. SCOPE

This Engineering Standard Specifies the minimum requirements for the design of protection against fire and Fire- Fighting Systems for Offshore Installations.

It also sets out, the main points and areas which should be noted for attention.

**Note 1:**

**This standard specification is reviewed and updated by the relevant technical committee on July 1998. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 35 on July. 1998. These modifications are included in the present issue of IPS.**

**Note 2:**

**This standard specification is reviewed and updated by the relevant technical committee on Jan. 2012. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No 327 on Jan. 2012. These modifications are included in the present issue of IPS.**

## 2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

**API (AMERICAN PETROLEUM INSTITUTE)**

| | |
|---|---|
| API RP 14G | "Fire Prevention and Control on Open Type Offshore Production Platforms" |
| API 2218 | “Fire Proofing Practices in Petroleum and Petrochemical Processing Plants” |

**IP (THE INSTITUTE OF PETROLEUM)**

| | |
|---|---|
| IP 15 | “Area Classification Code for Installations Handling Flammable Fluids Part 15 of the IP Model Code of Safe Practice in the Petroleum Industry” |
| IP- Section 12 | "Drilling and Production Safety Code for Offshore Operations" |

**ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)**

| | |
|---|---|
| ISO 13702 | “Petroleum and Natural gas Industries-Control and Mitigation of Fires and Explosions on Offshore Production Installations – Requirements and Guidelines” |

**LLOYD’S REGISTER OF SHIPPING**

| | |
|---|---|
| Part 6 chapter 4- | "Fire Protection, Detection and Extinction" |
| Part 6 chapter 5- | "Classification of Fire Fighting Units" |
| Part 8 chapter 1- | "Fire Protection, Detection and Extinction" |

**SOLAS**

Solas (LSA) Code "life saving Appliances (LSA) Code"

**NORSOK**

Norsok Standard s-001 "Technical Safety"

**NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)**

NFPA 2001 "Clean Agent Fire Extinguishing Systems"

**IPS (IRANIAN PETROLEUM STANDARD)**

IPS-E-GN-100 "Engineering Standard for Units"

IPS-E-EL-110 "Engineering Standard for Hazardous Area"

**ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)**

ASTM E119 "Standard Test Methods for Fire Tests of Building Construction and Materials"

ASTM E163 "Standard Methods of Fire Tests of Window Assemblies"

ASTM E152 "Standard Methods of Tests of Door Assemblies"

ASTM E814 "Standard Test Method for Fire Tests Through-Penetration Fire Soaps"

**UL (UNDERWRITERS LABORATORIES INC.)**

UL 1709 "Rapid Rise Fire Tests of Protection Materials for Structural Steel"

## 3. DEFINITIONS

### 3.1 Accommodation Spaces

Spaces used for public, corridors, lavatories, cabins, offices, hospitals, cinemas, games rooms and pantries. Public spaces are those portions of the accommodation which are used for halls, dining rooms lounges and similar permanently enclosed spaces.

### 3.2 Bell-Nipple

A short piece of pipe at the entry to a well which is belled at the top, to guide tools into the hole. Usually has side connections for the fill-up and mud return lines.

### 3.3 Blowout

An uncontrolled and often violent escape of reservoir fluids from a drilling well when a high pressure reservoir has been encountered and efforts to prevent or control the escape have failed. Production wells can also blow out due to surface equipment failure or if well servicing operations get out of control.

### 3.4 Flame Spread

Low flame spread means that the surface thus described will adequately restrict the spread of flame, having regard to the risk of fire in the spaces concerned, this being determined by an acceptable test procedure.

### 3.5 Offshore Installation

The term used to describe any offshore unit for the drilling or producing oil or gas.

### 3.6 Service Spaces

Service spaces are those used for galleys, pantries containing cooking appliances, lockers, and storerooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

### 3.7 Wellhead

An assembly on top of the well casing strings with outlets and valves for controlling flow of production.

## 4. UNITS

This Standard is based on International System of Units (SI), as per IPS-E-GN-100 except where otherwise is specified.

## 5. GENERAL

The following sections are general guidelines for providing fire control equipment on a platform. Some fires can be effectively controlled and extinguished by isolating the fuel source and thereby preventing escalation of the fire. Fuel sources should be isolated by manually or automatically closing block valves, with non return valves, and with depressurization.

Fire control systems on offshore platforms should use water only, chemicals only or combinations of water and chemicals.

Many considerations influence the design of the fire control system to provide the desired level of protection.

These include the size and complexity of the platform, the nature of operations, number and skill of operators for the fire extinguishing equipment, the areas protected by the system, availability of additional equipment not located on the platform, and the consequences of a major fire. The equipment described by these guidelines should be adequate to allow one or two persons to control and/or extinguish most fires or allow a platform fixed water spray system to protect the operator selected portions of a structure.

The proper training of personnel and maintenance of this fire control equipment in operable condition is of paramount importance.

The best protection against the occurrence of fires will be realized through the provision of well designed facilities and the training of personnel to employ safe operating practices. The facility should be designed and operated to account for all phases of the producing operations, including temporary situations such as drilling, workover, construction, etc. Facilities and operating practices should be capable of isolating fuel sources should a fire occur.

## 6. FIRE PREVENTION PRACTICES

### 6.1 Facility Design

The facility should be designed to prevent fires and minimize damage if a fire occurs. Some specific items that should be considered are the following.

### 6.2 Well and Process Safety Systems

An important role in preventing fires or minimizing their effect can be performed by the platform surface and subsurface safety systems. The purpose of a surface safety system is to detect abnormal conditions and initiate appropriate action to prevent creation of situations that could result in an accidental fire. The action normally initiated by the surface safety system is to shut off process flow, thus eliminating the major fuel source on a platform.

The safety system may also shut down potential ignition sources such as engines, compressors and heaters. A subsurface safety system can be provided which is designed to shut off flow from the wells.

### 6.3 Equipment Arrangement

Within the limits of practicality, equipment should be arranged on a platform to provide maximum separation of fuel sources and ignition sources.

Particular consideration should be given to the location of fired process vessels.

### 6.4 Ignition Prevention Devices

Fired vessels should be placed in a safe location. Natural draft components should be equipped with spark and flame arrestors to prevent spark emission.

### 6.5 Hot Surface Protection

Surfaces with a temperature in excess of (204°C) should be protected from liquid hydrocarbon spillage or mist, and surfaces in excess of (482°C) should be protected from combustible gases.

**TABLE 7.3- RELATIONSHIP BETWEEN TEMPERATURE CLASS AND MAXIMUM SURFACE TEMPERATURE OF THE APPARATUS* (IP 15)**

| Temperature class | Maximum surface temperature ($^{o}$C) |
|---|---|
| **T1** | **450** |
| **T2** | **300** |
| **T3** | **200** |
| **T4** | **135** |
| **T5** | **100** |
| **T6** | **85** |

**- Selection of T class (IP 15)**

Table 7.3 lists the appropriate T class of equipment for common petroleum products.

**Notes:**

**(a) Apparatus having a lower maximum surface temperature, i.e. higher temperature class may be used in place of that having a higher maximum surface temperature (lower T class), but not conversely.**

**(b) As with apparatus sub-group the effects of both internal and external release should be considered in the selection of temperature class. The temperature classes indicated in Table 7.2 relate to the external hazards. Apparatus with an internal and possibly different T class, in which case the more severe of the two should be selected. See also Annex F.**

**(c) An ambient temperature other than 40°C may also be adopted as in the case of cold climate conditions as encountered in the Arctic or northern North Sea, for which likewise this procedure will apply.**

**(d) Ignition temperatures are not inherent properties of a substance, but depend also on the method of test. The selection of apparatus based on Tables 7.2 and 7.3 is conservative and no additional safety factor is needed.**

**(e) When mixtures of substances can be released the most restrictive temperature class should be specified (see section 2.5)**

**(f) For ignition temperatures of mists, see Annex A.**

### 6.6 Fire Barriers

Barriers constructed from fire resistant materials will be helpful in special situations to prevent the spreading of flames and to provide a heat shield.

### 6.7 Electrical Protection

Protection from ignition by electrical sources should be provided by designing and installing electrical equipment using the area classifications as designated by standard under reference No. IPS-E-EL-110 .

### 6.8 Combustible Gas Detectors

The concentration of a combustible gas can be determined by detection devices which should initiate alarms or shutdowns.

The usual practice is to activate an audible and/or visual alarm at a low gas concentration and to initiate action to shut off the gas source and/or ignition source if the concentration reaches a preset limit below the lower explosive limit (L.E.L.).

### 6.9 Helicopter Fueling Facilities

Standards for helicopter fueling facilities include the followings:

**6.9.1** Helicopter fuel storage tanks should be installed in a location which is isolated from sources of ignition and which is protected from possible impact from landing aircraft.

**6.9.2** Fire extinguishing equipment should be readily accessible to the helicopter fueling area.

**6.9.3** Helicopter landing areas should be constructed so as not to retain liquids and to preclude liquids from spreading to or falling on other parts of the platform.

**6.9.4** Fuel storage tanks should be equipped with a pressure/vacuum relief valve, and should be electrically grounded.

**6.9.5** The helicopter fuel hose should be of a standard type for aircraft fuel service and should be equipped with a static grounding device and a "deadman" type nozzle. The helicopter should be grounded with self-releasing or spring-clamp ground cables (same potential as hose).

**6.9.6** Helicopter fuel transfer pumps, storage tanks, and hose storage areas should be enclosed by curbs, drip pans or catchments, etc., which drain to a sump with provisions to prevent vapor return.

**6.9.7** Suitable storage should be provided for the fueling hose.

**6.9.8** The fuel transfer pump should be equipped so that it can be shut down from the fueling

station.

**6.9.9** Fire detection device(s) such as fusible plugs should be installed in the fuel storage area.

### 6.10 Diesel Fuel Storage

Standards for diesel fuel storage facilities should include the followings:

**6.10.1** Diesel fuel storage tanks should be isolated as far as practicable from ignition sources.

**6.10.2** Diesel fuel tanks should be enclosed by curbs, drip pans, or catchments, etc., which drain to a sump with provisions to prevent vapor return.

**6.10.3** Diesel fuel tanks should be adequately vented or equipped with a pressure/vacuum relief valve and should be electrically grounded.

**6.10.4** Fire detection device(s) such as fusible plugs should be installed in the diesel fuel storage area.

## 7. FIRE FIGHTING EQUIPMENT

### 7.1 Scale of Equipment Provision

The scale of fire fighting equipment provided for any particular installation or vessel should be governed by the nature and extent of operations to be carried out. When drilling is involved the possibility of a fire from a well blowout should be provided for with hydrant equipment directable to the wellhead and bell nipple areas. In the case of production operations the processing areas should have priority attention.

When deciding the range and scale of equipment to be provided, it must always be kept in mind that when fire has to be dealt with onboard of an installation, the unit and the personnel onboard will be on their own, and external assistance will not be readily available.

Therefore the scale, range and quality of the fire fighting equipment and facilities should be generous with adequate back-up provided.

Consideration should also be given to the emergency support which is available from other Operating Oil Companies with installations already in the area. When the use of outside support for emergencies is planned it is essential that the compatibility of fire hose connections on the support vessels with those on the installation concerned is checked and provision made for any special fittings which shall be required.

### 7.2 Fire Pumps, Fire Mains, Hydrants and Hoses (Mobile and Fixed Off-Shore Installations)

#### 7.2.1 Fire pumps

**7.2.1.1** At least two independently driven power pumps are to be provided, each arranged to draw directly from the sea and discharge into a fixed fire main.

However, in units with high suction lifts, booster pumps and storage tanks should be installed, provided such arrangements will satisfy all the requirements of these standards.

**7.2.1.2** At least one of the required pumps is to be dedicated for fire-fighting duties and be available for such duties at all times.

**7.2.1.3** The arrangements of the pumps, sea suctions and sources of power are to be such as to ensure that a fire in any one space would not put both the required pumps out of action.

**7.2.1.4** The capacity of the required pumps is to be appropriate to the fire-fighting services supplied from the main.

However, the total capacity of the pumps shall not be less than 180 $m^3$/h.

Where more pumps than required are installed, their capacity is to be not less than 80 percent of the total required capacity divided by the number of fire pumps.

**7.2.1.5** Each pump is to be capable of delivering at least one jet simultaneously from each of any two fire hydrants, hoses and 19 mm nozzles while maintaining a minimum pressure of 3.5 bar (3.5 kgf/cm2) at any hydrant. In addition, where a foam system is provided for protection of the helicopter deck, the pump is to be capable of maintaining a pressure of 7 bar (7 kgf/cm2) at the foam installation. Meanwhile the facilities for using of hose reel should be considered and also all calculations regarding to this matter should be done during the engineering phase.

**7.2.1.6** The maximum pressure at any hydrant shall not exceed that at which the effective control of a fire-hose can be demonstrated.

**7.2.1.7** Where either of the required pumps is located in a space not normally manned and is relatively far removed from working areas, suitable provision is to be made for remote start-up of that pump and remote operation of associated suction and discharge valves from a normally manned space or fire-control station.

**7.2.1.8** Every centrifugal pump which is connected to the fire main is to be fitted with a non-return valve.

**7.2.1.9** Relief valves are to be provided in conjunction with all pumps connected to the fire main if the pumps are capable of developing a pressure exceeding the design pressure of the fire main, hydrants and hoses.

Such valves are to be so placed and adjusted as to prevent excessive pressure in any part of the fire main system.

**7.2.1.10** Where intermediate water storage tanks are fitted, as permitted by 7.2.1.1 they are to be of such size and be so operated that the lowest water level permitted will ensure that the supply of water is adequate for two hoses at a minimum nozzle pressure of 3.5 bar (3.5 kgf/$cm^2$) at the uppermost hydrant for at least 15 minutes (minimum tank capacity of 10 m3) in order to allow sufficient time for bringing a replenishment pump into operation. Valves and pumps serving the intermediate tank which are not readily accessible are to be provided with means for remote operation.

**7.2.1.11** The system is to be kept charged at the necessary pressure, and the pump supplying the water for the system is to be put automatically into action by a pressure drop in the system.

**7.2.1.12** The pump should be driven by independent internal combustion type machinery but if it is dependent upon power being supplied from the emergency generator, that generator is to be arranged to start automatically in case of main power failure. When the pump is driven by independent internal combustion type machinery it is to be so situated that a fire in the protected space will not affect the air supply to the machinery.

**7.2.1.13** The following features are to be incorporated in a system which includes an intermediate tank:

**a)** A low water level alarm.

**b)** Two reliable and adequate means to replenish water in the intermediate tank. Such means are to be pumps which are arranged in accordance with the requirements of this Section. At least one of the replenishment pumps is to be arranged for automatic operation.

**c)** If the unit is intended to operate in cold weather , the entire fire-fighting system is to be protected from freezing. This would include tanks used as water reservoirs.

### 7.2.2 Fire main

**7.2.2.1** A fixed fire main is to be provided and be so equipped and arranged as such that water for fire-fighting purposes can be supplied to any part of the installation. The fire main is to be:

**a)** Connected to at least two pumps situated in widely separated parts of the installation; and

**b)** With any one pump out of action, capable of delivering at least one jet simultaneously from each of any two fire hydrants, hoses and 19 mm nozzles while maintaining a minimum pressure of 3.5 bar (3.5 kgf/$cm^2$) at any hydrant.

In addition, where a foam system is provided for protection of the helicopter deck and is served by the fire main, a pressure of 7 bar (7 kgf/$cm^2$) at the foam installation is to be capable of being simultaneously maintained.

**7.2.2.2** With any one pump out of action, the aggregate capacity of the remaining pumps is to be not less than 180 $m^3$/h when supplying the fire hydrants only.

**7.2.2.3** The diameter of the fire main and water service pipes is to be sufficient for the effective distribution of the maximum required discharge from the required fire pumps operating simultaneously.

The maximum water velocity in the mains shall be 3m/s and shall not be less than 2m/s.

**7.2.2.4** Where practicable the fire main is to be routed clear of hazardous areas and be arranged in such a manner as to make maximum use of any thermal shielding or physical protection afforded by the structure of the unit.

**7.2.2.5** The fire main is to be provided with isolating valves located so as to permit optimum utilization in the event of physical damage to any part of the main.

**7.2.2.6** The fire main is not to have connections other than those necessary for fire-fighting purposes.

**7.2.2.7** All practical precautions consistent with having water readily available are to be taken to protect the fire main against freezing.

**7.2.2.8** Materials readily rendered ineffective by heat are not to be used for fire mains and hydrants unless adequately protected. The pipes and hydrants are to be so placed that the fire hoses may be easily coupled to them.

**7.2.2.9** A cock or valve is to be fitted to serve each fire hose so that any fire hose may be removed while the fire pumps are at work.

### 7.2.3 International shore connection (Mobile off-shore units)

The unit is to be provided with at least one international shore connection.

**7.2.3.2** Facilities are to be available enabling such a connection to be used on any side of the unit.

**7.2.3.3** Standard dimensions of flanges for the international shore connection are to be in accordance with Fig. 1.

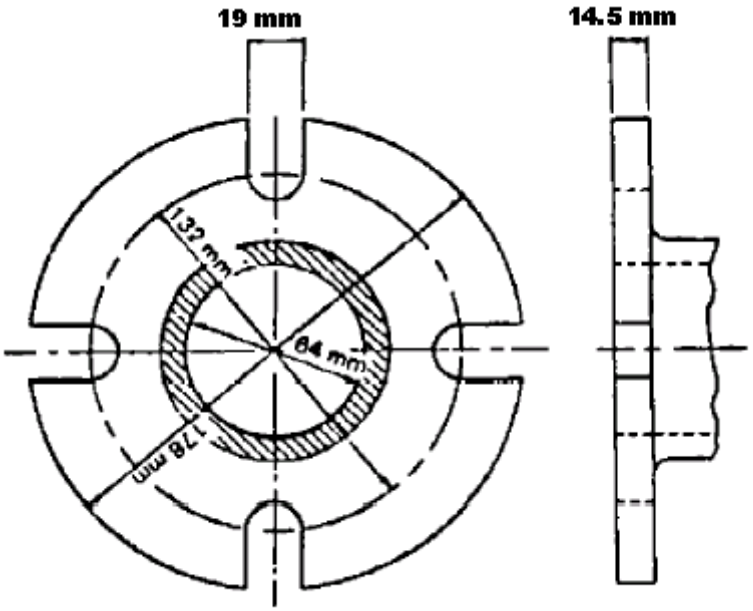


**Fig. 1**

**7.2.4 Hydrants-mobile and fixed off-shore installations**

**7.2.4.1** The number and position of the hydrants are to be such that at least two jets of water, not emanating from the same hydrant, one of which is to be from a single length of fire hose, shall reach any part of the unit normally accessible to those on board while the unit is being navigated or is engaged in drilling operations. A hose is to be provided for every hydrant.

**7.2.4.2** Fire hoses are to be of approved standard and be sufficient in length to project a jet of water to any of the spaces in which they are required to be used. Their length in general is not to exceed 25 m. Every fire hose is to be provided with a dual purpose jet/spray nozzle and the necessary couplings. Fire hoses together with any necessary fittings and tools are to be kept ready for use in conspicuous positions near the water service hydrants or connections.

**7.2.5 Nozzles (Mobile and fixed off-shore installations)**

**7.2.5.1** Standard nozzle sizes are to be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles shall be permitted if required as a result of special considerations.

**7.2.5.2** For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.

**7.2.5.3** For machinery spaces and exterior locations, the nozzle size is to be such as to obtain the maximum discharge possible from two jets at the pressure specified in 7.2.1.5 from the smallest pump, provided that a nozzle size greater than 19 mm need not be used.

**7.2.5.4** The jet throw at any nozzle is to be about 12 m.

**7.2.5.5** All nozzles are to be of an approved dual purpose type (i.e. spray/jet type) incorporating a shut-off.

**7.2.5.6** The number and arrangement of the nozzles are to be such as to ensure an effective average distribution of water over the areas to be protected. Nozzles are to be fitted above areas over which oil fuel is liable to spread and also above other specific fire hazards. Typical water application rates are as shown in Table 1.

**TABLE 1 - TYPICAL WATER APPLICATION RATES**

| FIRE RISK | APPLICATION RATE IN LITRES / $m^2$ / min |
|---|---|
| Boiler fronts or roof firing areas | 20 |
| Oil fuel units | 20 |
| Centrifugal separators (not oily water separators) | 20 |
| Oil fuel purifiers and clarifiers | 20 |
| Oil fuel pressure pumps | 20 |
| Hot oil fuel pipes near exhaust pipes or similar heater surfaces on main or auxiliary diesel engines | 10 |
| Machinery module floors | 5 |
| Tank top area | 5 |
| Oil tanks not forming part of the structure of the installation | 5 |

**TABLE 1 (CONTINUED)**

| Area/room | Type of protection in addition to portable | Typical minimum water application rates l/min/$m^2$ | Comments |
|---|---|---|---|
| Wellhead/manifold area | Deluge/foam/dry chemical | 10 (or 400 l/min/well) | |
| Process areas | Deluge/foam/dry chemical | 10 | |
| Pumps/compressors | Deluge/foam | 20 | |
| Gas treatment area | Deluge/dry chemical | 10 | Foam if area contains significant flammable liquids |
| Methanol area | Alcohol-resistant foam or deluge | 10 | Portable foam units, if the methanol area is small |
| Water-injection treatment area | None, if no HC risk | | |
| Drill floor | Deluge | 10 | Only if FES shows role for this system |
| BOP area | Deluge/foam | 400 | |
| Drillers cabin | None | | |
| Degasser room | Deluge/foam | 10 | Only if FES shows role for this system |
| Shale shaker room | Deluge/foam | 10 | |
| Active mud tank room | Deluge/foam | 10 | |
| Sack/bulk storage room | None | | Provided that no flammable materials stored |
| Mud lab | None | | |
| Cementing unit room | Water-mist/deluge/foam | | Water-mist according to supplier requirement |
| Control station | None | | To be confirmed in developing FES |
| Central control room (CCR) | None | | To be confirmed in developing FES |
| Instrument room adjacent to CS/CCR | None | | To be confirmed in developing FES |
| Local equipment room | None | | To be confirmed in developing FES |
| False floor and ceiling in CS/CCR and instrument rooms | | | Lifting gear for floor hatches. Gaseous system with lance |
| Turbine hall | Deluge | 10 | Dedicated system only if flammable inventories within the hall |
| Turbine hood | $CO_2$, gaseous or water-mist | | Interlock access to hood, if gaseous |
| Switch board room | None | | To be confirmed in developing FES |
| Battery room | None | | |
| Emergency generator room | Water-mist/foam/deluge | 10 | Effect of water on equipment in the room should be evaluated |
| Fire pump room | Water-mist/foam/deluge | 10 | Effect of water on equipment in the room should be evaluated |
| HVAC room | None | | |

**TABLE 1 (CONTINUED)**

| Area/room | Type of protection in addition to portable | Typical minimum water application rates l/min/m$^2$ | Comments |
|---|---|---|---|
| Mechanical workshop | Sprinkler | 6 | |
| Instrument workshop | Sprinkler | 6 | |
| Storage of gas bottles | None | | Provided stored externally and not exposed to radiant heat |
| Paint store | Sprinkler | | |
| Accommodation | None | | Section flammable materials to limit fuel at risk |
| Vent extract from galley | Gaseous | | Operated local in galley |
| General galley area | None | | |
| Galley cooking appliances and range | Proprietary systems | | According to supplier recommendation |
| Crane cabin | None | | |
| Crane engine room | Portable/water-mist | | Deluge, water-mist for diesel drives |
| Helideck | Foam/dry chemical | 6 | |
| Hangar | Sprinkler/foam/dry chemical | 10 | |
| Chain locker | Water | 60 | |
| Ballast control room | None | | |
| Turret area | Deluge/foam | 10 | |
| Pump room in column | None | | Unless flammable liquid present |
| Vertical and horizontal structures | Deluge | 10 (4 l/min/m$^2$ for horizontal) | |
| Escape and evacuation routes | Water curtain | 15 l/min/m to 45 l/min/m | |

### 7.3 Water Monitors (Mobile & Fixed Off-Shore Installations)

**7.3.1** The minimum number of monitors, their discharge rate, their range and their height of trajectory above sea level are to comply with the requirements of Table 2.

**7.3.2** The monitors are to be so arranged that the required direction, range and height of trajectory can be achieved with the required number of monitors when they are operating simultaneously.

**7.3.3** The monitors are to be capable of adequate adjustment in the vertical and horizontal direction and are to be so positioned that the jets will be unimpeded within the required range of operation.

**7.3.4** Means are to be provided for preventing the monitor jets from impinging on the unit's structure and equipment.

**7.3.5** The monitors are to be capable of being activated and manoeuvred by remote control from a protected position providing a good view of the monitors and the operating area of the water jets.

**7.3.6** Water monitors should be operated either remotely or locally. Each monitor arranged solely for local operation is to be:

**a)** Provided with an access route which is remote from the part requiring protection; and

**b)** So sited as to afford maximum protection to the operator from the effects of radiant heat.

**7.3.7** Each monitor is to be capable of discharging under jet and spray conditions.

**TABLE 2 - WATER MONITOR SYSTEM CAPACITIES**

| CLASS NOTATION | I | II | | III |
|---|---|---|---|---|
| No. of monitors | 2 | 3 | 4 | 4 |
| Cap.of each monitor in $m^3/h$ | 1200 | 2400 | 1800 | 2400 |
| No.of pumps $m^3/h$ | 1-2 | 2-4 | | 2-4 |
| Total pump cap. in $m^3$ | 2400 | 7200 | | 9600 |
| Length of throw in m [1)] | 120 | 150 | | 150 |
| Height of throw in m [2)] | 45 | 70 | | 70 |
| Fuel oil capacity in hours [3)] | 24 | 96 | | 96 |

**1) Measured horizontally from the mean impact area to the nearest part of the vessel when all monitors are in satisfactory operation simultaneously.**

**2) Measured vertically from sea level to mean impact area at a horizontal distance at least 70 m from the nearest part of the vessel.**

**3) Capacity for continuous operation of all monitors, to be included in the total capacity of the vessel's fuel oil tanks.**

**7.3.8** The notation 'Firefighting unit 1' or 'Firefighting unit 2' or 'Firefighting unit 3' signifies that a unit complies with these standards and is provided with the appropriate firefighting equipment described in Table 2 with the total discharge capacity of monitors in $m^3/h$.

### 7.4 Water Deluge Pumps and Water Deluge Main

**7.4.1** Each offshore installation is to be provided with a water deluge system and/or water monitor system complying with clause 7.3.6 by means of which any part of the installation containing equipment used for storing, conveying or processing hydrocarbon resources (other than fuels for use on the installation) can be protected in the event of fire. The following list identifies areas containing equipment requiring water protection and is intended to be typical rather than restrictive: ( see IPS-E-SF-220 Basic for Fire-Fighting Water System)

- Well-heads.
- Crude/gas separation equipment.
- Gas compressors.
- Liquefaction plant.
- Gas pressure vessels.
- Crude oil pumps.
- Crude oil and gas manifolds/piping (not fuel gas) including piping routed over bridges between platforms.
- Crude oil storage vessels or tanks.
- Gas liquids/concentrate storage vessels.
- Glycol regeneration plant.
- Flare knockout drums.
- Pig launchers/receivers.
- De-aeration/filtration equipment (if using gas).
- Drill floor/workover areas.
- Areas containing equipment (including piping) through which petroleum will flow during well test operations.

**7.4.2** Water deluge systems and water monitors are to be connected to a continuously pressurized water main supplies by at least two pumps capable, with any one pump out of action, of maintaining a supply of water at a pressure sufficient to enable the system or monitors to operate at the required discharge rates to meet the water demand of the largest single area requiring protection in

accordance with clause 7.2.2.1 (b).

**7.4.3** The pumps supplying the water main are to be remote from any part of the installation requiring water deluge protection.

**7.4.4** Once activated each pump is to be capable of continuous unattended operation for at least 18 hours.

### 7.5 Combined Fire Main and Water Deluge Main

7.5.1 A fire main and a water deluge main should be combined in a single continuously pressurized water main serving both functions and complying with the relevant requirements of clauses 7.2 and 7.4. The combined main is to be served by at least two pumps.

### 7.6 Water Deluge Systems

#### 7.6.1 General requirements

**7.6.1.1** The quantity of water supplied to any part requiring protection is to be at least sufficient to provide exposure protection to the relevant equipment within that part and, where appropriate, local principal load bearing structural members. 'Exposure protection' means the application of water spray to equipment or structural members to limit absorption of heat to a level which will reduce the possibility of failure.

**7.6.1.2** Generally the minimum water application rate is to be not less than 10 litres/minute over each square meter of exposed surface area requiring protection within the appropriate reference area.

Other water application rates in accordance with a suitable standard or code, which meets the specification of 7.6.1.1 will be considered. A reference area is a horizontal area bounded completely by:

**a)** Vertical 'A' or 'H' Class divisions, or

**b)** The seaward extremities of the offshore installation, or

**c)** A combination of (a) and (b).

**7.6.1.3** Each part requiring water protection is to be provided with a primary means of application which may be:

**a)** A fixed system of piping fitted with suitable spray nozzles, or

**b)** Water monitors, or

**c)** A combination of (a) and (b).

Water monitors may only be used for the protection of equipment sited in essentially open areas.

### 7.7 Automatic Sprinkler, Fire Detection and Fire-Alarm Systems for Fixed Off-Shore Installations

**7.7.1** Each installation is to be provided with an automatic sprinkler, fire detection and fire-alarm system complying with the following requirements:

**7.7.2** The system required by the above clause is to be capable of indicating the presence of a fire in all accommodation spaces and service spaces, except spaces which afford no substantial fire-risk such as void spaces, sanitary spaces, etc.

**7.7.3** Any required automatic water sprinkler, fire-alarm and fire detection system is to be designed for immediate use at any time, so that no action on the part of the installation's personnel is necessary to set it in operation. Where such a system is fitted, it is to be of the wet pipe type but small exposed sections may be of the dry pipe type where this is shown to be a necessary precaution. Any part of the system which is subjected to freezing temperatures in service is to be suitably protected against freezing. It is to be kept charged at the necessary pressure and have provision for a continuous supply of water.

**7.7.4** Each section of sprinklers is to include means for giving a visual and audible alarm signal

automatically at one or more indicating units whenever any sprinkler comes into operation. Such alarm systems are to be constructed so as to indicate if any fault occurs in the system.

**7.7.5** Such units are to give an indication of any fire and its location in any space served by the system and is to be centralized in the main fire-control station, which is to be so manned or equipped as to ensure that any alarm from the system is immediately received by a responsible person.

**7.7.6** Sprinklers are to be grouped into separate sections, each of which is to contain not more than 200 sprinklers. Any section of sprinklers is not to serve more than two floors, except where it is satisfactorily shown that the protection of the installation against fire will not thereby be reduced.

**7.7.7** Each section of sprinklers is to be capable of being isolated by one stop valve only. The stop valve in each section is to be readily accessible and its location is to be clearly and permanently indicated. Means are to be provided to prevent the operation of the stop valves by any unauthorized person.

**7.7.8** A gage indicating the pressure in the system is to be provided at each section stop valve and at a central station.

**7.7.9** The sprinklers are to be resistant to corrosion by marine atmosphere. In accommodation and service spaces the sprinklers are to come into operation within the temperature ranges from 68°C to 79°C, except that in locations such as drying rooms, where high ambient temperatures is expected, the operating temperature should be increased to not more than 30°C above the maximum underside of floor temperature.

**7.7.10** A list or plan is to be displayed each indicating unit showing the spaces covered and the location of the zone in respect of each section. Suitable instructions for testing and maintenance are to be available.

**7.7.11** Sprinklers are to be placed in an overhead position and spaced in a suitable pattern to maintain an average application rate of not less than 5 litres/m2/min over the nominal area covered by the sprinklers. The use of sprinklers providing other amounts of water suitably distributed, will be considered provided they are shown to be not less effective.

**7.7.12** A pressure tank having a volume equal to at least twice that of the charge of water specified in 7.7.13 is to be provided.

**7.7.13** The tank is to contain a standing charge of fresh water, equivalent to the amount of water which would be discharged in one minute by the pump referred to in 7.7.15 and the arrangements are to provide for maintaining such air pressure in the tank to ensure that where the standing charge of fresh water in the tank has been used the pressure will be not less than the working pressure of the sprinkler, plus the pressure exerted by a head of water measured from the bottom of the tank to the highest sprinkler in the system.

Suitable means of replenishing the air under pressure and of repleni-shing the fresh water charge in the tank are to be provided. A glass gage suitably protected is to be provided to indicate the correct level of the water in the tank.

**7.7.14** Means are to be provided to prevent the passage of sea water into the tank.

**7.7.15** An independent power pump is to be provided solely for the purpose of continuing automatically the discharge of water from the sprinklers. The pump is to be brought into action automatically by the pressure drop in the system before the standing fresh water charge in the pressure tank is completely exhausted. Consideration shall be given to alternative water suppling arrangements.

**7.7.16** The pump and the piping system are to be capable of maintaining the necessary pressure at the level of the highest sprinkler to ensure a continuous output of water sufficient for the simultaneous coverage of a minimum area of 280 $m^2$ at the application rate specified in 7.7.11.

**7.7.17** The pump is to have fitted on the delivery side a test valve with a short open-ended discharge pipe. The effective area through the valve and pipe is to be adequate to permit the release of the required pump output while maintaining the pressure in the system specified in 7.7.13.

**7.7.18** The sea inlet to the pump is to be wherever possible, in the space containing the pump and is to be so arranged that it will not be necessary to shut off the supply of sea water to the pump for any purpose other than the inspection or repair of the pump.

**7.7.19** The sprinkler pump and tank are to be situated in a position reasonably remote from any

main machinery space and not in any space required to be protected by the sprinkler system.

**7.7.20** There are to be not less than two sources of power supply for the sea water pump and automatic alarm and detection system . Where one of the sources of power for the pump is an internal combustion engine it is to be so situated that a fire in any protected space will not affect the air supply to the machinery, in addition to complying with 7.7.19. When the sources of power for the pump are electrical, see IPS-E-EL-110.

**7.7.21** The sprinkler system is to have a connection from the installation's fire main by way of a lockable screwdown non-return valve at the connection which will prevent a backflow from the sprinkler system to the fire main.

**7.7.22** A test valve is to be provided for testing the automatic alarm for each section of sprinklers by a discharge of water equivalent to the operation of one sprinkler. The test valve for each section is to be situated near the stop valve for that section.

**7.7.23** Means are to be provided for testing the automatic operation of the pump, on reduction of pressure in the system.

**7.7.24** Switches are to be provided at one of the indicating positions referred to in 7.7.4 which will enable the alarm and the indicators for each section of sprinklers to be tested.

### 7.8 Pressure Water-spraying Systems

#### 7.8.1 Pipes and nozzles

**7.8.1.1** Any required fixed pressure water-spraying fire-extinguishing system in machinery spaces is to be provided with spraying nozzles of an approved type suitable for extinguishing burning oil.

**7.8.1.2** For the number and arrangement of the nozzles see clause 7-2-5-6.

**7.8.1.3** Precautions are to be taken to prevent the nozzles from becoming clogged by impurities in the water or corrosion of the piping, nozzles, valves and pump.

**7.8.1.4** The system should be divided into sections, the distribution valves of which are to be operated from easily accessible positions outside the spaces to be protected and which will not be readily cut off by fire in the protected space.

**7.8.1.5** Where applicable the system is to include mobile sprayers ready for immediate use in the firing area of a boiler or in the vicinity of an oil fuel unit.

### 7.9 Hose Stations

**7.9.1** Hose stations are to be provided on each side of the unit and should be located considering accessibility from other decks (near a stairway) possibility of damage from a fire, coordination with other stations, and interference from other platform activities.

**7.9.2** Each hose station is to be provided with a hydrant, a hose and a nozzle capable of producing a jet or a spray and simultaneously a jet and a spray. The hoses are to be 25 m in length and not less than 38 mm nor more than 70 mm in diameter. Where hose stations are connected to the monitor supply lines, provision is to be made to reduce the water pressure at the hydrants to an amount at which each fire hose nozzle can be safely handled by one man. The water pressure shall be sufficient to produce a water jet throw of at least 12 m.

**7.9.3** Fire hoses should be stored on reels or other suitable devices designed for rapid deployment and for protection of the hose. These storage devices should be corrosion resistant.

### 7.10 Fire-Extinguishing Systems

#### 7.10.1 Fixed gas fire-extinguishing systems

##### 7.10.1.1 General requirements

**a)** The use of a fire-extinguishing medium which, either by itself or under expected

conditions of use, gives off toxic gases in such quantities as to endanger persons is not permitted.

**b)** The necessary pipes for conveying a fire-extinguishing medium into protected spaces are to be provided with control valves which are to be so placed that they will be easily accessible and not readily cut off from use by an outbreak of fire. The control valves are to be so marked as to indicate clearly the spaces to which the pipes are led. Suitable provision is to be made to prevent inadvertent admission of the medium to any space.

**c)** The piping for the distribution of fire-extinguishing medium is to be of adequate size and so arranged, and discharge nozzles so positioned that a uniform distribution of medium is obtained. All pipes are to be arranged to be self draining and where led into refrigerated spaces, the arrangement will be specially considered.

Means whereby the individual pipes to all protected spaces can be tested using compressed air are to be provided.

**d)** Steel pipes fitted in spaces where corrosion is likely to occur are to be galvanized, at least internally.

**e)** Distribution pipes are not to be smaller than 20 mm bore for carbon dioxide.

**f)** Means are to be provided to close all openings which may admit air to or allow gas to escape from a protected space.

**g)** Where the volume of free air contained in air receivers in any space is such that, if released in such a space in the event of fire, such release of air within that space would seriously affect the efficiency of the fixed fireextinguishing system, an additional quantity of fire-extinguishing medium is to be provided.

**h)** Means are to be provided for automatically giving audible warning of the release of fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm is to operate for a suitable period (depending on time required for personnel to evacuate) before the medium is released.

**i)** Where pneumatically operated alarms are fitted which require periodic testing, carbon dioxide is not to be used as an operating medium. Air operated alarms may be used provided that the air supply is clean and dry.

**j)** Where electrically operated alarms are used, the arrangements are to be such that the electric operating mechanism is located outside any hazardous area, alternatively the equipment is to be suitable for use in hazardous atmospheres. See IPS-E-EL-110.

**k)** The means of control of any fixed gas fire-extinguishing system are to be readily accessible and simple to operate and shall be grouped together in as few locations as possible at positions not likely to be cut off by a fire in a protected space. At each location there are to be clear instructions relating to the operation of the system having regard to the safety of personnel.

**l)** Automatic release of fire-extinguishing medium will not be permitted except as allowed by I.P.I.

**m)** Where the quantity of extinguishing medium is required to protect more than one space, the quantity of medium available need not be more than the largest quantity required for any one space so protected.

**n)** Except as otherwise permitted, pressure containers required for the storage of fire-extinguishing media are to be located outside protected spaces.

**o)** Means are to be provided for personnel to check safely the quantity of medium in the containers.

**p)** containers for the storage of fire-extinguishing media and associated pressure components are to be designed and tested to I.P. Standard having regard to their locations and the maximum ambient temperatures expected in service.

**q)** When the fire-extinguishing medium is stored outside a protected space, it is to be stored in a room which is situated in a safe and readily accessible position and effectively ventilated. Any entrance to such a storage room is preferably to be from the open deck and in any case be independent of the protected space.

Access doors are to open outwards, and walls and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and

adjoining enclosed spaces are to be gastight.

### 7.10.2 Flooding systems

A system consisting of an agent supply and distribution network designed to achieve a total flooding condition in a hazard volume.(Refer to 3.3.24 of NFPA 2001)

### 7.10.3 High expansion foam systems

#### 7.10.3.1 General requirements

**a)** Any required fixed high expansion foam system is to be capable of discharging rapidly through fixed discharge outlets a quantity of foam sufficient to fill the greatest space to be protected within 10 minutes and at a rate of at least 1 meter in depth per minute. The quantity of foam-forming liquid available is to be sufficient to produce a volume of foam equal to five times the volume of the largest space to be protected.

**b)** The expansion ratio of the foam is not to exceed 1000 to 1

**c)** When the gross horizontal area of the protected space exceeds 400 $m^2$ at least two foam generators are to be provided.

**d)** Alternative arrangements and discharge rates will be permitted provided that equivalent protection is achieved.

**e)** Supply ducts for delivering foam, air intakes to the foam generator and the number of foam producing units are to be such as will provide effective foam production and distribution.

**f)** Where major fire hazards exist in high positions in the protected space, foam is to be separately led to them by suitable ducts and permanent means are to be provided to contain the foam around and above the hazard.

**g)** The arrangement of the foam generator delivery ducting is to be such that a fire in the protected space will not affect the foam-generating equipment.

**h)** The foam generator, its sources of power supply, foam-forming liquid and means of controlling the system are to be readily accessible and simple to operate and are to be grouped in as few locations as possible at positions not likely to be cut off by fire in the protected space.

## 8. PROVISIONS FOR HELICOPTER LANDING AREAS

**8.1** Helicopter decks are to be of steel or equivalent fire-resistant construction. If the space below the helicopter deck is

a high fire-risk space, the deck is to be an ’A-60’ Class division as given in Lloyd’s PT 8 chapter 1.

Table 3 below shows the separating adjacent spaces.

**TABLE 3 - FIRE INTEGRITY OF DECKS SEPARATING ADJACENT SPACES**

| Space below ↓ Space above → | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9)[d] | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control stations | (1) | A-60° | A-0 | A-0 | A-0 | A-0 | A-0 | A-60 | A-0 | H-60 | A-0 | * |
| Corridors | (2) | A-0 | * | * | A-0 | * | A-0 | A-60 | A-0 | H-60 | * | * |
| Accommodation spaces | (3) | A-60 | A-0 | * | A-0 | * | A-0 | A-60 | A-0 | H-60 | A-60 | * |
| Stairways | (4) | A-0 | A-0 | A-0 | * | A-0 | A-0 | A-60 | A-0 | H-60 | * | * |
| Service spaces (low risk) | (5) | A-15 | A-0 | A-0 | A-0 | * | A-0 | A-60 | A-0 | H-60 | A-15 | * |
| Service spaces (high risk) | (6) | A-60 | A-0 | A-0 | A-0 | A-0 | * | A-60 | A-0 | H-60 | A-60 | * |
| Main machinery spaces | (7) | A-60 | A-60 | A-60 | A-60 | A-60 | A-60 | * | A-60° | H-60 | A-60 | * |
| Other machinery spaces | (8) | A-15 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | * | H-0 | A-15 | * |
| Hazardous areas | (9)[d] | H-60 | H-60 | H-60 | H-60 | H-60 | H-60 | H-60 | H-60° | --- | H-60 | --- |
| Survival craft embarkation areas | (10) | * | * | * | * | * | * | A-0 | * | H-0 | --- | --- |
| Open decks | (11) | * | * | * | * | * | * | * | * | --- | --- | --- |

**8.2** On any helicopter deck the followings are to be provided and stored near to the means of access to that deck:

**8.2.1** Dry powder extinguishers of a total capacity of not less than 45 kg.

**8.2.2** A suitable foam application system consisting of monitors or foam-making branch pipes capable of delivering low expansion foam solution at a rate of not less than 6 litres per minute for at least 5 minutes for each square meter of the area contained within a circle of diameter D, where D is the distance in meters across the main rotor and tail rotor in the fore and aft line of a helicopter with a single main rotor and across both rotors of a tandem rotor helicopter.

The operation of the foam system is not to interfere with the simultaneous operation of the fire main.

**8.2.3** Carbon dioxide extinguishers of a total capacity of not less than 18 kg. one of $Co_2$ extinguishers shall be so equipped as to enable it to reach the engine area of any helicopter using the deck, and so located that they would not be vulnerable to any damage sustained by the dry powder extinguishers mentioned in 8.2.1.

**8.2.4** At least two dual purpose nozzles and hoses sufficient to reach any part of the helicopter deck.

**8.2.5** For supply and installation of twin agent refer to Iranian Petroleum standard IPS-M-SF-142 "Foam Generating, Proportioning and Twin Agent Systems".

**8.3** Where helicopter re-fuelling facilities are provided, a designated area is to be provided for the storage of fuel tanks which is to be:

**8.3.1** As remote as is practicable from accommodation spaces, escape routes and embarkation stations.

**8.3.2** Suitably isolated from areas containing a source of vapor ignition.

**8.4** The fuel storage area is to be provided with arrangements whereby a fuel spillage may be collected and drained to a safe location.

**8.5** Tanks and associated equipment are to be protected against physical damage and from a fire in an adjacent space or area.

**8.6** Where portable fuel storage tanks are to be used, special attention is to be given to:

**8.6.1** Design of the tank for its intended purpose.

**8.6.2** Mounting and securing arrangements.

**8.6.3** Electrical bonding.

**8.6.4** Inspection procedures.

**8.7** Storage tank fuel outlet valves are to be provided with means which permit closure in the event of a fire. Such closure is to be possible from a remote position.

**8.8** The fuel pumping unit is to be connected to one tank at a time and the piping between the tank

and the pumping unit is to be of steel or equivalent material, as short as possible and protected against damage.

**8.9** Fire-extinguishing arrangements for protection of the designated area will be specially considered in relation to the location and the operating pressure of the fuel system.

**8.10** Fuel pumping units are to incorporate a device which will prevent over-pressurization of the delivery or filling hose.

**8.10.1** Attention is to be paid to the electrical bonding of all equipment used in re-fuelling operations.

## 9. FIREMAN'S OUT-FITS

**9.1** Each offshore installation is to be provided with at least four fireman's outfits:

Each outfit is to consist of:

**9.1.1 personal equipment comprising:**

**a)** Protective clothing of material to protect the skin from the heat radiating from the fire and from burns and scalding by steam. The outer surface is to be water resistant.

**b)** Boots and gloves of rubber or other electrically non-conducting material.

**c)** A rigid helmet providing effective protection against impact.

**d)** An electric safety lamp (hand lantern) of an approved type with a minimum lighting period of 3 hours.

**e)** An axe with an insulated handle.

**9.1.2** A self-contained breathing apparatus which is to be capable of functioning for a period of at least 30 minutes.

Spare cylinders are to be provided which are to be maintained fully charged except where facilities for re-charging the cylinders are available on the installation.

**9.1.3** For each breathing apparatus a fireproof lifeline of sufficient length and strength is to be provided capable of being attached by means of a snaphook to the harness of the apparatus or to a separate belt in order to prevent the breathing apparatus becoming detached when the lifeline is operated.

**9.1.4** The fireman's outfits are to be stored so as to be easily accessible and ready for use and one of the outfits should be located within easy access of any helicopter deck.

## 10. STORAGE OF GAS CYLINDERS

**10.1** Where more than one cylinder of oxygen and more than one cylinder of acetylene are carried simultaneously, such cylinders are to be arranged in accordance with the following:

**10.1.1** Permanent piping systems for oxy-acetylene are acceptable provided that:

**a)** All fixed piping is of steel or other approved material and suitable joints are fitted.

**b)** Material containing more than 70 percent copper is not, used in the system except for welding or cutting tips.

**c)** Allowance is made for expansion of the piping.

**d)** The piping system is suitable for the intended pressures.

**10.1.2** Where two or more cylinders of each gas are intended to be carried in enclosed spaces, separate dedicated storage rooms are to be provided for each gas.

**10.1.3** Storage rooms are to be constructed of steel, and be well ventilated and accessible from the open deck.

**10.1.4** Provision is to be made for the expeditious removal of cylinders in the event of fire.

**10.1.5** Where cylinders are stored in open locations, means are to be provided to:

**a)** protect cylinders and associated piping from physical damage,

**b)** minimize exposure to hydrocarbons,

**c)** ensure suitable drainage, and

**d)** protect cylinders against solar radiation.

## 11. PASSIVE PROTECTION

### 11.1 General

Passive fire protection is defined as any fire protection system that by its nature plays an inactive role in the protection of personnel and property from damage by fire. Appendix F contains additional information on passive fire protection maintenance, ratings, and penetrations. Passive fire protection is quite often generically referred to as Structural Fire Protection (SFP), particularly in governmental regulations. Examples of passive fire protection systems would be spray-on insulating materials or insulating blankets of fireproof materials. Conversely, examples of active fire protection systems would be fire water, AFFF, CO, or dry chemical systems. API Publ 2218 Fireproofing Practices in Petroleum and Petrochemical Processing Plants can provide useful information regarding fireproofing practices, materials, etc.

### 11.2 Uses

Generally, passive fire protection is not used as the only means of fire protection, but rather it is used in concert with active fire protection systems. This is because passive fire protection does not, in and of itself, provide inherent protection and is normally effective only for a finite time period. Once passive fire protection is exhausted, the protected component is vulnerable to damage by fire. Examples of where passive fire protection is used are: critical structural steel, living quarters, firewalls, etc.

### 11.3 Fireproofing Materials

Them are many types of fireproofing materials available and in use throughout the industry. These materials are lightweight concretes, preformed inorganic panels, masonry blocks and bricks, man-made mineral fibers, and subliming, intumescent, and ablative mastics. However, the fireproofing materials that have been most commonly used in the offshore petroleum industry, and which will be addressed here, can be broken down into two generic groups; active and inactive insulants. The active insulants undergo chemical and physical changes when exposed to fire and the inactive insulants do not.

#### a. Active Insulants

The active insulants are generally available as ceramic fiber (or similar fireproof materials) structures in an epoxy-based matrix which contains additional chemicals designed to cause some chemical or physical reaction upon exposure to heat. The active insulants typically are available in multiple-part mixtures which when mixed together form a slurry suitable for spray application. However, they can be purchased in pre-cast panels which can be bolted in place. Active insulants are also known as intumescent materials because when they are exposed to heat, they undergo a physical and chemical change which causes them to expand to several times their applied volumes, thereby providing enhanced insulation.

#### b. Inactive Insulants

The inactive insultants can be grouped into two general groups: cementitious materials and man-made fibers, such as ceramic fiber or mineral wool. The cementitious materials, as the name implies, are essentially cement-based materials of a fire brick refractory blend, which are normally mixed as a slurry and spray-applied; however, these materials are also available in precast slabs which can be bolted in place. Man-made fiber insulants come in many different forms: blankets, bulk, panels, etc. These systems are installed by mechanically supporting them in or on a wall or similar structure.

## 12. LIFE SAFETY

Refer to Solas/ (LSA) Code-Norsok standard s-001.

## APPENDICES

## APPENDIX A

## PASSIVE FIRE PROTECTION

### A.1 Maintenance

Generally, passive fire protection systems are maintenance free. However, periodic visual inspections are recommended with repairs as warranted. The epoxy-based systems should receive a complete visual inspection at least every 24 months. This inspection should look for cracks or voids either in the topcoating or the fireproofing itself with repairs as recommended by the manufacturer. Cementitious coatings should be inspected more frequently, and any noted cracks or fissures repaired as recommended by the manufacturer. These periodic inspections are important in order to maintain the integrity of the fireproofing and also to provide early detection of substrate corrosion. If partial disbanding of the fireproofing coating has occurred and there are surface

cracks in the area of the disbonding, moisture may migrate to the substrate, establish a corrosion cell and become a source of corrosion. This corrosion potential highlights the need to have a fireproofing coating application procedure, which ensures that a proper bond is established between the fireproofing coating and the substrate. Insulating blankets, which are normally not installed in areas exposed to weather, require little, if any, maintenance other than routine repair of tears in the outer covering.

### A.2 Fireproofing Ratings

The effectiveness of passive fire protection is generally expressed in terms of a given rating for a particular system or combination of systems. In this sense, use of the term rating means the length of time, expressed in minutes, that a given fireproofing system will provide a prescribed level of protection from a fire which has a specific rate of temperature rise (time-temperature).

#### a. Performance Criteria

For a system rating to have any meaning, there must be a performance criterion by which the system rating can be measured. Performance, as it is used in defining criteria for passive fire protection systems, means the period of resistance, expressed in time, to a fire exposure before the first critical point in behavior is observed. This critical point may be collapse or loss of strength of the materials comprising the fire barrier. Performance criteria usually require that the temperature of the unexposed surface of a test panel, subjected to a controlled fire test, not exceed a prestated temperature for a given number of minutes. For example, if the performance criteria for a given fireproofing system were 1000°F (538°C) at the end of 60 minutes and a test panel, protected with the system in question, did not exceed 1000°F (538°C) on its unexposed surface after 60 minutes of being exposed to a controlled fire test, then that system would be given a rating of 60 minutes. These ratings are achieved by taking credit for all of the insulating properties of the entire system: building materials, fireproofing material, air gaps, etc. Generally, empirical data is generated for a given system, and based on that data the performance of similar systems can be predicted for any change in the thickness of the various constituents. When specifying performance criteria for a fire barrier, the following minimum should be identified: test furnace time-temperature curve, maximum time-temperature (average and single-point) relationship acceptable for the unexposed surface, as well as any other critical behavior limitations required by the design. Quite often, one will see fire ratings expressed in alphanumeric terms (e.g., A-60). This nomenclature probably sprang from structural fire protection research associated with investigations of early ship fires. The investigations ultimately led the United States to issue Federal Regulations requiring structural fire protection on vessels seeking USCG certification. In 46 CFR 92.075, there are definitions of classes of bulkheads. “A” class bulkheads are defined as being steel or equivalent with the requirement that they be capable of preventing the passage of flame and smoke for one hour if subjected to a “standard fire test.” A standard fire test is also defined in 46 CFR 92.075 and has a time-temperature curve identical to ASTM E 119. This regulation also defines “B” and “C” class bulkheads. 46 CFR 164.007 further defines the testing requirements and in fact makes specific

reference to ASTM E 119. Additionally, in 46 CFR 164.008-2, the performance requirements for A, B, and C class construction are further defined. 46 CFR Part 108 contains definitions of, and requirements for, structural fire protection on Mobile Offshore Drilling Units (MODUs) and Tension Leg Platforms (TLPs), and the terminology is similar to the other parts of 46 CFR. Specific definitions of bulkheads meeting the requirements of the regulations are contained in Navigation and Inspection Circular (YV10 6-80) Guide to Structural Fire Protection Aboard Merchant Vessels.

Variations of this nomenclature have been used throughout the fireproofing industry to describe fireproofing systems. For example, a given system may have a described rating of A-60-H. The first letter (A) means that the system is made of steel, the second number (60) means that the system has a rating of 60 minutes, and the third letter (H) indicates the type of fire curve by which the rating was achieved; in this case, hydrocarbon. Unfortunately, there appears to be little formal standardization of the terminology used to describe fireproofing systems; therefore, descriptions and meanings may vary slightly from country to country or industry to industry.

**b. Applicable Test Standards**

There are two test standards which are in general use for providing criteria by which firewalls are tested: ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Materials, and UL 1709 Rapid Rise Fire Tests of Protection Materials for Structural Steel. Both standards contain a time-temperature curve, which dictates the rate or rise of the temperature in the test furnace to be used for rating fireproofing materials.

ASTM E 119 is a standard which was developed years ago in order to test assemblies of masonry units and composite assemblies of structural materials for buildings. The time-temperature curve in ASTM E 119 is based on a cellulosic fire which is the type of fire most commonly encountered in buildings; consequently, the rate of rise is relatively slow: 2000°F (1093°C) in 4 hours.

UL 1709 is a standard which was developed a few years ago in order to address the need to develop a method for measuring the resistance of fireproofing materials to rapid-temperature-rise fires, like a hydrocarbon fire. Therefore, the rate of rise required in UL 1709 is quite rapid: 2000°F (1093°C) in 5 minutes. For fireproofing on offshore structures, it may be more meaningful to require that fireproofing systems be rated in accordance with UL 1709.

UL 1709 requires that the temperature rise on the unexposed surface of the protected materials not exceed 1000°F (538°C) during the period of fire exposure. This temperature is based on the temperature at which most structural steels begin to yield and lose strength; this requirement primarily addresses the integrity of structural steel. While this may be suitable for structural steel, a much lower temperature (e.g., 250°F [121°C]) should be considered for fireproofing systems on buildings which house personnel (e.g., living quarters).

**A.3 Penetrations**

It is best to avoid penetrations in firewalls; however, this is not always possible, and therefore particular attention must be given to the design of the penetration. Quite often, it is necessary to make penetrations in firewalls in order to accommodate the passage of process piping, electrical cables, doors, etc. The designer of these penetrations must ensure that the penetration does not degrade the integrity and rating of the firewall that they penetrate. The designer should be aware that most commercially available penetrating devices currently on the market are not rated for the more severe hydrocarbon fire environment (UL 1709). If penetrations are to be made through firewalls designed to withstand hydrocarbon fires, it may be necessary to design purpose-built penetrations and subject them to performance “type-testing” in order to ensure that the penetration does, in fact, have the same performance rating as the wall through which it penetrates.

**a. Piping and Cables**

The typical approach to penetrating firewalls with process piping is to route the piping through a larger conduit with the annular space around the process piping filled with a fireproofing material, and the exterior of the conduit coated with an appropriate type and quantity of fireproofing material. Electrical cables are typically routed through fire rated multicable transits.

**b. Doors**

There are many manufacturers of fireproof doors, both in the United States and Europe. Most commercially available fireproof doors are fire rated to ASTM E 119 or a similar standard; however, there are some doors available which are rated to the more severe hydrocarbon fire curves.

**c. Applicable Standards**

There are several testing standards available which define the test requirements for piping/cable penetrations and doors. Some of the more pertinent standards are listed below:

1. ASTM E 163 Standard Methods of Fire Tests of Window Assemblies
2. ASTM E 152 Standard Methods of Fire Tests of Door Assemblies
3. ASTM E 814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops