OFFSHORE STANDARD


Fire protection
FOREWORD

DNV GL offshore standards contain technical requirements, principles and acceptance criteria related to classification of offshore units.

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Any comments may be sent by e-mail to rules@dnvgl.com
CHANGES – CURRENT

General
This document supersedes DNV-OS-D301, July 2014.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

On 12 September 2013, DNV and GL merged to form DNV GL Group. On 25 November 2013 Det Norske Veritas AS became the 100% shareholder of Germanischer Lloyd SE, the parent company of the GL Group, and on 27 November 2013 Det Norske Veritas AS, company registration number 945 748 931, changed its name to DNV GL AS. For further information, see www.dnvgl.com. Any reference in this document to “Det Norske Veritas AS”, “Det Norske Veritas”, “DNV”, “GL”, “Germanischer Lloyd SE”, “GL Group” or any other legal entity name or trading name presently owned by the DNV GL Group shall therefore also be considered a reference to “DNV GL AS”.

Main changes July 2015
• General
The revision of this document is part of the DNV GL merger, updating the previous DNV standard into a DNV GL format including updated nomenclature and document reference numbering, e.g.:
— Main class identification 1A1 becomes 1A.
— DNV replaced by DNV GL.
— DNV-RP-A201 to DNVGL-CG-0168. A complete listing with updated reference numbers can be found on DNV GL’s homepage on internet.

To complete your understanding, observe that the entire DNV GL update process will be implemented sequentially. Hence, for some of the references, still the legacy DNV documents apply and are explicitly indicated as such, e.g.: Rules for Ships has become DNV Rules for Ships.

• Ch.2 Sec.7 Supplementary requirements for oil and gas production and storage units
— [3.3]: Previous items 3.3.9 and 3.3.10 have been deleted since requirements are included in 3.3.4. Subsequent items have been renumbered.

• Ch.2 Sec.8 Supplementary requirements for floating storage units
— [3.3]: Previous items 3.3.9 and 3.3.10 have been deleted since requirements are included in 3.3.4. Subsequent items have been renumbered.

Editorial corrections
In addition to the above stated main changes, editorial corrections may have been made.
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CHAPTER 1 INTRODUCTION

SECTION 1  GENERAL

1  General

1.1  Introduction

1.1.1  This offshore standard provides principles for design, construction, installation and commissioning of fire protection of mobile units and offshore installations.

1.1.2  The standard has been written for general worldwide application. Governmental legislation may include requirements in excess of the provisions in this standard depending on type, location and intended service of the unit or installation.

1.1.3  The requirements of this standard are considered to meet the regulations of the International Maritime Organisation’s Code for Construction and Equipment of Mobile Offshore Drilling Units (MODU Code).

1.2  Objectives

The objectives of this standard are to:

— provide an internationally acceptable standard of safety for fire protection by defining minimum requirements for the design, construction and commissioning of such systems
— serve as a reference document in contractual matters between purchaser and contractor
— serve as a guideline for designers, purchasers and contractors
— specify procedures and requirements for fire protection systems subject to DNV GL certification and classification.

1.3  Scope

1.3.1  This standard is applicable to drilling/well intervention, storage, production, accommodation and other types of mobile units and offshore installations.

1.3.2  The standard covers the following systems and arrangements, including relevant equipment and structures:

— passive fire protection
— active fire protection of specific areas
— fire-fighting systems
— fire and gas detection and alarm systems
— miscellaneous items.

1.4  Application

1.4.1  Interpretations

This standard has been based on internationally accepted principal requirements, defined in the normative references as listed in Sec.2. In cases where these a) contain only functional requirements, b) allow alternative solutions to prescriptive requirements or c) are generally or vaguely worded, a DNV GL interpretation has been added.

1.4.2  The interpretations are not aiming at introducing additional requirements but at achieving uniform application of the principal requirements. The interpretations can be regarded as norms for fulfilling the principle requirements.

1.4.3  The interpretations do not preclude the use of other alternative solutions. Such solutions shall be documented and approved for compliance to the principal requirement equivalent to the original interpretation.
1.4.4 Classification

For use of this standard as technical basis for offshore classification as well as description of principles, procedures, and applicable class notations related to classification services, see the applicable Rules as listed in Table 1.

Table 1 DNV GL Rules for classification - Offshore units

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNVGL-RU-OU-0101</td>
<td>Offshore drilling and support units</td>
</tr>
<tr>
<td>DNVGL-RU-OU-0102</td>
<td>Floating production, storage and loading units</td>
</tr>
<tr>
<td>DNVGL-RU-OU-0103</td>
<td>Floating LNG/LPG production, storage and loading units</td>
</tr>
<tr>
<td>DNVGL-RU-OU-0104</td>
<td>Self-elevating units</td>
</tr>
</tbody>
</table>

1.4.5 The scope of classification may be extended by the voluntary notation ES. The applicable sections or requirements as indicated accordingly shall only be enforced in case this notation is part of this extended classification scope (see also, Ch.3 Sec.1 [1.2]).

1.4.6 Governing regulations

Alternative designs and arrangements deviating from the different regulatory standards as adapted in this standard (e.g. MODU code and FSS code requirements) may be specially considered.

For use of this standard to document compliance to the MODU code certificate, these deviations require acceptance of the Flag.

1.4.7 For the application of this standard, wherever the term Administration is quoted, this means:

- client or purchaser or other designated party, when used as a "neutral" technical standard, or
- DNV GL, when used for certification or classification purposes.

1.5 Structure

This standard is divided into three main parts:

- Ch.1: General introduction, scope, definitions and references.
- Ch.2: Technical provisions for fire protection systems applicable to all types of offshore units and installations in Sec.1 to Sec.5, followed by supplementary requirements for
  - Drilling/well intervention units (Sec.6)
  - Oil and gas production and storage units (Sec.7)
  - Oil and gas storage units (Sec.8)
  - LNG Import and Export Terminals (and LNG Production Units) (Sec.9)
  - Other special service type units or installations (Sec.10)
- Ch.3: Certification and Classification

2 Normative references

2.1 General

2.1.1 The standards in [2.2] and [2.3] include provisions, which, through reference in the text, constitute provisions of this offshore standard. Latest issue of the references shall be used unless otherwise agreed. Other recognised standards may be used provided it can be demonstrated that these meet or exceed the requirements of the standards referenced in [2.2] to [2.3].
2.1.2 Any deviations, exceptions and modifications to the design codes and standards shall be documented and agreed between the contractor, purchaser and verifier, as applicable.

2.2 Offshore standards
The latest edition of the DNV GL Offshore Standards listed in Table 2 applies.

Table 2 DNV GL Offshore Standards

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNVGL-OS-A101</td>
<td>Safety principles and arrangement</td>
</tr>
<tr>
<td>DNVGL-OS-D101</td>
<td>Marine and machinery systems and equipment</td>
</tr>
<tr>
<td>DNVGL-OS-D201</td>
<td>Electrical installation</td>
</tr>
<tr>
<td>DNVGL-OS-D202</td>
<td>Automation, safety and telecommunication systems</td>
</tr>
</tbody>
</table>

2.3 Other references
The latest edition including amendments of the documents listed in Table 3 applies.

Table 3 Normative references

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNV Rules for ships</td>
<td>DNV Rules for Classification of Ships</td>
</tr>
<tr>
<td>EN 54</td>
<td>Fire detection and fire alarm systems – (relevant parts as indicated in the main text)</td>
</tr>
<tr>
<td>EN 1834, Part 1-3</td>
<td>Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres</td>
</tr>
<tr>
<td>FTP Code</td>
<td>International Code for Application of Fire Test Procedures</td>
</tr>
<tr>
<td>NFPA Codes</td>
<td>National Fire protection Association</td>
</tr>
<tr>
<td>FSS Code</td>
<td>International Code for Fire Safety Systems</td>
</tr>
<tr>
<td>ISO 13702</td>
<td>Petroleum and natural gas industries - Control and mitigation of fires and explosions on offshore production installations - Requirements and guidelines</td>
</tr>
<tr>
<td>ISO 17631</td>
<td>Ships and marine technology -- Shipboard plans for fire protection, life-saving appliances and means of escape</td>
</tr>
<tr>
<td>MODU Code</td>
<td>Code for the Construction and Equipment of Mobile Offshore Drilling Units</td>
</tr>
<tr>
<td>SOLAS</td>
<td>International Convention for the Safety of Life at Sea</td>
</tr>
</tbody>
</table>

3 Definitions

3.1 Verbal forms

3.1.1 The following verbal forms are used throughout the standard.

Table 4 Verbal forms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>shall</td>
<td>verbal form used to indicate requirements strictly to be followed in order to conform to the document</td>
</tr>
<tr>
<td>should</td>
<td>verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required</td>
</tr>
<tr>
<td>may</td>
<td>verbal form used to indicate a course of action permissible within the limits of the document</td>
</tr>
</tbody>
</table>

3.1.2 Agreement or by agreement: Unless otherwise indicated, means agreed in writing between manufacturer or yard and purchaser.
### 3.2 Terms

#### Table 5 Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| "H" class divisions| divisions formed by bulkheads and decks which comply with the following: 1) they shall be constructed of steel or other equivalent material 2) they shall be suitably stiffened 3) they shall be constructed as to be capable of preventing the passage of gas, smoke and flames up to the end of the two-hour standard fire test 4) they shall be insulated with approved non-combustible materials or equivalent passive fire protection such that the average and maximum temperature of the unexposed side will not rise to more than 140°C and 180°C respectively above the original temperature, within the time listed below:  
  class H-120  120 minutes  
  class H-60   60 minutes  
  class H-0    0 minutes.  
  (Additionally, a class H-0400 is often used, where 400 means the temperature limitation on the unexposed side. The class H-240 is also used for some equipment). A test of a prototype division is required to ensure that it meets the requirements for integrity and temperature rise. |
| "A" class divisions| divisions formed by bulkheads and decks which comply with the following: 1) they shall be constructed of steel or other equivalent material; 2) they shall be suitably stiffened; 3) they shall be so constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test; 4) they shall be insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature, within the time listed below:  
  class "A-60"  60 minutes  
  class "A-30"  30 minutes  
  class "A-15"  15 minutes  
  class "A-0"   0 minutes.  
  (Ref. SOLAS reg. II-2/3.2) |
| "B" class divisions| divisions formed by bulkheads, decks, ceilings or linings which comply with the following: 1) they shall be so constructed to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test; 2) they shall have an insulation value such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 225°C above the original temperature, within the time listed below:  
  class "B-15"  15 minutes  
  class "B-0"   0 minutes.  
  3) they shall be constructed of recognised non-combustible materials and all materials entering into the construction and erection of "B" class divisions shall be non-combustible, with the exception that combustible veneers may be permitted provided they meet other requirements of this Chapter.  
  (Ref. SOLAS reg. II-2/3.4) |
| "C" class divisions| divisions constructed of approved non-combustible materials They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise. Combustible veneers are permitted provided they meet other requirements of this Chapter.  
  (Ref. SOLAS reg. II-2/3.10) |
Table 5 Terms (Continued)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>accommodation spaces</td>
<td>accommodation spaces are those used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobby rooms, pantries containing no cooking appliances and similar spaces Public spaces are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces. (Ref. MODU code 1.3.3) Guidance note: The accommodation area is normally used as the safe haven or temporary refuge.</td>
</tr>
<tr>
<td>active fire protection</td>
<td>equipment and systems which are used to control, mitigate and extinguish fires</td>
</tr>
<tr>
<td>control station or control room</td>
<td>general term for any location space where essential control functions are performed during transit, normal operations or emergency conditions Typical examples are central control room, radio room, process/drilling/well intervention control room, bridge, emergency response room etc. For the purpose of compliance with the SOLAS Convention and the MODU Code, UPS rooms and fire pump rooms are defined as control stations.</td>
</tr>
<tr>
<td>corridor</td>
<td>includes corridors and lobbies</td>
</tr>
<tr>
<td>deluge system</td>
<td>a system to apply firewater through an array of open spray nozzles by operation of a valve on the inlet to the system The system will discharge through all nozzles served by the deluge valve.</td>
</tr>
<tr>
<td>draught stop</td>
<td>a close fitting hindering any smoke from passing</td>
</tr>
<tr>
<td>drilling areas</td>
<td>includes the derrick, drill floor, BOP area and the area containing shale shakers and degassers This includes also areas for drilling utilities such as mud mixing, pumping, bulk storage and cementing.</td>
</tr>
<tr>
<td>embarkation area</td>
<td>the area where personnel collect and enter each lifeboat or liferaft The embarkation area may also be the muster area.</td>
</tr>
<tr>
<td>enclosed spaces</td>
<td>any space bounded by floors, bulkhead and/or decks which may have doors, windows or other similar openings</td>
</tr>
<tr>
<td>fire and gas detection system</td>
<td>a fire and gas detection system is either a combined fire detection system and gas detection system or separated systems for fire and gas detection</td>
</tr>
<tr>
<td>fire area</td>
<td>an area separated from other areas by horizontal and vertical fire divisions, of relevant fire rating Alternatively segregation by sufficient physical distance may be used.</td>
</tr>
<tr>
<td>fire detection area</td>
<td>area, or areas, of similar environmental conditions and hazards, and with similar detection and protection arrangements defined for the purpose of grouping areas or rooms into similar F&amp;G logic</td>
</tr>
<tr>
<td>fire detection system</td>
<td>the system includes: a) fire detectors and manual call points (MACs) b) a fire central receiving and evaluating signals from the fire detectors and MACs, and creating output signals to the alarm system and the shutdown system. The fire central shall include a device providing visual indication of activated detectors and a local audible alarm c) signal transfer lines between detectors, MACs and fire central d) power supply.</td>
</tr>
<tr>
<td>fire load</td>
<td>the total released heat quantity in case of a complete combustion of all combustible materials in an area, including materials in walls, decks and ceilings</td>
</tr>
<tr>
<td>fire pump system</td>
<td>the total system, which supplies water for fire main, e.g. water inlets with filters, fire-water pumps including lift pumps as relevant, risers, power sources including utilities, power transmissions, day tanks including downstream fuel pipes, control system</td>
</tr>
<tr>
<td>fixed water-spraying system</td>
<td>a system either connected to fire main or with its own water supply This can either be a deluge-, water mist- or sprinkler system.</td>
</tr>
<tr>
<td>flame retardant</td>
<td>property of a substance or treatment applied to a material to substantially suppress, reduce or delay the propagation of a flame</td>
</tr>
</tbody>
</table>
### Table 5 Terms (Continued)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| gas detection system | the system includes:  
  a) gas detectors  
  b) a gas central receiving and evaluating signals from the gas detectors, and creating output signals to the alarm system and the shutdown system. The gas central shall include a device providing visual indication of activated detectors and a local audible alarm  
  c) signal transfer lines between detectors and gas central  
  d) power supply. |
| hazardous areas | three-dimensional space in which a flammable atmosphere may be expected to be present at such frequencies as to require special precautions for the control of potential ignition sources |
| ignition sources | any source with sufficient energy to initiate combustion |
| jet fire | an ignited release of pressurised and flammable fluid |
| low flame spread | means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with the Fire Test Procedures Code (Ref. SOLAS reg. II-2/3.29 as referred to by MODU Code 1.3.31) |
| machinery spaces | machinery spaces are all machinery spaces of category A and all other spaces containing propelling machinery and other fired processes, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilising, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces (Ref. MODU code 1.3.33) |
| machinery spaces of category A | machinery spaces of category A are all spaces which contain internal combustion machinery used for either:  
  a) main propulsion; or  
  b) for other purposes where such machinery has in the aggregate a total power output of not less than 375 kW;  
  c) or which contain any oil-fired boiler or oil fuel unit; and trunks to such spaces. (Ref. MODU code 1.3.34) |
| mobile unit | a buoyant construction engaged in offshore operations including drilling, production, storage or support functions, not intended for service at one particular offshore site and which can be relocated without major dismantling or modification  
  **Guidance note:** The following is the definition in the MODU Code: Mobile offshore drilling unit (MODU) or unit is a vessel capable of engaging in drilling operations for the exploration for or exploitation of resources beneath the sea-bed such as liquid or gaseous hydrocarbons, sulphur or salt. (ref. MODU Code 1.3.40) |
| non-combustible material | is material that neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined in accordance with the Fire Test Procedures Code (FTP Code)  
  Any other material is a combustible material. (Ref. SOLAS reg. II-2/3.33) |
| offshore installation | a buoyant or non-buoyant construction engaged in offshore operations including drilling, production, storage or support functions, and which is designed and intended for use at a location for an extended period  
  This will also include Floating LNG terminals. |
| oil fuel unit | the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 N/mm². (Ref. SOLAS reg. II-2/3.34)  
  Spaces which contain oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc. should be considered as machinery spaces of category "A" in accordance with this regulation. (Ref. IMO MSC/Circ.847 Annex) |
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>open decks</td>
<td>open deck spaces, excluding hazardous areas</td>
</tr>
<tr>
<td>passive fire protection</td>
<td>coating or cladding arrangement or free-standing system which, in the event of fire, will provide thermal protection to restrict the rate at which heat is transmitted to the object or area being protected</td>
</tr>
<tr>
<td>pool fire</td>
<td>combustion of flammable or combustible liquid spilled and retained on a surface</td>
</tr>
<tr>
<td>primary deck covering</td>
<td>a deck covering which will not readily ignite or give rise to toxic or explosive hazards at elevated temperatures Testing shall be based on IMO res. A.687(17) or an equivalent test procedure.</td>
</tr>
<tr>
<td>processing area</td>
<td>any area designated for separation, compression, treatment and disposal of reservoir fluids</td>
</tr>
<tr>
<td>production area</td>
<td>the area accommodating the entire production process from the wellhead, incoming flowlines or pipelines to the most downstream discharge valve, as relevant to the unit in question This includes the riser or turret area.</td>
</tr>
<tr>
<td>public spaces</td>
<td>those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces (Ref. SOLAS reg. II-2/3.39)</td>
</tr>
<tr>
<td>sanitary and similar spaces</td>
<td>communal sanitary facilities such as showers, baths, lavatories, etc., and isolated pantries containing no cooking appliances Sanitary facilities which serve a space and with access only from that space shall be considered a portion of the space in which they are located. (Ref. MODU code 9.2.5.2.11)</td>
</tr>
<tr>
<td>service spaces</td>
<td>service spaces are those spaces used for galleys, pantries containing cooking appliances, lockers and store rooms, workshops other than those forming part of the machinery spaces, and trunks to such spaces (Ref. MODU code 9.2.5.2.49)</td>
</tr>
<tr>
<td>service spaces (high risk)</td>
<td>lockers, store-rooms and working spaces in which flammable materials are stored, galleys, pantries containing cooking appliances, paint rooms and workshops other than those forming part of the machinery space (Ref. MODU code 9.2.5.2.9)</td>
</tr>
<tr>
<td>service spaces (low risk)</td>
<td>lockers, storerooms and working spaces in which flammable materials are not stored, drying rooms and laundries (Ref. MODU code 9.2.5.2.5)</td>
</tr>
<tr>
<td>sprinkler system</td>
<td>a system to apply firewater through nozzles by heat exposure of frangible bulb The system is charged with pressurised firewater up to the nozzle (may also be pressurised air). Only fire exposed nozzles will discharge firewater. The system normally also include a control valve and a device for actuating alarm when system operates.</td>
</tr>
<tr>
<td>stairways</td>
<td>interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto In this connection a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door. (Ref. MODU code 9.2.5.2.4)</td>
</tr>
<tr>
<td>surface unit</td>
<td>a unit with a ship- or barge-type displacement hull of single or multiple hull construction intended for operation in the floating condition (Ref. MODU code 1.3.54)</td>
</tr>
<tr>
<td>turret</td>
<td>a turnable support for riser and mooring lines to enable heading control of the vessel without twisting mooring lines and flexible risers</td>
</tr>
<tr>
<td>wellhead area</td>
<td>the deck area surrounding the wellheads including test, production, and injection manifolds and associated flowlines</td>
</tr>
<tr>
<td>working spaces</td>
<td>open or enclosed spaces containing equipment and processes, associated with drilling operations, which are not included in machinery spaces or hazardous areas</td>
</tr>
</tbody>
</table>
3.3 Abbreviations
The abbreviations in Table 6 are used.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>In full</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOP</td>
<td>blow out preventer</td>
</tr>
<tr>
<td>D&amp;ID</td>
<td>duct and instrument diagram</td>
</tr>
<tr>
<td>EEBD</td>
<td>emergency escape breathing device</td>
</tr>
<tr>
<td>ESD</td>
<td>emergency shutdown</td>
</tr>
<tr>
<td>FTP</td>
<td>fire test procedures (Code)</td>
</tr>
<tr>
<td>HVAC</td>
<td>heating, ventilation and air conditioning</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organisation for Standardisation</td>
</tr>
<tr>
<td>LEL</td>
<td>lower explosion limit</td>
</tr>
<tr>
<td>MAC</td>
<td>manually activated call point</td>
</tr>
<tr>
<td>MODU</td>
<td>mobile offshore drilling unit</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>OS</td>
<td>offshore standard</td>
</tr>
<tr>
<td>PFP</td>
<td>passive fire protection</td>
</tr>
<tr>
<td>RP</td>
<td>recommended practice</td>
</tr>
<tr>
<td>STL</td>
<td>submerged turret loading</td>
</tr>
<tr>
<td>STP</td>
<td>submerged turret production</td>
</tr>
<tr>
<td>UPS</td>
<td>uninterruptible power supply</td>
</tr>
</tbody>
</table>

4 Documentation
Design documentation covering the following aspects is normally produced to document fire and gas technical systems provided under this standard:

- fire pumps
- fire protection philosophy
- fire protection specification
- fire main
- hydrants and hoses
- fixed fire-extinguishing systems
- fire control plan
- automatic sprinkler system
- fixed fire detection and alarm systems
- fixed gas detection and alarm system
- specification and location of detectors, equipment alarms and call points
- wiring diagrams
- ventilation system D&ID’s including dimensions and penetrations of ducts through fire divisions
- details of fire dampers
- penetrations of cables and pipes through fire divisions
- arrangement of means of control for closure of openings, stop of ventilation fans and stop of fuel oil pumps in machinery spaces
- fire integrity of bulkheads and decks
- general arrangement of all rooms showing fire insulation and draught stops
- details of insulation and specification of materials
— fire doors in different types of bulkheads and specification of doors
— deck coverings and surface materials specification and positions.

For documentation requirements for classification see. Ch.3 Sec.1 [1.4].
CHAPTER 2 TECHNICAL PROVISIONS

SECTION 1 PASSIVE FIRE PROTECTION

1 General

1.1 Objective

The objectives of passive fire protection (PFP) are to prevent or mitigate the serious consequences from a fire, such as to:

— prevent escalation of fire from one area to an adjacent area
— ensure the temporary refuge is intact for the time necessary
— protect personnel from the fire (heat and smoke) and make escape or evacuation possible
— protect systems and equipment of essential importance for safety
— maintain structural integrity for the required period of time.

1.2 Scope

1.2.1 These requirements have been formulated principally for units having their hull, superstructure, structural bulkheads, decks and deckhouses constructed of steel. (Ref. MODU Code 9.2.1)

1.2.2 Units constructed of other materials may be accepted, provided that they provide an equivalent standard of safety. (Ref. MODU Code 9.2.2)

Interpretation:
The equivalent standard of safety should be documented and is subject to approval.

------------- end of Interpretation -------------

1.2.3 For supplementary requirements applicable to units for special types of service, see Sec.6 to Sec.10.

2 Fire technical requirements

2.1 Fire resistance tests

The qualifying properties for fire resistance shall be established through recognised codes and standards. The latest edition of the documents listed below applies.
2.2 Structural elements

2.2.1 Structural fire protection details shall avoid the risk of heat transmission at intersections and terminal points of required thermal barriers. The insulation of a deck or bulkhead shall be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

(Ref. MODU code 9.27)

Interpretation:

1) Special attention should be given to the insulation of aluminium alloy components of columns, stanchions and other structural members as
   — support lifeboat and liferaft stowage
   — launching and embarkation areas
   — support for safety critical equipment, e.g. fire-water system, valves and escape routes
   — "A" class divisions

   to ensure that for such members the temperature is below the critical temperature for structural integrity at the end of one hour:

2) For "B" class divisions, the temperature rise limitation shall apply at the end of half an hour.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
2.2.2 Normally the critical temperatures with respect to structural integrity are as given in Table 2.

Table 2 Critical temperatures

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural steel and ordinary reinforcing steel</td>
<td>400 to 450°C</td>
</tr>
<tr>
<td>Pre-stressed reinforcing steel</td>
<td>350°C</td>
</tr>
<tr>
<td>Aluminium</td>
<td>200°C</td>
</tr>
</tbody>
</table>

2.2.3 Other critical values may be used as long as corresponding changes are taken into account concerning the thermal and mechanical properties.

2.3 Ventilation ducts for accommodation spaces, service spaces, control stations and machinery spaces

2.3.1 Ventilation ducts shall be of non-combustible material. Short ducts, however, not generally exceeding 2 m in length and with a cross-sectional area not exceeding 0.02 m² need not be non-combustible, subject to the following conditions:

1) these ducts shall be of a material which has a low fire risk;
2) they may only be used at the end of the ventilation device;
3) they shall not be situated less than 600 mm, measured along the duct, from where it penetrates any “A” or “B” class division including continuous “B” class ceilings.

(Ref. MODU Code 9.3.13)

2.3.2 Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m² passes through “A” class bulkhead or decks, the opening shall be lined with a steel sheet sleeve having a thickness of at least 3 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the deck pierced. Where ventilation ducts with a cross-sectional area exceeding 0.02 m² pass through class “A” bulkheads or decks, the opening shall be lined with a steel sheet sleeve unless the ducts passing through the bulkheads or decks are of steel in the vicinity of penetrations through the deck or bulkhead; the ducts and sleeves at such places shall comply with the following:

1. The ducts or sleeves shall have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length shall be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, shall be provided with fire insulation. The insulation shall have at least the same fire integrity as the bulkhead or deck through which the duct passes. Equivalent penetration protection may be provided to the satisfaction of the Society.

2. Ducts with a cross-sectional area exceeding 0.075 m², except those serving hazardous areas, shall be fitted with fire dampers in addition to meeting the provisions above. The fire damper shall operate automatically but shall also be capable of being closed manually from both sides of the bulkhead or deck. The damper shall be provided with an indicator which shows whether the damper is open or closed. Fire dampers are not required, however, where ducts pass through spaces surrounded by “A” class divisions, without serving those spaces, provided those ducts have the same fire integrity as the divisions which they pierce. Operation from one side of a division only is subject to a case-by-case approval.

(Ref. MODU Code 9.3.14)

2.3.3 In general, ventilation systems for machinery spaces of category A, galleys and hazardous areas shall be separated from each other and from the ventilation systems serving other spaces. Ducts serving hazardous areas shall not pass through accommodation spaces, service spaces, or control spaces. Ducts provided for the ventilation of machinery spaces of category A and galleys shall not pass through accommodation spaces, service spaces or control spaces unless:

1) the ducts are constructed of steel having a thickness of at least 3 mm and 5 mm for ducts the widths or diameters of which are up to and including 300 mm and 760 mm and over respectively and, in the case of such ducts, the width or diameter of which are between 300 mm and 760 mm, having a thickness obtained by interpolation;
2) the ducts are suitably supported and stiffened;
3) the ducts are fitted with automatic fire dampers close to the boundaries penetrated; and
4) the ducts are insulated to “A-60” standard from the machinery spaces or galleys to a point at least 5 m beyond each fire damper;
   or
5) the ducts are constructed of steel in accordance with 1 and 2; and
6) the ducts are insulated to “A-60” standard throughout the accommodation spaces, service spaces or control stations.

(Ref. MODU Code 9.3.15)

2.3.4 Ducts provided for the ventilation of accommodation spaces, service spaces or control stations shall not pass through machinery spaces of category A, galleys or hazardous areas. Except for the ducts passing through hazardous areas, a relaxation from this requirement may be approved provided that:
1) the ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with (2.3.3 1)) and (2.3.3 2));
2) automatic fire dampers are fitted close to the boundaries penetrated; and
3) the integrity of the machinery space or galley boundaries is maintained at the penetrations;
   or
4) the ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with (2.3.3 1)) and (2.3.3 2)); and
5) are insulated to “A-60” standard within the machinery space or galley.

(Ref. MODU Code 9.3.16)

2.3.5 Ventilation ducts with a cross-sectional area exceeding 0.02 m² passing through “B” class bulkheads shall be lined with steel sheet sleeves of 900 mm in length divided preferably into 450 mm on each side of the bulkhead unless the duct is of steel for this length.

(Ref. MODU Code 9.3.17)

2.3.6 Where they pass through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges shall be of equivalent fire integrity to “A” class divisions.

(Ref. MODU Code 9.3.18)

2.3.7 Each galley exhaust duct shall be fitted with:
1) a grease trap readily removable for cleaning;
2) a fire damper located in the galley end of the ducts which is automatically and remotely operated and, in addition a remotely operated fire damper located in the exhaust end of the duct;
3) arrangements, operable from within the galley, for shutting off the exhaust fans; and
4) fixed means for extinguishing a fire within the duct.

(Ref. MODU Code 9.3.19)

2.3.8 The main inlets and outlets of all ventilation systems shall be capable of being closed from outside the spaces being ventilated.

(Ref. MODU Code 9.3.20)

2.3.9 Power ventilation of accommodation spaces, service spaces, control stations, machinery spaces and hazardous areas shall be capable of being stopped from an easily accessible position outside the space being served. The accessibility of this position in the event of a fire in the spaces served shall be specially considered. The means provided for stopping the power ventilation serving machinery spaces or hazardous areas shall be entirely separate from the means provided for stopping ventilation of other spaces.

(Ref. MODU Code 9.3.21)
2.4 Penetrations
Openings and penetrations in fire rated divisions shall be arranged so as to maintain the fire rating of the divisions. Penetrations shall be approved for the actual divisions where they are to be installed.

Interpretation:
Openings in bulkheads of “H” class should be avoided.

------------- end of Interpretation -------------

3 Protection of spaces or areas

3.1 General
The general requirements for arrangement and the separation of spaces or areas of different category and/or operation are given in DNVGL-OS-A101.

3.2 Fire integrity of bulkheads and decks

3.2.1 Fire integrity of bulkheads separating adjacent spaces shall be as given in Table 3 and Table 4.

3.2.2 In addition to complying with the specific provisions for fire integrity of bulkheads and decks in this section and in 300, the minimum fire integrity of bulkheads and decks shall be as prescribed in Table 3 and Table 4. Exterior boundaries of superstructures and deckhouses enclosing accommodation, including any overhanging decks which support such accommodation, shall be constructed to “A-60” standard for the whole of the portion which faces and is within 30 m of the centre of the rotary table. For units that have a movable substructure the 30 m shall be measured with the substructure at its closest drilling position to the accommodation.

(Ref. MODU Code 9.2.4)

Table 3 Fire integrity of bulkheads separating adjacent spaces

<table>
<thead>
<tr>
<th>Spaces</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
<th>(11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control stations</td>
<td>A-0</td>
<td>A-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-15</td>
<td>A-60</td>
<td>A-15</td>
<td>A-60(e)</td>
<td>A-60</td>
<td>*</td>
<td>A-0</td>
</tr>
<tr>
<td>Corridors (2)</td>
<td>C</td>
<td>B-0</td>
<td></td>
<td>B-0</td>
<td>A-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0(e)</td>
<td>A-0</td>
<td>*</td>
<td>B-0</td>
</tr>
<tr>
<td>Accommodation spaces (3)</td>
<td>C</td>
<td>B-0</td>
<td>A-0</td>
<td>B-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0(e)</td>
<td>A-0</td>
<td>*</td>
<td>C</td>
</tr>
<tr>
<td>Stairways (4)</td>
<td>B-0</td>
<td>A-0</td>
<td>A-0</td>
<td>B-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0(e)</td>
<td>A-0</td>
<td>*</td>
<td>B-0</td>
</tr>
<tr>
<td>Service spaces (low risk) (5)</td>
<td>C</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*</td>
<td>B-0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery spaces of category A (6)</td>
<td>*</td>
<td>A-0(c)</td>
<td>A-0</td>
<td>A-60</td>
<td>A-60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other machinery spaces (7)</td>
<td>A-0(c)</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hazardous areas (8)</td>
<td></td>
<td></td>
<td></td>
<td>A-0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service spaces (high risk) (9)</td>
<td>A-0(c)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open decks (10)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sanitary and similar spaces (11)</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Ref. MODU Code 9.2.4)
3.2.3 See notes under Table 4.

### Table 4 Fire integrity of decks separating adjacent spaces

<table>
<thead>
<tr>
<th>Space - above below</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
<th>(11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control stations (1)</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
</tr>
<tr>
<td>Corridors (2)</td>
<td>A-0</td>
<td>*)</td>
<td>*)</td>
<td>A-0</td>
<td>*)</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>*)</td>
</tr>
<tr>
<td>Accommodation spaces (3)</td>
<td>A-60</td>
<td>A-0</td>
<td>*)</td>
<td>A-0</td>
<td>*)</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>*)</td>
</tr>
<tr>
<td>Stairways (4)</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>A-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>A-0</td>
</tr>
<tr>
<td>Service spaces (low risk) (5)</td>
<td>A-15</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>A-0</td>
</tr>
<tr>
<td>Machinery spaces of category A (6)</td>
<td>A-60</td>
<td>A-60</td>
<td>A-60</td>
<td>A-60</td>
<td>*)</td>
<td>A-60</td>
<td>A-60</td>
<td>A-60</td>
<td>*)</td>
<td>A-0</td>
<td></td>
</tr>
<tr>
<td>Other machinery spaces (7)</td>
<td>A-60</td>
<td>A-60</td>
<td>A-60</td>
<td>A-60</td>
<td>*)</td>
<td>A-60</td>
<td>A-60</td>
<td>A-60</td>
<td>*)</td>
<td>A-0</td>
<td></td>
</tr>
<tr>
<td>Hazardous areas (8)</td>
<td>A-60(e)</td>
<td>A-0(e)</td>
<td>A-0(e)</td>
<td>A-60(e)</td>
<td>A-0</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td></td>
</tr>
<tr>
<td>Service spaces (high risk) (9)</td>
<td>A-60</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
</tr>
<tr>
<td>Open decks (10)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td>*)</td>
<td></td>
</tr>
<tr>
<td>Sanitary and similar spaces (11)</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>A-0</td>
<td>*)</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>A-0</td>
<td>*)</td>
<td>*)</td>
</tr>
</tbody>
</table>

**Notes:** To be applied to Table 3 and Table 4, as appropriate.

The required fire integrity should be qualified through the conditions for the dimensioning accidental load that applies. Areas where the dimensioning fire load exceeds 100 kW/m², H-rated divisions shall be applied. See DNVGL-OS-A101 Sec.2.

(a) Where the space contains an emergency power source or components of an emergency power source adjoining a space containing a ship’s service generator or the components of a ship’s service generator, the boundary bulkhead or deck be-tween those spaces shall be an “A-60” class division.

(b) For clarification as to which note applies see [3.3.3] and [3.3.5].

(c) Where spaces are of the same numerical category and superscript “c” appears, a bulkhead or deck of the rating shown in the tables is only required when the adjacent spaces are for a different purpose, e.g. in category (9). A galley next to a galley does not require a bulkhead but a galley next to a paint room requires an “A-0” bulkhead.

(d) Bulkheads separating the navigating bridge, chartroom and radio room from each other may be “B-0” rating.

(e) An engineering evaluation shall be conducted in accordance with [3.3.1]. In no case shall the bulkhead or deck rating be less than the value indicated in the tables.

*) Where an asterisk appears in the tables, the division shall be of steel or equivalent material, but need not be of “A” class standard. However, where a deck is penetrated for the passage of electric cables, pipes and vent ducts, such penetrations shall be made tight to prevent the passage of flame and smoke.

(Ref. MODU Code Table 9-1 and Table 9-2)

3.2.4 The following requirements shall govern application of the tables:

a) Table 1-3 and Table 1-4 shall apply respectively to the bulkheads and decks separating adjacent spaces.

b) For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk, as shown in categories 1. to 11. below.

The title of each category is intended to be typical rather than restrictive. The number in parenthesis preceding each category refers to the applicable column or row in the tables:

1) “Control stations” are spaces as defined in Ch.1 Sec.1.
2) “Corridors” means corridors and lobbies.
3) “Accommodation spaces” are spaces as defined in Ch.1 Sec.1, excluding corridors, lavatories and pantries containing no cooking appliances.
4) “Stairways” are interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto. In this connection a stairway which is enclosed only at one level shall be regarded as part of the space from which it is not separated by a fire door.

5) “Service spaces (low risk)” are lockers, store-rooms and working spaces in which flammable materials are not stored, drying rooms and laundries.

6) “Machinery spaces of category A” are spaces as defined in Ch.1 Sec.1.

7) “Other machinery spaces” are spaces as defined in Ch.1 Sec.1 other than machinery spaces of category A.

8) “Hazardous areas” are areas as defined in Ch.1 Sec.1.

9) “Service spaces (high risk)” are lockers, store-rooms and working spaces in which flammable materials are stored, galleys, pantries containing cooking appliances, paint rooms and workshops other than those forming part of the machinery space.

10) “Open decks” are open deck spaces, excluding hazardous areas.

11) "Sanitary and similar spaces" are communal sanitary facilities such as showers, baths, lavatories, etc., and isolated pantries containing no cooking appliances. Sanitary facilities which serve a space and with access only from that space shall be considered a portion of the space in which they are located.

(Ref. MODU Code 9.2.5)

3.2.5 Continuous “B” class ceilings or linings in association with the relevant decks or bulkheads may be accepted as contributing wholly or in part to the required insulation and integrity of a division.

(Ref. MODU Code 9.2.6)

3.2.6 In approving structural fire protection details, risks of heat transmission at intersections and terminal points of required thermal barriers shall be considered. The insulation of a deck or bulkhead shall be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of “A” class standard having insulation of different values, the insulation with the bigger value shall continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

(Ref. MODU Code 9.2.7)

3.2.7 Windows and side scuttles, with the exception of navigating bridge windows, shall be of the non-opening type. Navigating bridge windows may be of the opening type provided the design of such windows permits rapid closure. Windows and side scuttles outside hazardous areas may be of the opening type.

(Ref. MODU Code 9.2.8)

3.2.8 The fire resistance of doors shall, as far as practicable, be equivalent to that of the division in which they are fitted. External doors in superstructures and deckhouses shall be constructed to at least “A-0” class standard and be self-closing, where practicable.

(Ref. MODU Code 9.2.9)

3.2.9 Self-closing doors in fire rated bulkheads shall not be fitted with hold-back hooks. However, hold-back arrangements incorporating remote release fitting of the fail-safe type may be utilized.

(Ref. MODU Code 9.2.10)

3.3 Protection of accommodation spaces, service spaces and control stations

3.3.1 In general, accommodation spaces, service spaces and control stations shall not be located adjacent to hazardous areas. However, where this is not practicable, an engineering evaluation shall be performed to ensure that the level of fire protection and blast resistance of the bulkheads and decks separating these spaces from the hazardous areas are adequate for the likely hazard.

(Ref. MODU code 9.3.1)
Interpretation:
The engineering evaluation should be a documented risk-, fire load- or blast analysis covering the most likely hazards. The analysis should demonstrate that in the worst foreseen scenario, the structural integrity of the bulkhead or deck and the protection against heat radiation remain within the limits established by the FTP Code during the time period of the event up to a maximum of 120 minutes.

----------------- end of Interpretation -----------------

3.3.2 All bulkheads that are to be “A” class divisions shall extend from deck to deck and to the deckhouse side or other boundaries.

(Ref. MODU code 9.3.2)

3.3.3 All bulkheads forming "B" class divisions shall extend from deck to deck and to the deckhouse side or other boundaries, unless continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, in which case the bulkhead may terminate at the continuous ceiling or lining. In corridor bulkheads, ventilation openings may be permitted only in and under the doors of cabins, public spaces, offices and sanitary spaces. The openings shall be provided only in the lower half of the door. Where such an opening is in or under a door, the total net area of any such opening or openings shall not exceed 0.05 m². When such an opening is cut in a door, it shall be fitted with a grille made of non-combustible material. Such openings shall not be provided in a door in a division forming a stairway enclosure.

(Ref. MODU Code 9.3.3)

3.3.4 Stairs shall be constructed of steel or equivalent material.

(Ref. MODU Code 9.3.4)

3.3.5 Stairways which penetrate only a single deck shall be protected at least at one level by "A" or "B" class divisions and self-closing doors so as to limit the rapid spread of fire from one deck to another. Personnel lift trunks shall be protected by “A” class divisions. Stairways and lift trunks which penetrate more than a single deck shall be surrounded by “A” class divisions and protected by self-closing doors at all levels.

(Ref. MODU Code 9.3.5)

3.3.6 Air spaces enclosed behind ceilings, panelling or linings shall be divided by close fitting draught stops spaced not more than 14 m apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., shall be closed at each deck.

(Ref. MODU Code 9.3.6)

3.3.7 Except for insulation in refrigerated compartments, insulation material, pipe and vent duct lagging, ceilings, linings and bulkheads shall be of non-combustible material. Insulation of pipe fittings for cold service systems and vapour barriers and adhesives used in conjunction with insulation need not be non-combustible but they shall be kept to a minimum and their exposed surfaces shall have low flame spread characteristics (see Guidance note). In spaces where penetration of oil products is possible, the surfaces of the insulation shall be impervious to oil or oil vapours.

(Ref. MODU Code 9.3.7)

Guidance note:
Refer to the Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials, adopted by the Organization by resolution A.653(16), in conjunction with the Guidelines on the evaluation of fire hazards properties of materials, adopted by the Organization by resolution A.166(ES.IV) and Annex 1, Part 1 of the International Code for Application of Fire Test Procedures (FTP Code).

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.8 The framing, including grounds and the joint pieces of bulkheads, linings, ceilings and draught stops, shall be of non-combustible material.

(Ref. MODU Code 9.3.8)

3.3.9 All exposed surfaces in corridors and stairway enclosures and surfaces in concealed or inaccessible spaces in accommodation and service spaces and control stations shall have low flame spread.
characteristics. Exposed surfaces of ceilings in accommodation and service spaces and control stations shall have low flame spread characteristics.

(Ref. MODU Code 9.3.9)

3.3.10 Bulkheads, linings and ceilings may have combustible veneers provided that the thickness of such veneers shall not exceed 2.5 mm within any space other than corridors, stairway enclosures and control stations where the thickness shall not exceed 1.5 mm. Combustible materials used on these surfaces shall have a calorific value (see Guidance note) not exceeding 45 MJ/m² of the area for the thickness.

(Ref. MODU Code 9.3.10)

Guidance note:
Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 1716, Reaction to fire tests for building products – Determination of heat combusition.

3.3.11 Primary deck coverings, if applied within accommodation and service spaces and control stations, shall be of approved material which will not readily ignite, this being determined in accordance with the FTP code.

(Ref. MODU Code 9.3.11)

3.3.12 Paints, varnishes and other finishes used on exposed interior surfaces shall not be capable of producing excessive quantities of smoke and toxic products, this being determined in accordance with the FTP code.

(Ref. MODU Code 9.3.12)

4 Cables

4.1 General
Equipment and systems that are important to safety and need to be kept intact during a fire shall be provided with passive fire protection or located such that they will not be exposed to excessive fire loads. Cables with such functions shall be fire resistant, see IEC 60331-11/21.

(Ref. FSS code 9.2.3.3)

Interpretation:
Such equipment and systems includes valves and their accumulators, cables and their trays, piping systems and pressure vessels with their support, position mooring system etc.

4.2 Detailed requirements

4.2.1 All electrical cables in accommodation areas shall be flame retardant according to IEC 60332-3 with additions, or other similar test method.

4.2.2 Where oil absorbing insulating material is used, the insulation shall be covered by non-combustible vapour-tight sheeting.

4.2.3 For fire resistance requirements for cables reference is made to DNVGL-OS-D201 Ch.2 Sec.2(10) and Sec. 9 as applicable.

Guidance note:
Reference is made to MODU Code 5.6.9 and 5.6.10.
SECTION 2  ACTIVE FIRE PROTECTION OF SPECIFIC AREAS

1  General
This section gives requirements for active fire protection of specific areas common to all types of mobile offshore units and offshore installations.

General system requirements for fire fighting systems listed are given in Sec.3.

For supplementary requirements applicable to units and installations for special types of service, see Sec.6 to Sec.10.

2  Fire-extinguishing systems in specific areas

2.1  Accommodation, service and working spaces, and control stations

2.1.1  Except for the supplementary arrangements provided in Table 1, portable fire extinguishers in accommodation spaces, service spaces, control stations, machinery spaces of category A, other machinery spaces, cargo spaces, weather deck and other spaces shall be provided in accordance with IMO MSC.1/Circ. 1275.

(Ref. MODU Code 9.9.1)

Interpretation:

Portable fire extinguishers should be located so that they can be reached within a distance of 15 m.

-------------- end of Interpretation --------------

2.1.2  Table 2-1 contains supplemental recommendations for number and distribution of additional portable fire extinguishers. Where the recommendations in Table 1 differ from IMO MSC.1/Circ. 1275 the provisions of Table 1 shall be followed. In all cases, the selection of the fire-extinguishing medium shall be based on the fire hazard for the space protected in line with IMO resolution A.951. The classes of portable fire extinguishers in the table are only for reference.

(Ref. MODU Code 9.9.2)

Table 1  Recommended number and distribution of additional portable extinguishers

<table>
<thead>
<tr>
<th>Type of space</th>
<th>Minimum number of extinguishers 1)</th>
<th>Class(es) of extinguisher(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space containing the controls for the main source of electrical power</td>
<td>1; and 1 additional extinguisher suitable for electrical fires when main switchboards are arranged in the space</td>
<td>A and/or C</td>
</tr>
<tr>
<td>Cranes: With electric motors/hydraulics</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Cranes: With internal combustion engine</td>
<td>2 (1 in cab and 1 at exterior of engine compartment)</td>
<td>B</td>
</tr>
<tr>
<td>Drill floor</td>
<td>2 (1 at each exit)</td>
<td>C</td>
</tr>
<tr>
<td>Helidecks</td>
<td>In accordance with Sec.5</td>
<td>B</td>
</tr>
<tr>
<td>Machinery spaces of category A</td>
<td>In accordance with [2.2]</td>
<td>B</td>
</tr>
</tbody>
</table>
Interpretation:

'Near' in note 2 of the above table should be understood as less than 4 metres from the entrance to that space.

--- end of Interpretation ---

### 2.2 Machinery spaces and in spaces containing fired processes

#### 2.2.1 In spaces where main or auxiliary oil-fired boilers and other fired processes of equivalent thermal rating are situated, or in spaces containing oil fuel units or settling tanks, the unit shall be provided with the following:

1) One of the following fixed fire-extinguishing systems complying with SOLAS regulation II-2/10.4:
   - a fixed pressure water-spraying;
   - a fixed gas fire-extinguishing system;
   - a fixed high-expansion foam.

2) Where the machinery space and spaces containing fired processes are not entirely separate, or if fuel oil can drain from the latter spaces into the machinery space, the combined machinery space and fired process space shall be considered as one compartment.

3) At least two approved portable foam extinguishers or equivalent in each space containing a fired process and each space in which a part of the oil fuel installation is situated. In addition, at least one extinguisher of the same description with a capacity of 9 l for each burner, whereby the total capacity of the additional extinguisher or extinguishers need not exceed 45 l for any one space.

4) A receptacle containing sand, sawdust impregnated with soda, or other approved dry material in such quantity as may be required by the Administration. An approved portable extinguisher may be provided as an alternative.

(Ref. MODU Code 9.8.1)

Interpretation:

1) The fixed water-spray system should cover the entire space instantaneously at release. Even though the fixed water-spray system can by definition either deluge, sprinkler or a water mist system, this excludes sprinkler systems.

2) The quantity of the dry material should be at least 0.1 m³.

3) A suitable shovel for spreading the dry material should be available.

(as based on SOLAS II-2, 10.5.1.2.3)

--- end of Interpretation ---
2.2.2 Spaces containing internal combustion machinery used either for main propulsion or for other purposes, when such machinery has a total power output of not less than 750 kW, shall be provided with the following arrangements:

— One of the fixed fire-extinguishing arrangements required by [2.2.1], 1); and
— One approved foam-type extinguisher of not less than 45 l capacity or equivalent in every engine space and one approved portable foam extinguisher for each 750 kW of engine power output or part thereof. The total number of portable extinguishers so supplied shall be not less than two and need not exceed six.

(Ref. MODU code 9.8.2)

Interpretation:

A turbine module should be regarded as a space containing internal combustion machinery.

Guidance note:

A water mist system is recommended for use in turbine modules.

2.2.3 Special consideration shall be given to the fire-extinguishing arrangements to be provided in spaces not fitted with fixed fire-extinguishing installations containing steam turbines which are separated from boiler rooms by watertight bulkheads.

(Ref. MODU code 9.8.3)

Interpretation:

1) For steam turbines having in the aggregate a total output of not less than 375 kW, one of the fire-extinguishing systems specified in [2.2.1], first item should be provided.
2) In addition there should be approved foam fire extinguishers each of at least 45 l capacity or equivalent sufficient in number to enable foam or its equivalent to be directed on to any part of the pressure lubrication system, on to any part of the casings enclosing pressure lubricated parts of the turbines, engines or associated gearing, and any other fire hazards. However, such extinguishers shall not be required if protection, at least equivalent to that required by this interpretation is provided by a fixed fire-extinguishing system fitted.
3) There should be a sufficient number of portable foam extinguishers or equivalent to be so located that no point in the space is more than 10 m walking distance from an extinguisher and that there are at least two such extinguishers in each such space, except that such extinguishers shall not be required in addition to any provided in compliance with paragraph [2.2.1].

(as based on SOLAS II-2, 10.5.3.1)

2.2.4 Where a fire hazard exists in any machinery space for which no specific provisions for fire-extinguishing appliances are prescribed in [2.2.1] to [2.2.3] there shall be provided in, or adjacent to, that space a number of approved portable fire extinguishers or other means of fire extinction to the satisfaction of the Administration.

(Ref. MODU code 9.8.4)

Interpretation:

1) The fire extinction capability should be equivalent with the requirements for the other rooms taken into account the fire risk.
2) Electrical spaces should take into account the potential for short circuit as a result of sea water-based extinguishing systems.
3) The number of portable fire extinguishers should follow [2.1.2].

---------------- end of Interpretation ---------------

2.3 Lockers containing flammable liquids

2.3.1 The following covers spaces used for the storage of paint or other flammable liquids like adhesives, lubrications and solvents.

2.3.2 Lockers with a deck area equal or greater than 4 m² shall be protected by either:

— a carbon dioxide system, designed to give a minimum volume of free gas equal to 40% of the gross volume of the protected space
— a dry powder system, designed for at least 0.5 kg powder / m³
— a water spraying or sprinkler system, designed for 5(l/min)/m². Water spraying systems may be connected to the fire main of the ship, or
— a system providing equivalent protection.

In all cases, the system shall be operable from outside the protected space.

(Ref. SOLAS Chapter II-2 10.6.3.1)

2.3.3 For lockers of a deck area less than 4 m², which do not give access to accommodation spaces, a portable carbon dioxide fire extinguisher sized to provide a minimum volume of free gas equal to 40% of the gross volume of the space may be accepted in lieu of a fixed system. A discharge port shall be arranged in the locker to allow the discharge of the extinguisher without having to enter into the protected space. The required portable fire extinguisher shall be stowed adjacent to the port. Alternatively, a port or hose connection may be provided to facilitate the use of fire main water.

(Ref. SOLAS Chapter II-2 10.6.3.3)

2.4 Gas cylinders

Spaces for the storage of acetylene and oxygen cylinders shall have a satisfactory fire-extinguishing arrangement.

(Ref. MODU code 9.17.2)

Interpretation:

These areas should be protected by a fixed water protection system, which shall be activated upon confirmed fire detection in relevant areas. The capacity of this system is to be at least 10 (l/min)/m² of space to be protected.

---------------- end of Interpretation ---------------
SECTION 3  FIRE-FIGHTING SYSTEMS

1 General

1.1 Objective
The objectives of this section are to outline technical standards or requirements for fire-fighting systems and equipment. Such equipment shall be installed with the aim to extinguish fires, reduce the effects to enable emergency actions, provide efficient control of fires and limit damage to structures and equipment.

1.2 Scope
This section gives requirements for fire-fighting systems common to all types of mobile offshore units and offshore installations.

1.3 Structure
The section is divided in two parts:
— Subsection [2]: on fire main system including fire-water pump, fire main and fire hydrants and hoses
— Subsection [3]: on local fire-fighting systems including fixed gas fire-extinguishing system, fixed foam fire-extinguishing system, water mist, deluge systems, monitors, sprinkler systems and portable extinguishers.

For supplementary requirements applicable to units and installations for special types of service, see Sec.6 to Sec.10.

2 Fire main systems

2.1 General

2.1.1 Manual local release of fire-fighting systems and equipment shall be possible from a location outside the area to be protected. The location shall be such that personnel operating the release will not be exposed to excessive heat loads.

2.1.2 Active fire protection systems and equipment shall be designed for testing without interruption of normal operation.

2.1.3 All fire-fighting equipment must be protected against freezing to the extent necessary.

2.2 Fire-water pump system

2.2.1 At least two independently driven power pumps shall 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 may be installed, provided such arrangements will satisfy all the requirements of [2.2.1] to [2.2.9].

(Ref. MODU code 9.7.1)

Interpretation:
Both pumps should provide 100% capacity. Unless specific requirements are given, normally one pump should be supplied from main power and the other from emergency power or dedicated driver.

--------------  end of Interpretation  --------------

2.2.2 At least one of the required pumps shall be dedicated for fire-fighting duties and be available for such duties at all times.

(Ref. MODU code 9.7.2)
2.2.3 The arrangements of the pumps, sea suctions and sources of power shall be such as to ensure that a fire in any one space would not put both the required pumps out of action.

(Ref. MODU code 9.7.3)

Interpretation:
If the fire-water pump unit is required to be started on detected gas (e.g. due to activation of deluge systems to reduce the explosion loads systems), the engine should be protected as if it is installed in hazardous areas (reference is made to DNVGL-OS-D101 Ch.2, Sec.5, 2.2.1/ DNVGL-OS-A101 Ch.2, Sec.2, 4.4.1).

--------------- end of Interpretation ---------------

2.2.4 The capacity of the required pumps shall be appropriate to the fire-fighting services supplied from the fire main.

(Ref. MODU Code 9.7.4)

Guidance note:
The above should be understood as the total capacity of the required pumps combined.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2.5 Each pump shall 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 0.35 N/mm² at any hydrant. In addition, where a foam system is provided for protection of the helicopter deck, the pump shall be capable of maintaining a pressure of 0.7 N/mm² at the foam installation. If the water consumption for any other fire protection or fire-fighting purpose shall exceed the rate of the helicopter deck foam installation, this consumption shall be the determining factor in calculating the required capacity of the fire pumps.

(Ref. MODU code 9.7.5)

2.2.6 Where either of the required pumps is located in a space not normally manned and, in the opinion of the Administration, is relatively far removed from working areas, suitable provision shall be made for remote start-up of that pump and remote operation of associated suction and discharge valves.

(Ref. MODU Code 9.7.6)

Interpretation:
1) The required fire pump(s) pump should be put automatically into action by a pressure drop in the in fixed pressure water systems in line with FSS Code 7.2.1.3.
2) The remote start-up of the pump should be installed unless the pump is located in a room directly adjacent to a permanently manned control station.

--------------- end of Interpretation ---------------

2.2.7 Except as provided in [2.2.2], sanitary, ballast, bilge or general service pumps maybe accepted as fire pumps, provided that they are not normally used for pumping oil.

(Ref. MODU code 9.7.7)

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

(Ref. MODU code 9.7.8)

2.2.9 Relief valves shall 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 shall be so placed and adjusted as to prevent excessive pressure in the fire main system.

(Ref. MODU code 9.7.9)

2.2.10 Fire pumps shall start at low pressure in fire main.

(Ref. FSS code 7.2.1.3, 8.2.5.1 and 8.2.5.3)
2.2.11 Starting arrangement for fire water pump engines shall be in accordance with DNVGL-OS-D201 Ch.2. Sec.2 [3.3.3].

Interpretation:
Battery installations should comply with DNVGL-OS-D201 Ch2 Sec.2 [4]. Hydraulic and compressed air systems should be in accordance with NFPA 20 or equivalent.

------------- end of Interpretation -------------

2.3 Fire main

2.3.1 A fixed fire main shall be provided and be so equipped and arranged as to meet the requirements of 2.3.2 to 2.3.10.
(Ref. MODU code 9.7.10)

2.3.2 The diameter of the fire main and water service pipes shall be sufficient for the effective distribution of the maximum required discharge from the required fire pumps operating simultaneously.
(Ref. MODU code 9.7.11)

2.3.3 With the required fire pumps operating simultaneously, the pressure maintained in the fire mains shall be to the satisfaction of the Administration and be adequate for the safe and efficient operation of all equipment supplied therefrom.
(Ref. MODU code 9.7.12)

Interpretation:
All systems supplied should have available a pressure equal to or higher than their minimum design working pressure and that the relevant functional requirements wrt reach and/or capacity are met.

------------- end of Interpretation -------------

2.3.4 The fire main shall, where practicable, 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.
(Ref. MODU code 9.7.13)

2.3.5 The fire main shall be provided with isolating valves located so as to permit optimum utilisation in the event of physical damage to any part of the main.
(Ref. MODU code 9.7.14)

Interpretation:
1) The isolation valves should include provisions for easy access of operation including clear marking. Where the isolation valves are remotely operated, manual operation should be possible locally.
2) Water main supply to deluge systems or water monitors should be so arranged that damage to any single section of the main due to fire within a protected area is not to disrupt water supply to deluge system or fire-fighting equipment in an adjacent area.
3) Two separate supplies to the deluge firewater distribution pipework should be provided, the main supply being from the deluge valve. The secondary supply should be from another section of the fire main by an isolation valve in the fire main between the two supply locations. The secondary supply may be manually activated provided the requirements of [2.1.1] are met.

------------- end of Interpretation -------------

2.3.6 The fire main shall not have connections other than those necessary for fire-fighting purposes.
(Ref. MODU code 9.7.15)

2.3.7 All practical precautions consistent with having water readily available shall be taken to protect the fire main against freezing.
(Ref. MODU code 9.7.16)
2.3.8 Materials readily rendered ineffective by heat shall not be used for fire mains and hydrants unless adequately protected. The pipes and hydrants shall be so placed that the fire hoses may be easily coupled to them.

(Ref. MODU code 9.7.17)

2.3.9 For use of GRE/GRP material in firewater ring main, refer DNVGL-OS-D101 Ch.2 Sec.2, [2.5.5].

2.3.10 A cock or valve shall be fitted to serve each fire hose so that any fire hose may be removed while the fire pumps are operating.

(Ref. MODU code 9.7.18)

2.4 Fire hydrants and hoses

2.4.1 The number and position of the hydrants shall be such that at least two jets of water, not emanating from the same hydrant, one of which shall be from a single length of fire hose, may 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 shall be provided for every hydrant.

(Ref. MODU code 9.7.19)

2.4.2 Fire hoses shall be of material approved by the Administration and be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their maximum length shall be to the satisfaction of the Administration. Every fire hose shall be provided with a dual purpose nozzle and the necessary couplings. Fire hoses, together with any necessary fittings and tools, shall be ready for use at any time and shall be kept in conspicuous positions near the water service hydrants or connections.

(Ref. MODU code 9.7.20)

Interpretation:

Their length should be sufficient to project a jet of water to any of the spaces in which they may be required to be used.

(based on SOLAS II-2 10.2.3.1.1)

-------------------- end of Interpretation --------------------

2.4.3 Fire hoses shall have a length of at least 10m, but not more than:

1) 15 m in machinery spaces;
2) 20 m in other spaces and open decks; and
3) 25 m for open decks with a maximum breadth in excess of 30 m.

(Ref. MODU code 9.7.21)

2.4.4 Dual purpose jet spray nozzles shall comply with the following requirements:

1) Standard nozzle sizes shall be 12 mm, 16 mm and 19 mm or as near thereto as possible. Larger diameter nozzles are subject to case-by-case approval.
2) For accommodation and service spaces, a nozzle diameter of 12 mm (1/2 in) shall be used.
3) For machinery spaces and exterior locations, the nozzle size shall be such as to obtain the maximum discharge possible from two jets at the pressure specified in [2.2.5] from the smallest pump, provided that a nozzle size greater than 19 mm (3/4 in) need not be used.

(Ref. MODU Code 9.7.22 and IACS UR D11.2.3)

2.4.5 Fire hose nozzles made of plastic type material, e.g. polycarbonate, are considered acceptable provided capacity and serviceability are documented and the nozzles are found suitable for the marine environment.

(Ref. IACS UI SC98)
2.4.6 It shall be possible to operate the fire hose in a safe manner. Considerations in this respect shall be given to hose size and pressure.

**Interpretation:**
Maximum pressure should not exceed 7 bar.

------------- end of Interpretation -------------

**Guidance note:**
For recommended hose size, see NFPA 14, 2-7.2.

---end---of---guidance---note---

2.4.7 The surface unit shall be provided with at least one international shore connection complying with regulation II-2/10-2.1.7 and the FSS Code. Facilities shall be available enabling such a connection to be used on any side of the unit.

(Ref. MODU code 9.7.23)

Standard dimensions of flanges for the international shore connection shall be in accordance with **Table 1**.

**Table 1 International shore connection**

<table>
<thead>
<tr>
<th>Description</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside diameter</td>
<td>178 mm</td>
</tr>
<tr>
<td>Inside diameter</td>
<td>64 mm</td>
</tr>
<tr>
<td>Bolt circle diameter</td>
<td>132 mm</td>
</tr>
<tr>
<td>Slots in flange</td>
<td>4 holes 19 mm in diameter spaced equidistantly on a bolt circle of the above diameter, slotted to the flange periphery</td>
</tr>
<tr>
<td>Flange thickness</td>
<td>14.5 mm minimum</td>
</tr>
<tr>
<td>Bolts and nuts</td>
<td>4, each of 16 mm diameter, 50 mm in length</td>
</tr>
</tbody>
</table>

(Ref. FSS Code Ch.2.2.1)

2.4.8 The connection shall be of steel or other equivalent material and shall be designed for 1.0 N/mm² services. The flange shall have a flat face on one side and on the other side; it shall be permanently attached to a coupling that will fit the ship's hydrant and hose. The connection shall be kept aboard the ship together with a gasket of any material suitable for 1.0 N/mm² services, together with four bolts of 16 mm diameter and 50 mm in length, four 16 mm nuts and eight washers.

(Ref. FSS Code Ch.9.2.2)

3 **Local fire-fighting systems**

3.1 **Fixed gas fire-extinguishing system**

3.1.1 **General**

3.1.2 Where the quantity of the fire-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.

(Ref. FSS Code Ch. 5.2.1.1)

3.1.3 The volume of starting air receivers, converted to free air volume, shall be added to the gross volume of the machinery space when calculating the necessary quantity of the fire-extinguishing medium. Alternatively, a discharge pipe from the safety valves may be fitted and led directly to open air.

(Ref. FSS Code Ch. 5.2.1.2)

3.1.4 Means shall be provided for the crew to safety check the quantity of the fire-extinguishing medium in the containers.

(Ref. FSS Code Ch. 5.2.1.3)
3.1.5 Containers for the storage of fire-extinguishing medium and associated pressure components shall be designed to pressure codes of practice having regard to their locations and maximum ambient temperature expected in service.

(Ref. FSS Code Ch. 5.2.1.4)

3.1.6 The necessary pipes for conveying fire-extinguishing medium into protected spaces shall be provided with control valves so marked as to indicate clearly the spaces to which the pipes are led. Suitable provision shall be made to prevent inadvertent release of the medium into the space. Where a cargo space fitted with a gas fire-extinguishing system is used as a passenger space, the gas connection shall be blanked during such use. The pipes may pass through accommodation areas provided that they are of substantial thickness and that their tightness is verified with a pressure test, after they installation, at a pressure head not less than 5 N/mm². In addition, pipes passing through accommodation area shall be joined only by welding and shall not be fitted with drains or other openings within such spaces. The pipes shall not pass through refrigerated spaces.

(Ref. FSS Code Ch. 5.2.1.3.1)

3.1.7 The piping for the distribution of fire-extinguishing medium shall be arranged and discharge nozzles so positioned that a uniform distribution of medium is obtained.

(Ref. FSS Code Ch. 5.2.1.2.1)

3.1.8 Means shall be provided to close all openings which may admit air to or allow gas to escape from a protected space.

(Ref. SOLAS reg. II-2/5.1.4)

3.1.9 Means shall 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 pre-discharge alarm shall be automatically activated (e.g. by opening of the release cabinet door). The alarm shall operate for a the length of time needed to evacuate the space, but in no case less than 20 s before the medium is released.

(Ref. FSS Code Ch. 5.2.1.3.2)

3.1.10 Control

The means of control of any fixed gas fire-extinguishing system shall be readily accessible, 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 shall be clear instructions relating to the operation of the system having regard to the safety of personnel.

(Ref. FSS Code Ch. 5.2.1.3.3)

3.1.11 Automatic release of fire-extinguishing medium shall not be permitted.

(Ref. FSS Code Ch. 5.2.1.3.4)

**Guidance note:**

Inergen gas based extinguishing system may be automatically released.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.12 Storage

Pressure containers required for the storage of fire-extinguishing medium, other than steam, shall be located outside protected spaces in accordance with regulation II-2/10.4.3 of SOLAS.

(Ref. FSS Code Ch. 5.2.1.2.2)

3.1.13 Spare parts

Spare parts for the system shall be stored on board.

(Ref. FSS Code Ch. 5.2.1.2.3)
3.1.14 Carbon dioxide systems

For cargo spaces the quantity of carbon dioxide available shall be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space so protected in the ship.

(Ref. FSS Code Ch. 5.2.2.1.1)

3.1.15 For machinery spaces the quantity of carbon dioxide carried shall be sufficient to give a minimum volume of free gas equal to the larger of the following volumes, either:

- 40% of the gross volume of the largest machinery space so protected, the volume to exclude that part of the casing above the level at which the horizontal area of the casing is 40% or less of the horizontal area of the space concerned taken midway between the tank top and the lowest part of the casing; or
- 35% of the gross volume of the largest machinery space protected, including the casing;

(Ref. FSS Code Ch. 5.2.2.1.2)

3.1.16 For the purpose of this paragraph the volume of free carbon dioxide shall be calculated at 0.56 m³/kg.

(Ref. FSS Code Ch. 5.2.2.1.4)

3.1.17 For machinery spaces the fixed piping system shall be such that 85% of the gas can be discharged into the space within 2 minutes.

(Ref. FSS Code Ch. 5.2.2.1.5)

3.1.18 The carbon dioxide control systems shall comply with the following requirements:

1) Two separate controls shall be provided for releasing carbon dioxide into a protected space and to ensure the activation of the alarm. One control shall be used for opening the valve of the piping which conveys the gas into the protected space and a second control shall be used to discharge the gas from its storage containers; and
2) The two controls shall be located inside a release box clearly identified for the particular space. If the box containing the controls is to be locked, a key to the box shall be in a break-glass type enclosure conspicuously located adjacent to the box.

(Ref. FSS Code Ch. 5.2.2.2)

3.1.19 Steam systems

The boiler or boilers available for supplying steam shall have an evaporation of at least 1.0 kg of steam per hour for each 0.75 m³ of the gross volume of the largest space so protected.

(Ref. FSS Code Ch. 5.2.3)

3.1.20 Other gas systems

Where gas other than carbon dioxide or steam is produced on the ship and is used as a fire-extinguishing medium, the system shall comply with the following.

(Ref. FSS Code Ch. 5.2.4.1)

3.1.21 Gas shall be a gaseous product of fuel combustion in which the oxygen content, the carbon monoxide content, the corrosive elements and any sold combustible elements in a gaseous product shall have been reduced to a permissible minimum.

(Ref. FSS Code Ch. 5.2.4.2.1)

3.1.22 Where such gas is used as the fire-extinguishing medium in a fixed fire-extinguishing system for the protection of machinery spaces, it shall afford protection equivalent to that provided by a fixed system using carbon dioxide as the medium.

(Ref. FSS Code Ch. 5.2.4.2.2.1)

3.1.23 Where such gas is used as a fire-extinguishing medium in a fixed fire-extinguishing system for the protection of cargo spaces, a sufficient quantity of such gas shall be available to supply hourly a volume of...
free gas at least equal to 25% of the gross volume of the largest space protected in this way for a period of 72 hours.
(Ref. FSS Code Ch. 5.2.4.2.2.2)

3.2 Fixed foam fire-extinguishing system

3.2.1 Fixed foam fire-extinguishing systems shall be capable of generating foam suitable for extinguishing oil fires.
(Ref. FSS Code Ch. 6.2.1)

3.2.2 General
The foam concentrates of high-expansion foam fire-extinguishing systems shall be approved in accordance with MSC/Circ 670.
(Ref. FSS Code Ch. 6.2.2.1.1)

3.2.3 Any required fixed high-expansion foam system in machinery spaces shall be capable of rapidly discharging through fixed discharge outlets a quantity of foam sufficient to fill the greatest space to be protected at a rate of at least 1 m in depth per minute. The quantity of foam-forming liquid available shall be sufficient to produce a volume of foam equal to five times the volume of the largest space to be protected. The expansion ratio of the foam shall not exceed 1000 to 1.
(Ref. FSS Code Ch. 6.2.2.1.2)

3.2.4 Alternative arrangements and discharge rates provided that it is satisfied that equivalent protection is achieved.
(Ref. FSS Code Ch. 6.2.2.1.3)

3.2.5 Supply ducts for delivering foam, air intakes to the foam generator and the number of foam-producing units shall provide effective foam production and distribution.
(Ref. FSS Code Ch. 6.2.2.2.1)

3.2.6 The arrangement of the foam generator delivery ducting shall be such that a fire in the protected space will not affect the foam generating equipment. If the foam-generators are located adjacent to the protected space, foam delivery ducts shall be installed to allow at least 450 mm of separation between the generators and the protected space. The foam delivery ducts shall be constructed of steel having a thickness of not less than 5 mm. In addition, stainless steel dampers (single or multibladed) with a thickness of not less than 3 mm shall be installed at the openings in the bulkheads or decks between the foam generators and the protected spaces. The dampers shall be automatically operated (electrically, pneumatically or hydraulically) by means of remote control of the foam generator related to them.
(Ref. FSS Code Ch. 6.2.2.2.2)

3.2.7 The foam generator, its sources of power supply, foam-forming liquid and means of controlling the system shall be readily accessible and simple to operate and shall be grouped in as few locations as possible at positions not likely to be cut off by a fire in the protected space.
(Ref. FSS Code Ch. 6.2.2.2.3)

3.2.8 Fixed low-expansion foam fire-extinguishing systems
The foam concentrates of low-expansion foam fire-extinguishing systems shall be approved in accordance with MSC/Circ.582 and Corr.1.
(Ref. FSS Code Ch. 6.2.3.1.1)

3.2.9 The system shall be able of discharging through fixed discharge outlets in not more than 5 min a quantity of foam sufficient to cover a depth of 150 mm the largest single are over which oil fuel is liable to spread. The expansion ratio of the foam shall not exceed 12 to 1.
(Ref. FSS Code Ch. 6.2.3.1.2)

3.2.10 Means shall be provided for the effective distribution of the foam through a permanent system of
piping and control valves or cocks to suitable discharge outlets, and for the foam to be effectively directed by fixed sprayers onto other main fire hazards in the protected spaces. The means for effective distribution of the foam shall be documented through calculation or by testing.

(Ref. FSS Code Ch. 6.2.3.2.1)

3.2.11 The means of control of any such system shall 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 the protected space.

(Ref. FSS Code Ch. 6.2.3.2.2)

3.3 Water mist

3.3.1 The number and arrangement of the nozzles shall be such as to ensure an effective average distribution of water of at least 5 l/m²/minute in the spaces to be protected, unless specified specifically in other sections.

(Ref. FSS Code Ch. 7.2.1.2)

3.3.2 Nozzles shall be fitted above bilges, tank tops and other areas over which oil fuel is liable to spread and also above other specific fire hazards in the machinery spaces.

(Ref. FSS Code Ch. 7.2.1.2.1)

3.3.3 The system may be divided into sections, the distribution valves of which shall be operated from easily accessible positions outside the spaces to be protected so as not to be readily cut off by a fire in the protected space.

(Ref. FSS Code Ch. 7.2.1.2.2)

3.3.4 The pump and its controls shall be installed outside the space or spaces to be protected. It shall not be possible for a fire in the space or spaces protected by the water-spraying system to put the system out of action.

(Ref. FSS Code Ch. 7.2.1.2.3)

3.3.5 The system shall be kept charged at the necessary pressure and the pump supplying the water for the system shall be put automatically into action by a pressure drop in the system.

(Ref. FSS Code Ch. 7.2.1.3)

3.3.6 The pump shall be capable of simultaneously supplying at the necessary pressure all sections of the system in any one compartment to be protected.

(Ref. FSS Code Ch. 7.2.1.4)

3.3.7 The pump may be driven by independent internal combustion machinery, but, if it is dependent upon power being supplied from the emergency generator fitted in compliance with the provisions of SOLAS II-1/43 as appropriate, that generator shall be so arranged as to start automatically in case of main power failure so that power for the pump required by [3.3.6] is immediately available. The independent internal combustion machinery for driving the pump it shall be so situated that a fire in the protected space will not affect the air supply to the machinery.

(Ref. FSS Code Ch. 7.2.1.5)

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

(Ref. FSS Code Ch. 7.2.1.3)

3.3.9 Water-mist fire-extinguishing systems for machinery spaces and cargo pump-rooms shall be approved in accordance with MSC/Circ. 1165 as amended in MSC.1./Circ.1237/1269/1385/1386.

(Ref. FSS Code Ch. 7.2.2)
3.4 Deluge systems

3.4.1 The water pressure available at the inlet to the system or an individual section shall be sufficient for the efficient operation of all nozzles in that system or section under design flow conditions.

3.4.2 The system shall be kept charged at the necessary pressure and the pump supplying the water for the system shall be put automatically into action by a pressure drop in the system.

(Ref. FSS Code Ch. 7, 2.1.3)

Interpretation:

1) Since the deluge system is connected to the fire main, the above implies a pressure drop in the fire main, upstream of the deluge valve.
2) It should be possible to manually actuate the deluge system in case of failure of the automatic release. The actuation should be possible both locally and remotely.
3) The remote activation should be at the control station where the operating status of the systems is monitored.
4) The local activation should have safe access from the emergency control station and located outside the fire zone protected by the actual system.

---------- end of Interpretation  ----------

3.4.3 The piping for a deluge system shall be designed to be robust and adequately secured and supported.

3.4.4 The nozzle type, location and orientation shall be suitable for the possible fire events and the environmental conditions. It shall be ensured that the required quantity of water or foam will impinge on the surfaces to be protected. Due account is to be taken to the effects of obstructions.

3.4.5 Provisions for flushing of the distribution pipework shall be provided.

3.4.6 For the supply of the deluge system from fire main, see [2.3.5].

3.5 Monitors

A fire-water monitor may be remotely or locally operated.

(IACS UR D11.3.2)

Interpretation:

1) A remotely operated monitor should have local manual override control.
2) Manual operated monitors should be easily accessible, including access during fire situations.
3) The monitor should have sufficient movement horizontally and vertically in order to permit the monitor to cover the complete area of protection.
4) The monitor should be provided with a locking device for operating in a selected position.
5) A monitor should be easy switchable between jet and spray discharge.

---------- end of Interpretation  ----------

3.6 Sprinkler systems

Sprinkler systems, where used, shall comply with FSS code Ch. 8.

Guidance note:

Automatic sprinkler systems are typically used in areas where fires are expected to involve cellulosic fuels, and where slow fire growth is expected. A typical use is in accommodation areas.

---------- end of Guidance note  ----------

3.7 Portable extinguishers

3.7.1 All fire extinguishers shall be of approved types and designs based on the guidelines developed by the Organization.

* Refer to the Improved Guidelines for marine portable fire extinguishers, adopted by the Organization by resolution A.951(23).
3.7.2 Each powder or carbon dioxide extinguisher shall have a capacity of at least 5 kg and each foam extinguisher shall have a capacity of at least 9 l. The mass of a portable fire extinguishers shall not exceed 23 kg and it shall have a fire-extinguishing capability at least equivalent to that of a 9 l fluid extinguisher. (FSS Code Ch.4.3)

3.7.3 Only refills approved for the fire extinguisher in question shall be used for recharging. (Ref. SOLAS reg. II-2/10.3/FSS Code Ch.4.3 as referred to by MODU Code 9.9)

3.7.4 Spare charges shall be provided for 100% of the first ten extinguishers and 50% of the remaining extinguishers capable of being recharged on board. Not more than sixty total spare charges are required. Instructions for recharging shall be carried on board. (Ref. SOLAS reg. II-2/10.3.3.1 as referred to by MODU Code 9.9)

3.7.5 For fire extinguishers which cannot be recharged on board, additional portable fire extinguishers of the same quantity, type, capacity and number as determined by [3.7.4] above shall be provided in lieu of spare charges. (Ref. SOLAS reg. II-2/10.3.3.2 as referred to by MODU Code 9.9)
SECTION 4  FIRE AND/OR GAS DETECTION AND ALARM SYSTEMS

1 General

1.1 Introduction

1.1.1 This section gives requirements for fire and gas detection and alarm systems common to all types of mobile offshore units and offshore installations. The requirements are applicable both for combined and separated systems.

1.1.2 For supplementary requirements applicable to units and installations for special types of service, see Sec.6 to Sec.10.

1.1.3 For specific requirements for the emergency shutdown (ESD) system, see DNVGL-OS-A101.

1.1.4 For specific requirements for alarm systems, see DNVGL-OS-A101 and DNVGL-OS-D202.

1.2 Basis provisions

1.2.1 The fire and gas detection and alarm systems shall be designed to allow testing without interrupting other systems onboard and be regarded as a safety system as defined in DNVGL-OS-A101.

1.2.2 The requirements of DNVGL-OS-D202 apply to the fire and gas detection and alarm systems.

1.2.3 If shutdown actions are performed by the fire and gas detection systems, the requirements for the emergency shutdown (ESD) system apply as given in DNVGL-OS-A101.

1.2.4 The ventilation of the accommodation spaces and control stations shall be arranged in such a way as to prevent the ingress of flammable, toxic or noxious gases, or smoke from surrounding areas.

(Ref. MODU code 9.3.23)

Interpretation:

1) The lay-out of ventilation intakes should comply to DNVGL-OS-A101 Ch.2, Sec.3.

-------------- end of Interpretation --------------

2 Fire detection and alarm system

2.1 System design requirements

2.1.1 Spaces having a fire risk, in principle, shall be provided with an automatic fire detection and alarm system. This includes accommodation, service spaces and control stations. Accommodation spaces shall be fitted with smoke detectors.

(Ref. IACS UR D11.6 and MODU Code 9.10.1)

2.1.2 The fire detectors to be used for each individual area shall be based on detection principle suitable for the types of fire that may occur in that area including the ability to avoid spurious alarm and trips.

(Ref. IACS UR D11.6.2 – 11.6.5)
Interpretation:

The table below show how the above principles should be followed.

Table 1 Location of fire detectors

<table>
<thead>
<tr>
<th>Area</th>
<th>Detection principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major hazard areas</td>
<td></td>
</tr>
<tr>
<td>Wellhead</td>
<td>Flame or heat</td>
</tr>
<tr>
<td>Drill floor</td>
<td>Flame</td>
</tr>
<tr>
<td>Process areas, degasser room, shale shaker room, active mud tank room, turret, hazardous pump room, tank deck</td>
<td>Flame or heat</td>
</tr>
<tr>
<td>Other areas</td>
<td></td>
</tr>
<tr>
<td>Mechanically ventilated utility areas, control rooms, switchgear rooms, battery rooms, mud lab, instrument rooms, local equipment rooms, telecommunication or public address rooms, HVAC rooms, electrically driven crane engine rooms, non-hazardous pump room</td>
<td>Smoke</td>
</tr>
<tr>
<td>Turbine/ generator areas/rooms (excluding turbine hoods),</td>
<td>Flame or smoke</td>
</tr>
<tr>
<td>Air compressor rooms</td>
<td>Smoke or heat</td>
</tr>
<tr>
<td>Sack or bulk storage area, workshops</td>
<td>Flame or heat</td>
</tr>
<tr>
<td>Paint store</td>
<td>Flame or heat</td>
</tr>
<tr>
<td>Mud processing, fuel oil storage, turbine hood, water injection treatment area, cementing unit room, diesel engine room</td>
<td>Flame or heat</td>
</tr>
<tr>
<td>Accommodation areas</td>
<td></td>
</tr>
<tr>
<td>Cabins, corridors, rooms/offices, staircases, public rooms, washrooms, WCs radio room, laundry, HVAC inlets</td>
<td>Smoke</td>
</tr>
<tr>
<td>Galley, galley hood or duct,</td>
<td>Heat</td>
</tr>
</tbody>
</table>

2.1.3 Sufficient manual fire alarm stations are to be installed throughout the unit. One manually operated call point is to be located at each exit.
(Ref. MODU Code 9.10.2 and IACS UR D11.6.6)

2.1.4 A fixed fire detection and fire alarm system shall be installed in:
1) Periodically unattended machinery spaces; and
2) machinery spaces where:
   a) the installation of automatic and remote control system and equipment has been approved in lieu of continuous manning of the spaces, and
   b) the main propulsion and associated machinery, including the main sources of electrical power, are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room.
(Ref. MODU code 9.10.3)

2.1.5 Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point.
(Ref. IACS UR D11.6.6)

2.1.6 Measures are to be taken to prevent inadvertent operation of the manual call alarm system.
(Ref. IACS UR D11.6.6)

2.1.7 Sectioning

Detectors and manually operated call points shall be grouped into sections.
(Ref. FSS Code Ch.9.2.4.1.1)
an accommodation space shall not include a machinery space of category A. For fixed fire detection systems with remotely and individually identifiable fire detectors, a section covering fire detectors in accommodation, service spaces and control stations shall not include fire detectors in machinery spaces of category A.

(Ref. FSS Code Ch. 9.2.4.1.2)

Interpretation:

A section is considered as a group of detectors which are covering one or more fire areas, either as addressable or non-addressable detectors.

------------- end of Interpretation -------------

2.1.8 Where the fire detection and fire alarm system does not include means of remotely identifying each detector individually, no section covering more than one deck within accommodation, service and control stations shall normally be permitted except a section which covers an enclosed stairway. In order to avoid delay in identifying the source of fire, the number of enclosed spaces included in each section shall be limited. If the detection system is fitted with remotely and individually identifiable fire detectors, the sections may cover several decks and serve any number of enclosed spaces.

(Ref. FSS Code Ch. 9.2.4.1.3)

2.1.9 Any required fixed fire detection and fire alarm system with manually operated call points shall be capable of immediate operation at all times (this does not require a backup control panel).

(Ref. FSS Code Ch.9.2.1.1)

Interpretation:

The fire detection for each fire detection area should have continuous availability R0 as defined in DNVGL-OS-D202 Ch.2 Sec.1 [2] or a response to failures as required by DNVGL-OS-D202 Ch.2 Sec.1 [3].

------------- end of Interpretation -------------

2.1.10 Notwithstanding [3.1.1], particular spaces may be disconnected, for example, workshops during hot work. The means for disconnecting the detectors shall be designed to automatically restore the system to normal surveillance after a predetermined time that is appropriate for the operation in question. The space shall be manned or provided with a fire patrol when detectors required by regulation are disconnected. Detectors in all other spaces shall remain operational.

(Ref. FSS Code Ch.9.2.1.1)

Interpretation:

When it is intended that a particular section or detector should temporarily be inhibited/over-ridden or blocked, this state should be clearly indicated.

------------- end of Interpretation -------------

2.1.11 The fire detection system shall be designed to:

1) control and monitor input signals from all connected fire and smoke detectors and manual call points;
2) provide output signals to the navigation bridge, continuously manned central control station or onboard safety centre to notify the crew of fire and fault conditions;
3) monitor power supplies and circuits necessary for the operation of the system for loss of power and fault conditions; and
4) the system may be arranged with output signals to other fire safety systems including:
   1) paging systems, fire alarm or public address systems;
   2) fan stops;
   3) fire doors;
4) fire dampers;
5) sprinkler systems;
6) smoke extraction systems;
7) low-location lighting systems;
8) fixed local application fire-extinguishing systems;
9) closed circuit television (CCTV) systems; and
10) other fire safety systems.

(Ref. FSS Code Ch. 9.2.1.2)

2.1.12 The fire detection system may be connected to a decision management system provided that:

1) the decision management system is proven to be compatible with the fire detection system;
2) the decision management system can be disconnected without losing any of the functions required by this chapter for the fire detection system; and
3) any malfunction of the interfaced and connected equipment shall not propagate under any circumstance to the fire detection system.

(Ref. FSS Code Ch. 9.2.1.3)

2.1.13 Detectors and manual call points shall be connected to dedicated sections of the fire detection system. Other fire safety functions, such as alarm signals from the sprinkler valves, may be permitted if in separate sections.

(Ref. FSS Code Ch. 9.2.1.4)

2.1.14 The system and equipment shall be suitably designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in mobile offshore units and offshore installations. All electrical and electronic equipment on the bridge or in the vicinity of the bridge shall be tested for electromagnetic compatibility according to IEC 60945 and 61000 (ref OS-D202, Ch. 2, Sec. 4, B900).

(Ref. FSS Code 9.2.1.5)

2.1.15 Fixed fire detection and fire alarm systems with individually identifiable fire detectors shall be so arranged that:

1) Means are provided to ensure that any fault (e.g. power break, short circuit, earth, etc.) occurring in the section will not prevent the continued individual identification of the remainder of the connected detectors in the section;
2) All arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g. electrical, electronic, informatics, etc.);
3) The first initiated fire alarm will not prevent any other detector from initiating further alarms; and
4) No section will pass through a space twice. When this is not practical (e.g. for large public spaces), the part of the section which by necessity passes through the space for a second time shall be installed at the maximum possible distance from the other parts of the section.

(Ref. FSS Code Ch. 9.2.1.6)

2.2 Component requirements

2.2.1 Detectors shall be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be considered by the Administration provided that they are no less sensitive than such detectors.

(Ref. FSS Code Ch. 9.2.3.1.1)
2.2.2 Performance of heat, smoke and flame detectors shall be in accordance with a recognised standard, e.g. EN 54-5, 54-7 and 54-10 respectively. Smoke detectors required in stairways, corridors and escape routes within accommodation spaces shall operate before the smoke density exceeds 12.5% obscuration per metre, but not until the smoke density exceeds 2% obscuration per metre. Smoke detectors to be installed in other spaces shall operate within sensitivity limits to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or over sensitivity.

(Ref. FSS Code Ch.9.2.3.1.2)

2.2.3 Heat detectors shall be certified to operate before the temperature exceeds 78°C but not until the temperature exceeds 54°C, when the temperature is raised to those limits at a rate less than 1°C per minute, when tested according to standards EN 54:2001 and IEC 60092-505:2001. At higher rates of temperature rise, the heat detector shall operate within temperature limits to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or over sensitivity.

(Ref. FSS Code Ch. 9.2.3.1.3)

2.2.4 The operation temperature of heat detectors in drying rooms and similar spaces of a normal high ambient temperature may be up to 130°C, and up to 140°C in saunas.

(Ref. FSS Code Ch. 9.2.3.1.4)

2.2.5 All detectors shall be of a type such that they can be tested for correct operation and restored to normal surveillance without the renewal of any component.

(Ref. FSS Code Ch. 9.2.3.1.6)

2.2.6 Detectors fitted in hazardous areas shall be tested and approved for such service.

(Ref. FSS Code Ch. 9.2.3.1.8)

2.2.7 Control panel

The control panel for the fire detection system shall be tested according to standards EN 54-2:1997, EN 54-4:1997 and IEC 60092-504:2001.

(Ref. FSS Code Ch. 9.2.3.2)

2.3 Power supply

2.3.1 There shall be not less than two sources of power supply for the electrical equipment used in the operation of the fixed fire detection and fire alarm system, one of which shall be an emergency source. The supply shall be provided by separate feeders reserved solely for that purpose. Such feeders shall run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system. The main (respective emergency) feeder shall run from the main (respective emergency) switchboard to the change-over switch without passing through any other distributing switchboard.

(Ref. FSS Code Ch.9.2.2.1)

Interpretation:

The fire detection and alarm system should be powered as required by DNVGL-OS-D201, Ch.2, Sec.2, including a transitional source of power/ UPS.

------------- end of Interpretation  -------------

2.3.2 There shall be sufficient power to permit the continued operation of the system with all detectors activated, but not more than 100 if the total exceeds this figure.

(Ref. FSS Code Ch. 9.2.2.2)

2.3.3 The emergency source of power specified in [2.3.1] shall be sufficient to maintain the operation of the fire detection and fire alarm system for the periods required under SOLAS II-1/43, and at the end of that period, shall be capable of operating all connected visual and audible fire alarm signals for a period of at least 30 min. See also DNVGL-OS-D201, Ch.2, Sec.2.

(see FSS Code Ch. 9.2.2.3)
2.4 Installation

2.4.1 Location of detectors

Detectors shall be located for optimum performance. Positions near beams and ventilation ducts or other positions where patterns of air flow could adversely affect performance and positions where impact or physical damage is likely shall be avoided. Detectors shall be located on the overhead at a minimum distance of 0.5 m away from bulkheads except in corridors, lockers and stairways.

(Ref. FSS Code Ch. 9.2.4.2.1)

2.4.2 The maximum spacing of detectors shall be in accordance with the Table 2 below:

<table>
<thead>
<tr>
<th>Type of detector</th>
<th>Maximum floor area per detector (m²)</th>
<th>Maximum distance between centres (m)</th>
<th>Maximum distance away from bulkheads (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>37</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>Smoke</td>
<td>74</td>
<td>11</td>
<td>5.5</td>
</tr>
</tbody>
</table>

The Administration may require or permit other spacing based upon test data which demonstrate the characteristics of the detectors.

(Ref. FSS Code Ch. 9.2.4.2.2)

2.4.3 Detectors in stairways shall be located at least at the top level of the stair and at every second level beneath.

(Ref. FSS Code Ch. 9.2.4.2.3)

2.4.4 When fire detectors are installed in freezers, drying rooms, saunas, parts of galleys used to heat food, laundries and other spaces where steam and fumes are produced, heat detectors may be used.

(Ref. FSS Code Ch. 9.2.4.2.4)

2.4.5 Where a fixed fire detection and fire alarm system is required by regulation II2/7.5 of SOLAS, spaces having little or no fire risk need not be fitted with detectors. Such spaces include void spaces with no storage of combustibles, private bathrooms, public toilets, fire-extinguishing medium storage rooms, cleaning gear lockers (in which flammable liquids are not stowed), open deck spaces and enclosed promenades having little or no fire risk and that are naturally ventilated by permanent openings.

(Ref. FSS Code Ch. 9.2.4.2.5)

2.4.6 Arrangement of cables

Cables which form part of the system shall be so arranged as to avoid galleys, machinery spaces of category A, and other enclosed spaces of high fire risk except where it is necessary to provide for fire detection or fire alarms in such spaces or to connect to the appropriate power supply.

(Ref. FSS Code 9.2.4.3.1)

2.4.7 A section with individually identifiable capability shall be arranged so that it cannot be damaged at more than one point by a fire.

(Ref. FSS Code Ch. 9.2.4.3.2)

2.5 System control requirements

2.5.1 The activation of any detector or manually operated call point shall initiate a visual and audible fire signal at the control panel and indicating units. If the signals have not been acknowledged within 2 min, an audible alarm shall be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces of category A. This alarm sounder system need not be an integral part of the detection system.

(Ref. FSS Code Ch. 9.2.5.1.1)
Interpretation:

1) The above includes all regularly manned areas.
2) For confirmed fire in hazardous areas, the alarm should be activated in outside areas without delays.

--- end of Interpretation ---

2.5.2 The control panel shall be located on the navigation bridge or in the fire control station.
(Ref. FSS Code Ch.9.2.5.1.2)

Interpretation:

1) The SOLAS/FSS terms “navigation bridge”/ “fire control station” can be interpreted as the continuously manned central control room.
2) The fire detection central/ logic solver can be separated from the control panel, and located as described in DNVGL-OS-A101 Ch.2, Sec.2, [4.1.1].
3) If an integrated operator station is used as the fire system interface the requirements of DNVGL-OS-D202 Ch.2 Sec.3 [1.2] apply.

--- end of Interpretation ---

2.5.3 An indicating unit shall as a minimum denote the section in which a detector has activated or manually operated call point has operated. One indicating unit shall be located on the navigating bridge if the control panel is located in the main fire control station.
(Ref. FSS Code Ch. 9.2.5.1.3

2.5.4 Clear information shall be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.
(Ref. FSS Code Ch.9.2.5.1.4)

2.5.5 Power supplies and electric circuits necessary for the operation of the system shall be monitored for loss of power and fault conditions as appropriate including:

- A single open or power break fault caused by a broken wire;
- A single ground fault caused by the contact of a wiring conductor to a metal component; and
- A single wire to wire fault caused by the contact of two or more wiring conductors.

Occurrence of a fault condition shall initiate a visual and audible fault signal at the control panel which shall be distinct from a fire signal.
(Ref. FSS Code Ch. 9.2.5.1.5)

2.5.6 Means to manually acknowledge all alarm and fault signals shall be provided at the control panel. The audible alarm sounders on the control panel and indicating units may be manually silenced. The control panel shall clearly distinguish between normal, alarm, acknowledged alarm, fault and silenced conditions.
(Ref. FSS Code Ch. 9.2.5.1.6)

2.5.7 The system shall be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.
(Ref. FSS Code Ch. 9.2.5.1.7)

Interpretation:

Automatic reset should only take place after alarm and fault conditions are cleared and the alarms have been acknowledged by the Operator

--- end of Interpretation ---

2.5.8 When the system is required to sound a local audible alarm within the cabins where the detectors are located, a means to silence the local audible alarms from the control panel shall not be permitted.
(Ref. FSS Code Ch. 9.2.5.1.8)
2.6 Additional requirements for periodically unattended machinery spaces

2.6.1 An approved fire detection system based on the self-monitoring principle and including facilities for periodical testing shall be installed in periodically unattended machinery spaces.

(Ref. MODU code 8.3.4)

2.6.2 The fire detection system shall comply with the following:

1) This fire detection system shall be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is especially appropriate, detection systems using only thermal detectors shall not be permitted. The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed at the locations required by DNVGL-OS-A101 Ch.2, Sec.5 [10].

2) After installation the system shall be tested under varying conditions of engine operation and ventilation.

3) The fire detection system, where electrically supplied, shall be fed automatically from an emergency source of power by a separate feeder if the main source of power fails.

(Ref. MODU code 8.3.5)

Guidance note:
The distinctive alarm as mentioned in item 1. Should be understood as the general emergency/ muster alarm as specified in MODU Code 5.7.2 (see also DNVGL-OS-A101, Ch.2 Sec.5 [6.2.1])

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---

2.6.3 Means shall be provided in case of fire:

1) in boiler air supply casings and exhausts (uptakes); and
2) in scavenging air belts of propulsion machinery
to detect fires and give alarms at an early stage, unless the Administration considers this to be unnecessary in a particular case.

(Ref. MODU code 8.3.6)

2.6.4 Internal combustion engines of 2250 kW and above or having cylinders of more than 300 mm bore shall be provided with crankcase oil mist detectors or engine bearing temperature monitors or equivalent devices.

(Ref. MODU code 8.3.7)

2.7 Maintainability

2.7.1 Fire detectors shall be kept in good order so as to ensure their intended performance if a fire occurs.

(Ref. MODU code 9.19.3)

Interpretation:

When fire detectors are provided with the means to adjust their sensitivity, necessary arrangements should ensure to fix and identify the set point.

------------- end of Interpretation -------------

2.7.2 Suitable instructions and component's spares for testing and maintenance shall be provided.
Detectors shall be periodically tested using equipment suitable for the types of fires to which the detector is designed to respond. Mobile offshore units and offshore installations with selfdiagnostic systems that have in place a cleaning regime for areas where heads may be prone to contamination may carry out testing to ensure functionality.

(Ref. FSS Code Ch. 9.2.5.2)
3 Gas detection and alarm systems

3.1 System design requirements

3.1.1 A fixed automatic gas detection and alarm system shall be provided so arranged as to monitor continuously all enclosed areas of the unit in which an accumulation of flammable gas may be expected to occur.

(Ref. MODU code 9.11.1)

Interpretation:

1) The gas detection for each fire detection area should have continuous availability R0 as defined in DNVGL-OS-D202 Ch.2 Sec.1 [2] or fail-safe functionality as required by DNVGL-OS-D202 Ch.2 Sec.1 [3].
2) For the assessment on occurrence of gas open spaced should be taken into account, either as source or as result of migration.
3) The gas detection and alarm systems should be arranged to the principles as for fire detection systems as given in [2.1.14] and [2.1.15].
4) When it is intended that a particular section or detector shall be temporarily switched off, this state should be clearly indicated.

------------- end of Interpretation -------------

3.1.2 The requirement of [3.1.1] includes the following areas:

— hazardous areas, except in zone 0 and areas mechanically ventilated
— ventilation outlets from hazardous areas having mechanical ventilation
— all intakes for ventilation air, including
  — ventilation intakes of enclosed machinery spaces contiguous to hazardous areas and containing internal combustion engines and boilers; and
  — ventilation intakes and near other openings of accommodation spaces.
(Ref. IACS UR D11.7.1)

For a more service unit specific descriptions, see Sec.6, Sec.7 and Sec.9.

Guidance note:
On units and installations where the sources of leakage of inflammable and toxic gases are concentrated in a small area, gas detectors in the air inlets of mechanically ventilated areas may be omitted provided that:

— the ventilation systems are shut down automatically in the event of gas detection anywhere, and
— the gas detectors are located in all zone 1 and 2 areas.

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.3 At least two portable gas monitoring devices shall be provided, each capable of accurately measuring a concentration of flammable gas.

(Ref. MODU code 9.11.2)

3.1.4 Actions

On confirmed gas detection actions shall either be taken directly or a signal sent to ESD system to perform the executive actions in accordance with the shutdown philosophy.

Guidance note:
For hazardous areas it is common to have alarm level of 25% and 60% of lower explosion limit whereas for ventilation inlets it is common to have 10% and 30% of lower explosion limit. Unconfirmed level is normally a single low level detection. Confirmed can either be one high level detection or voting. Similar for line detectors, the setpoints are 1 and 3 LELm.

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---

3.1.5 Confirmed gas detection in HVAC in air intakes shall trip HVAC and close damper as applicable. For confirmed gas detection in outlets from hazardous areas shall not trip any ventilation from the relevant area.
3.2 Power supply

3.2.1 There shall be not less than two sources of power supply for the electrical equipment used in the operation of the gas detection and -alarm system, one of which shall be an emergency source. The supply shall be provided by separate feeders reserved solely for that purpose. Such feeders shall run to an automatic change-over switch situated in or adjacent to the control panel for the gas detection system.

(based on MODU code 9.11.1 and FSS code Ch. 9.2.2.1)

Interpretation:

The gas detection system should be powered as required by DNVGL-OS-D201, Ch.2, Sec.2, including an transitional source of power/ UPS.

3.2.2 Power supplies and electric circuits necessary for the operation of the gas detection and -alarm system shall be monitored for loss of power or fault conditions as appropriate. Occurrence of a fault condition shall initiate a visual and audible fault signal at the control panel which shall be distinct from a fire signal.

(Ref. MSC.1/Circ.1370, 3.2.1 as referred to in FSS code Ch. 16)

3.3 System control requirements

The gas detection system is to indicate both by audible and visible alarm in the control centre for unconfirmed and confirmed gas detection.

(Ref. MODU code 9.10.1)

Interpretation:

1) Confirmed gas alarm should initiate platform alarm directly.
2) Voting of detectors may be used to reduce the number of unwanted alarms/actions, but should not reduce the ability of the system to respond to a real incident

3.4 Maintainability

Gas detectors shall be kept in good order so as to ensure their intended performance if a gas release occurs.

(Ref. MODU code 9.19.3.1)

Interpretation:

Suitable instructions and spares for testing and maintenance should be provided. Detectors should be periodically tested using equipment suitable for the types of gasses to which the detector is designed to respond. Mobile offshore units and offshore installations with selfdiagnostic systems that have in place a cleaning regime for areas where heads may be prone to contamination should carry out testing to ensure functionality.

(as based on FSS Code Ch. 9.2.5.2)
SECTION 5 MISCELLANEOUS ITEMS

1 Introduction
This section gives requirements for miscellaneous fire technical items common to all types of mobile offshore units and offshore installations.

For supplementary requirements applicable to units and installations for special types of service, see Sec.6 to Sec.10.

2 Fire-fighter’s outfits

2.1 General

2.1.1 At least two fire-fighters' outfits complying with the relevant requirements of FSS Code shall be provided, each with portable instruments for measuring oxygen and flammable vapour concentrations.
(Ref. MODU code 9.13.1)

2.1.2 Two spare charges shall be provided for each required breathing apparatus. Units that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus.
(Ref. MODU code 9.13.2)

Interpretation:
Spare charges for breathing apparatus should be stored in the same location as the breathing apparatus.

----------------- end of Interpretation -----------------

2.1.3 The fire-fighters' outfits shall be kept ready for use in an easily accessible location that is permanently and clearly marked. They shall be stored in two or more widely separated locations.
(Ref. MODU code 9.13.3)

3 Recharging of air cylinders

3.1 General

3.1.1 The apparatus for recharging air cylinders, if provided, shall have its power supplied from the emergency supply or be independently diesel-powered, or be so constructed or equipped that the air cylinder may be used immediately after recharging.
(Ref. MODU code 9.14.1)

Interpretation:
Regardless of the means used to recharge air cylinders, they should be ready for immediate use after recharging.

----------------- end of Interpretation -----------------

3.1.2 The apparatus shall be suitably located in a sheltered space above main deck level of the unit.
(Ref. MODU code 9.14.2)

3.1.3 Intakes for air compressors shall draw from a source of clear air.
(Ref. MODU code 9.14.3)

3.1.4 The air shall be filtered after compression to eliminate compressor oil contamination.
(Ref. MODU code 9.14.4)
4 Arrangements in machinery and working spaces

4.1 General

4.1.1 Means shall be provided for stopping ventilating fans serving machinery and working spaces and for closing all doorways, ventilators, annular spaces around funnels and other openings to such spaces. These means shall be capable of being operated from outside such spaces in case of fire.

(Ref. MODU code 9.15.1)

4.1.2 Machinery driving forced and induced draught fans, electric motor pressurisation fans, oil fuel transfer pumps, oil fuel unit pumps and other similar fuel pumps shall be fitted with remote controls situated outside the space concerned so that they may be stopped in the event of a fire arising in the space in which they are located.

(Ref. MODU code 9.15.2)

4.1.3 Every oil fuel suction pipe from a storage, settling or daily service tank situated above the double bottom shall be fitted with a cock or valve capable of being closed from outside the space concerned in the event of a fire arising in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel, valves on the tanks shall be fitted but control in the event of fire may be effected by means of an additional valve on the pipeline or lines outside the tunnel or tunnels.

(Ref. MODU code 9.15.3)

5 Provisions for helicopter facilities

5.1 General

5.1.1 Fire-fighting appliances shall be provided to adequately protect the units from the fire hazards associated with helicopter operations;

(Ref. MODU code 9.16.1.2)

5.1.2 The deckhouse top and bulkheads under the helideck shall have no openings;

(Ref. MODU code 9.16.2.2.1)

5.1.3 Windows under the helideck shall be provided with steel shutters

(Ref. MODU code 9.16.2.2.2)

5.1.4 In close proximity to the helicopter deck, the following fire-fighting appliances shall be provided and stored near to the means of access to that helideck:

1. at least two dry powder extinguishers having a total capacity of not less than 45 kg but not less than 9 kg each;

2. carbon dioxide extinguisher of a total capacity of not less than 18 kg or equivalent;

3. a foam application system consisting of monitors or foam-making branch pipes capable of delivering foam solution to all parts of the helicopter deck in all weather conditions in which the helideck is intended to be available for helicopter operations. The minimum capacity of the foam production system will depend upon the size of the area to be protected, the foam application rate, the discharge rates of installed equipment and the expected duration of application:

   a) a minimum application rate of 6 l/m² within a circle of diameter “D” value;
   b) A minimum of 5 min discharge capability shall be provided;
   c) Foam delivery at the minimum application rate shall start within 30 s of system activation;

4. and the principal agent shall be suitable for use with salt water and conform to performance standards not inferior to those acceptable to the International Civil Aviation Organization Airport Services Manual, part 1, Rescue and Fire-fighting, chapter 8, Extinguishing Agent Characteristics, paragraph 8.1.5, Foam Specifications table 8-1, level 'B'. 
5. at least two nozzles of an approved dual-purpose type (jet/spray) and hoses sufficient to reach any part of the helicopter deck.

6. in addition to the provision of [2.1], two fire-fighter’s outfits; and

7. at least the following equipment shall be stored in a manner that provides for immediate use and protection from the elements:
   a) Adjustable wrench;
   b) Blanket, fire-resistant;
   c) Cutters, bolt, 600 mm;
   d) Hook, grab or salving;
   e) Hacksaw, heavy duty complete with six spare blades;
   f) Ladder;
   g) Lift line 5 mm diameter and 30 m in length;
   h) Pliers, side-cutting;
   i) Set of assorted screwdrivers, harness knife complete with sheath; and
   j) Crowbar.

(Ref. MODU code 9.16.4)

6 Storage of gas cylinders
Where more than one cylinder of oxygen and more than one cylinder of acetylene are carried simultaneously, such cylinders shall be arranged in accordance with the following:

1) Permanent piping systems for oxyacetylene systems are acceptable provided that they are designed having due regard to standards and codes of practice to the satisfaction of the Administration.

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

3) Storage rooms shall be constructed of steel, and be well ventilated and accessible from the open deck.

4) Provision shall be made for the expeditious removal of cylinders in the event of fire.

5) "NO SMOKING" signs shall be displayed at the gas cylinder storage rooms.

6) Where cylinders are stowed in open locations means shall be provided to:
   — protect cylinders and associated piping from physical damage;
   — minimise exposure to hydrocarbons; and
   — ensure suitable drainage.

(Ref. MODU code 9.17.1)

Interpretation:

The standards and codes as referred to in item 1 should be international recognized.

end of Interpretation

Guidance note:
For the fire-extinguishing arrangements as required for gas cylinder storage areas, see Sec.2 [2.4].
7 Fire control plan

7.1 General

7.1.1 A fire control plan complying with regulation II-2/15.2.4 of the SOLAS and IMO resolution A.952 shall be permanently exhibited.

(Ref. MODU code 9.18)

7.1.2 In all mobile offshore units and offshore installations a general arrangement plans shall be permanently exhibited for the guidance of the ship’s officers, showing clearly for each deck the control stations, the various fire sections enclosed by “A” class divisions, the sections enclosed by “B” class divisions together with particulars of the fire detection and fire alarm systems, the sprinkler installation, the fire-extinguishing appliances, means of access to different compartments, decks, etc., and the ventilating system including particulars of the fan control positions, the position of dampers and identification numbers of the ventilating fans serving each section. Alternatively, at the discretion of the Administration, the aforementioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and one copy shall at all times be available on board in an accessible position. Plans and booklets shall be kept up to date; any alterations thereto shall be recorded as soon as practicable. Description in such plans and booklets shall be in the language or languages required by the Administration. If the language is neither English nor French, a translation into one of those languages shall be included.

(Ref. SOLAS reg. II-2/15.2.4.1)

7.1.3 A duplicate set of fire control plans or a booklet containing such plans shall be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shore-side firefighting personnel i.a.w. IMO MSC/Circ. 451.

(Ref. SOLAS reg. II-2/15.2.4.2)

8 Emergency escape breathing devices

8.1 General

8.1.1 Emergency escape breathing devices (EEBDs) shall not be used for fighting fires, entering oxygen deficient voids or tanks, or worn by fire-fighters. In these events, a self-contained breathing apparatus, which is specifically suited for such applications, shall be used.

(Ref. FSS Code Ch. 3, 2.2.1.2)

8.1.2 The EEBD shall have at least a duration of service of 10 min.

(Ref. IMO MSC/Circ. 849, 4.1)

8.1.3 Emergency escape breathing devices shall be provided as follows:

1) In machinery spaces of category A containing internal combustion machinery used for main propulsion, EEBDs shall be positioned as follows:
   
   — One (1) EEBD in the engine control room, if located within the machinery space;
   
   — One (1) EEBD in workshop areas. If there is, however, a direct access to an escape way from the workshop, an EEBD is not required; and
   
   — One (1) EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of space).
   
   Alternatively, a different number or location may be determined by the Administration taking into consideration the layout and dimensions or the normal manning of the space.

2) For machinery spaces of category A other than those containing internal combustion machinery used for main propulsion, one (1) EEBD shall, as a minimum, be provided on each deck or platform level near
the escape ladder constituting the second means of escape from the space (the other means being an
enclosed escape trunk or watertight door at the lower level of the space).

(Ref. MODU code 9.6.2)

Guidance note:
The EEBD for spaces under 2 may be omitted if the machinery space is limited to a single platform level

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

8.2 Respiratory protection equipment for hydrogen sulphide

8.2.1 A self-contained breathing apparatus (SCBA) positive-pressure/pressure-demand breathing
equipment with full-face piece and rated for a minimum of 30 minutes is to be provided for each person in
working areas where hydrogen sulphide may be encountered, and each person in other areas is to be
provided with a SCBA rated for a minimum of 15 minutes

(Ref. IACS UR D11.9.1)

8.2.2 As an alternative to [8.2.1], air line breathing equipment coupled with an EEBD equipped low
pressure warning alarm and rated for a minimum of 15 minutes is to be provided for each person on board
the unit.

Breathing air supply line stations are to be provided at least in the following areas:

(a) Living quarter;
(b) Muster/evacuation area;
(c) Drilling areas;
(d) Mud processing areas; and
(e) Other working areas.

(Ref. IACS UR D11.9.2)
SECTION 6
SUPPLEMENTARY REQUIREMENTS FOR DRILLING AND WELL INTERVENTION UNITS

1 General
This section gives fire technical requirements applicable to mobile drilling and well intervention units with return of hydrocarbon fluids. The requirements are to be applied supplementary to the requirements given by Sec.1 to Sec.5.

For specific requirements for ESD and fire and gas detection systems, see DNVGL-OS-A101 and DNVGL-OS-D202.

2 Passive fire protection
Windows and side scuttles in boundaries which are required to meet an “A-60” standard which face the drill floor area shall be:

1) constructed to an “A-60” standard; or
2) protected by a water curtain; or
3) fitted with shutters of steel or equivalent material.

(Ref. MODU code 9.3.22)

3 Active fire protection of specific areas

3.1 General
3.1.1 Reference is made to Sec.2 and Sec.3 for general requirements for protection of systems and equipment.

3.1.2 For minimum exposure protection capacities for well intervention/well test areas and water curtain, see Sec.7 Table 1.

3.2 Drilling areas
3.2.1 Fixed fire-extinguishing systems shall be installed to cover and protect the drilling areas.

(Ref. IACS UR D11.3)

Interpretation:
This should cover the following areas and equipment:
— Wellhead area/ surface BOP,
— drill floor.

-------------------- end of Interpretation --------------------

3.2.2 A fixed water spray system is to be provided to protect drilling areas. The minimum water application rate is not less than 20 l/min-m².

(IACS UR D11.3.2)

Guidance note:
It is recommended to use a deluge system in open areas, being to a small degree prone to wind.

------------ end of Guidance note ------------

3.2.3 Instead of a fixed water spray system, as given in [3.2.2], at least two dual-purpose (jet/spray) fire monitors may be installed to cover drilling areas. The minimum capacity of each monitor is not less than 100 m³/h.
The monitors may be operated either remotely or locally. Monitor arranged for local operation shall be sited on an accessible protected position.

(IACS UR D11.3.2)

Interpretation:

1) The required capacity should be rated at a discharge pressure of 3.5 bar.
2) It should be demonstrated that the monitors are able to cover the entire drill floor.

------------------ end of Interpretation ------------------

Guidance note:
Self-oscillating may be used to ensure the coverage of the required area
A combination of both may be applied provided the intended effect is achieved.

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---

3.2.4 For the mud processing area, a suitable fixed foam system is to be provided. The system is to be capable of delivering foam solution at a rate of not less than 6.5 l/min·m² (4.1 l/min·m² for Aqueous Film Forming Foam or Film-Forming Fluoroprotein Foam) for 15 minutes. Alternatively, a gas fixed fire-extinguishing system may be used for enclosed mud processing spaces.

(IACS UR D11.3)

3.3 Processing areas

3.3.1 Fixed water protection systems in line with [3.2.2] alternatively [3.2.3] shall be installed to cover the well test areas.

(Ref. IACS UR D11.3)

Interpretation:

1) This implies the following areas
   — well test area including the process equipment
   — well intervention area when fluids from well are returned to unit.

2) The application rate for fixed water spray systems should be 10 (l/min)/m².
3) Exposed pipework, pressure vessels and tanks containing inflammable gas or liquids should have dedicated protection of minimum 10 (l/min)/m² of the exposed surfaces in addition to area protection. The rate may be adjusted depending on passive fire protection.

------------------ end of Interpretation ------------------

Guidance note:
The horizontal extent of the area requiring protection may be limited by adjacent vertical class A or H divisions and/or the external boundaries of the installation.

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---

3.3.2 In areas where liquid pool fires can be predicted, manual or fixed facilities shall be provided for application of foam of suitable type. The foam system should have capacity for application of foam over the protected area of 10 (l/min)/m² for not less than 15 minutes.

4 Gas detection and alarm

4.1 Flammable gas

4.1.1 The following provisions apply to drilling units in addition to the common provisions in Sec.4 [3].
4.1.2 The requirement for fixed automatic combustible gas detection and alarm systems as given in Sec.4 [3.1], includes the following areas:

a) Cellar deck  
b) Drill floor  
c) Mud pit area  
d) Shale shaker area  
e) Enclosed spaces containing the open components of mud circulation system from the bell nipple to the mud pits.

(Ref. IACS UR D11.7.1)

4.1.3 The executive actions as mentioned in Sec.4 [3.1.4] and [3.1.5] need not take place on confirmed gas detection in gas extraction from shale shaker and mud tank ventilation systems if so provided.

4.2 Hydrogen sulphide

4.2.1 A fixed automatic hydrogen sulphide gas detection and alarm system shall be provided so arranged as to monitor continuously the drilling area, mud processing area and well fluid test area on the unit.  
(Ref. MODU code 9.12.1)

4.2.2 The system is clearly to indicate where gas has been detected and capable of giving audible and visual alarm at the main control points.  
(Ref. MODU code 9.12.1 and IACS UR D11.8.2)

4.2.3 Alarm levels

The system shall include a low and high level alarm, the low level to be set at 10 ppm.  
(Ref. IACS UR D11.8.2)  

Interpretation:

The high level should be set to 20 ppm  

--------- end of Interpretation ---------

4.2.4 If the alarm at the main control point is unanswered within 2 min, the toxic gas (hydrogen sulphide) alarm and the helideck status light shall be automatically activated.  
(Ref. MODU code 9.12.1 and IACS UR D11.8.2)  

Interpretation:

Confirmed detection should result in an immediate toxic gas alarm. Confirmed implies either two detectors at low level or one at a high level.  

--------- end of Interpretation ---------

4.2.5 At least two portable hydrogen sulphide monitoring devices shall be provided on the unit.  
(Ref. MODU code 9.12.2)

5 Emergency escape breathing devices

For requirements for EEBD see Sec.5 [8.1.2].

Interpretation:

A minimum of at least 4 sets should be available for the drilling areas. These are to be properly marked and easily accessible. One of these should be stored on or by the drill floor, one in the mud pit area and one in the shale shaker area The breathing apparatus should be safely located with regards to fire in these areas.  

--------- end of Interpretation ---------
6 Enhanced fire protection - ES

6.1 Introduction
In case this standard is used for classification purposes, the requirements in this sub-section are applicable for vessels with the voluntary notation ES only.

6.2 Fire-fighting systems

6.2.1 Water treatment may be necessary to prevent marine growth from impairing fire-water system performance. Inlet strainers shall be installed to prevent damage of the pump.

6.2.2 Measures to minimize the effect of pressure surge in the fire-water main ring shall be considered.

6.2.3 Moon pool
For drill ships with moon pool there shall be an adequate active fire protection systems that can be activated and function without any risk to operators. This moon pool area shall be taken as the same fire area as the drill floor unless there is adequate separation of these fire areas.

6.2.4 Control
The fire pump shall start on confirmed fire detection and by activation of manual pushbutton in main control room.

6.2.5 Normally fire pumps shall only be stopped locally. However, for units where continuous running of fire pumps may cause stability problems, then a remote stop from the control station may be acceptable.

6.2.6 Maintainability
The deluge valve system shall be designed to allow isolation and maintenance without isolation of the ring main.

6.3 Fire and gas detectors

6.3.1 Installation
Smoke detectors shall be installed on all intakes for ventilation air to accommodation, control and service spaces.

6.3.2 All intakes for ventilation air to accommodation, control and service spaces shall be equipped with H2S detectors.

6.3.3 Effects upon detection
Upon unconfirmed gas detection, all welding sockets and temporary equipment shall be tripped.

In addition to Sec.4, the helideck status light is to be automatically activated upon confirmed gas detection.

Guidance note:
The executive actions as mentioned above need not take place on confirmed gas detection in gas extraction from shale shaker and mud tank ventilation systems if so provided.

For additional effects upon confirmed gas detection, see DNVGL-OS-A101 Ch.2 Sec.6.

---e-n-d---of---g-u-i-d-a-n-c-e-n-o-t-e---
SECTION 7 SUPPLEMENTARY REQUIREMENTS FOR OIL AND GAS PRODUCTION AND STORAGE UNITS

1 General
This section gives fire technical requirements applicable to oil production and storage units. The requirements are to be applied supplementary to the requirements given by Sec.1 to Sec.5.
For specific requirements for ESD and fire and gas detection systems, see DNVGL-OS-A101 and DNVGL-OS-D202.

2 Passive fire protection

2.1 Structural elements
2.1.1 Load-bearing structures shall maintain integrity for the required period of time when exposed to the defined dimensioning accidental loads as defined in DNVGL-OS-A101.
2.1.2 In addition to the items listed in Sec.2 [2.2.1] interpretation 1), special attention shall be given to the insulation of aluminium alloy components of columns, stanchions and other structural members required to support the process modules on the open deck.

2.2 Systems and equipment
Reference is made to DNVGL-OS-A101 for general requirements for protection of systems and equipment.

2.3 Protection of spaces or areas
2.3.1 Exterior boundaries of superstructures and deckhouses enclosing accommodation spaces, service spaces and control stations, including any overhanging decks which support such accommodation, are to be protected against heat, for the portions facing the tank area, including 3 m of the side boundary, by insulation to minimum class “A-60” standard. See Table 3 and Table 4.
2.3.2 Bulkheads between crude oil pump rooms, including their trunks, and machinery spaces are to be class “A”, and are to have no penetrations which are less than class “A-0” or equivalent in all respects, other than the crude oil pump shaft glands and similar glanded penetrations, see also Table 3 and Table 4.
2.3.3 Skylights to crude oil pump rooms shall be of steel and be capable of being closed from outside the pump room.
2.3.4 Permanent approved gas tight lighting enclosures for illuminating cargo pump-rooms may be permitted in bulkheads and decks separating cargo pump-rooms and other spaces provided they are of adequate strength and the integrity and gas tightness of the bulkhead or deck is maintained.

3 Active fire protection of specific areas

3.1 General
3.1.1 Attention shall be given to any statutory requirements of the national authority having jurisdiction in the waters where the vessel is located during operation.
3.1.2 Reference is made to Sec.2 and Sec.3 for general requirements for protection of systems and equipment.

3.2 Production or processing areas
3.2.1 Fixed water protection systems shall be installed to cover the following areas and equipment as applicable:
   — wellhead or turret areas
— processing areas
— crude oil and gas manifolds or piping on deck
— glycol regeneration plant
— areas containing equipment or piping through which hydrocarbon fluids is flowed for the purpose of production, export or offloading and storage
— areas of storage of cylinders with compressed gas (oxygen, acetylene, etc.).

3.2.2 The quantity of water supplied to areas requiring protection including equipment surfaces shall be sufficient to provide exposure protection to equipment within that area. See Table 1 for recommended capacity.

3.2.3 The horizontal extent of the area requiring protection may be limited by adjacent vertical class A or H divisions and/or the external boundaries of the installation.

Fixed water protection systems may consist of
— automatic deluge or
— water monitors or
— a combination of both.

Water monitors are only considered suitable for protection of equipment in open areas and provided they can be activated without any risk from the fire. The layout is to ensure that all protected surfaces are wetted in all weather conditions. The minimum capacity given in Table 1 shall be applied for area coverage of automatic operated deluge systems.

### Table 1 Minimum capacities

<table>
<thead>
<tr>
<th>Area</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wellhead area</td>
<td>20 (l/min)/m²</td>
</tr>
<tr>
<td>Turret area</td>
<td>20 (l/min)/m²</td>
</tr>
<tr>
<td>Processing area/offloading area</td>
<td>10 (l/min)/m²</td>
</tr>
<tr>
<td>Well test/well intervention area</td>
<td>10 (l/min)/m²</td>
</tr>
<tr>
<td>Water curtain</td>
<td>10 (l/min)/m²</td>
</tr>
</tbody>
</table>

3.2.4 Instead of a fixed water spray system, as given in [3.2.3], at least two dual-purpose (jet/spray) fire monitors may be installed to cover the relevant areas. The minimum capacity of each monitor shall not be less than 100m³/h.

The monitors may be operated either remotely or locally. Monitor arranged for local operation shall be sited on an accessible protected position.

Interpretation:

1) The required capacity should be rated at a discharge pressure of 3.5 bar.

2) It should be demonstrated that the monitors are able to cover the entire drill floor, especially if the floor is equipped with wind-walls.

---end---of---Interpretation---

3.2.5 In areas where liquid pool fires can be predicted, manual or fixed facilities shall be provided for application of foam of suitable type. The foam system is to have capacity for application of foam over the protected area for not less than 15 minutes.

3.2.6 Exposed pipework, pressure vessels and tanks containing inflammable gas or liquids shall have dedicated protection of minimum 10 (l/min)/m² of the exposed surfaces in addition to area protection unless safety measures (see Guidance note) justifies lower rates. See also Table 2.

**Guidance note:**

The rate may be adjusted in line with the design criteria, any passive fire protection and the capacity of the depressurising system.

---e-n-d---of---g-u-i-d-a-n-c-e---n-o-t-e---
3.3 Deck fire-fighting systems

3.3.1 Oil production and/or storage vessels are to have a fixed deck foam fire-extinguishing system in accordance with the requirements in this subsection.

3.3.2 The arrangement for providing foam shall be capable of delivering foam to the entire tank deck area as well as into any crude oil tank with ruptured deck.

3.3.3 The deck foam system shall be capable of simple and rapid operation. The main control station for the system shall be suitably located outside the area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.

3.3.4 The rate of supply of foam solution shall be not less than the greatest of the following:

1) 0.6 litre/minute/m² of storage tank deck area, where crude oil tank deck area means the maximum breadth of the ship multiplied by the total longitudinal extent of the cargo tank spaces;
2) 6 litre/minute/m² of the horizontal sectional area of the single tank having the largest such area, or;
3) 3 litre/minute/m² of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1250 litre/minute.

3.3.5 The foam system shall be designed to ensure at least 20 minutes of foam generation in tankers fitted with an inert gas installation, and 30 minutes of foam generation in tankers not fitted with an inert gas installation when using solution rates given in [3.3.4]1), 2), or 3), whichever is the greatest.

3.3.6 The foam expansion ratio (i.e. the ratio of the volume of foam produced to the volume of the mixture of water and foam-making concentrate supplied) is generally not to exceed 12 to 1. Where systems essentially produce low-expansion foam but at an expansion ratio slightly in excess of 12 to 1, the quantity of foam solution available is to be calculated as for 12 to 1 expansion ratio systems. When medium-expansion ratio foam (between 50 to 1 and 150 to 1 expansion ratio) is employed the application rate of the foam and the capacity of a monitor installation will be specially considered.

3.3.7 Foam from the fixed foam system shall be supplied by means of monitors and foam applicators. At least 50% of the foam solution supply rate required in [3.3.4]1), 2), or 3) is to be delivered from each monitor.

3.3.8 The distance from the monitor to the farthest extremity of the protected area forward of that monitor is not to be more than 75% of the monitor-throw in still air conditions.

3.3.9 A monitor and hose connection for a foam applicator shall be situated both port and starboard at the front of the poop or accommodation spaces facing the storage tank deck.

3.3.10 Applicators shall be provided to ensure flexibility of action during fire-fighting operations and to cover areas screened from the monitors. The capacity of any applicator shall not be less than 400 litres/minute and the applicator throw in still air condition shall not be less than 15 m. No less than four foam applicators shall be provided.

The number and disposition of foam main outlets shall be such that foam from at least two applicators can be directed to any part of the storage tank deck area.

3.3.11 Valves shall be provided in the foam main, and in the fire main when this is an integral part of the deck foam system, immediately forward of any monitor position to isolate damaged sections of those mains.

3.3.12 Operation of a deck foam system at its required output shall permit the simultaneous use of the minimum required number of jets of water at the required pressure from the fire main.

3.4 Fire-fighting in stored product or crude oil pump rooms

3.4.1 Each stored product and/or crude oil pump room shall be provided with one of the following fixed fire-extinguishing systems operated from a readily accessible position outside the pump room.

3.4.2 Stored product pump rooms shall be provided with a system suitable for machinery spaces of category A.

— A fixed gas fire-extinguishing system (see Sec.3 [3.1]).
— A high expansion foam system provided that the foam concentrate supply is suitable for extinguishing fires involving the products stored.
— A fixed pressure water-spraying system.

3.4.3 Where the extinguishing medium used in the stored product pump room system is also used in systems serving other spaces, the quantity of medium provided or its delivery rate need not be more than the maximum required for the largest compartment.

3.5 Fire-fighting in offloading area and turret area

3.5.1 The offloading and turret areas shall have the following fire-fighting equipment:
— water jets and foam monitors covering the offloading and mooring area. Number, location and type of monitors are to be optimised with regard to fire-fighting efficiency. The foam system is to be independent from the vessel's main foam system
— deluge system covering the mooring chain, fairlead and the exterior of the bow control station, if fitted
— foam-based sprinkler system for the offloading connector room.

3.5.2 Fixed fire-extinguishing system in the turret area shall be according to the requirements in stored product, see [3.3].

3.6 Fire-fighting in engine and boiler rooms

3.6.1 An additional fire-extinguishing system shall be fitted in the engine and boiler rooms when auxiliary boilers and turbines are fuelled by crude oil or gas. The system shall be installed in such a way that it is possible for an approved fire-extinguishing medium to be directed on to the gas turbines, boiler fronts and on to the spill tray. The emission of extinguishing medium is automatically to stop the exhaust fan of the boiler hood.

3.6.2 For boilers and engines/turbines located above the tank deck, a similar additional fire-extinguishing system shall be fitted with the similar functionalities as above with documented capacities in all environmental conditions.

3.6.3 There shall be in each boiler room or at an entrance outside of the boiler room at least one portable foam applicator unit complying with the provisions of the Fire Safety Systems Code.
(Ref. SOLAS reg. II-2/10.5.1.2.1)

3.6.4 There shall be at least two portable foam extinguishers or equivalent in each firing space in each boiler room and in each space in which a part of the oil fuel installation is situated. There shall be not less than one approved foam type extinguisher of at least 135 l capacity or equivalent in each boiler room. These extinguishers shall be provided with hoses on reels suitable for reaching any part of the boiler room. In the case of domestic boilers of less than 175 kW an approved foam-type extinguisher of at least 135 l capacity is not required.
(Ref. SOLAS reg. II-2/10.5.1.2)

Interpretation:
50 kg dry powder or 45 kg CO₂ is considered as equivalent to 135 l foam liquid.

3.7 Fire-fighting in turbine hood

Turbine hood(s) shall be adequately protected by a fixed fire-fighting system according to NFPA750 or another recognised standard.
4 Fire-water systems

4.1 Fire-water pump system

4.1.1 The fire-water pump systems shall be selected to deliver the pressure and flow requirements for the operation of the water based systems, such as the deluge, sprinkler, monitors, hoses etc. The required capacity will be the single largest fire area, which will have fixed-firewater extinguishing system installed and additionally manual fire-fighting demand from two hose streams and any relevant monitors. See also Table 1.

Interpretation:
In determining the single largest fire area, the limitations of the area may be based on fire divisions, ref. Ch.1 Sec.1 [3.2]. If however distance is used as a criterion for determining the extent of fire area, both consequences of fire loads and potential for automatic detection of fire and subsequent release in the neighboring area should be taken into account.

4.1.2 Measures to minimize the effect of pressure surge in the fire water main ring shall be considered.

4.1.3 The pumps required in Sec.3 [2.2.1] shall be dedicated for fire-fighting duty and be available at all time. The pumps shall be arranged such that one incident does not put all pumps out of action.

At least one of the pump systems shall be designed as a self-contained unit. The other may be driven via the emergency power switchgear, and in that case, the emergency source of power shall be capable to supply the fire water pump in addition to other services, see DNVGL-OS-D201 Ch.2 Sec.2 Table 2-1.

Guidance note:
It is recommended to establish special precautions during maintenance periods.

4.1.4 Water treatment may be necessary to prevent marine growth from impairing fire water system performance. Inlet strainers shall be installed to prevent damage of the pump.

4.1.5 The status of the fire pump systems shall at all times be available at the central control station.

4.1.6 In addition to the automatic start at low pressure in the fire main (ref. Sec.3 [2.2.10]), the fire pump shall start either on confirmed fire detection or by activation of manual pushbutton in main control room.

4.1.7 Each pump system shall have a rated capacity of 100% of the anticipated fire water demand, see [4.1.1] and Sec.3 [2.2.1]. Each pump system shall preferably consist of 2 × 50% pump units.

Guidance note:
Other variations on combining pump units into fire pump systems may also be considered provided that the design ensures that there is sufficient firewater available at any given time to meet the maximum design water demand.

4.1.8 The pumps shall be designed to supply 150% of rated capacity at not less than 65% of rated head, ref. NFPA 20 Sec.6.2. The maximum capacity shall be verified during site acceptance test.

4.1.9 Fire pumps shall only be capable of being manually stopped at the driver. The only automatic trip accepted is for overspeed protection. However, for units where continuous running of fire pumps may cause stability problems, then a remote stop from the control station may be acceptable.

4.1.10 It shall be possible to reset the overspeed protection manually in a simple manner.

4.1.11 Fire detection at the fire water pump and/or its driver area shall not stop the pump or inhibit the start of the fire pump driver.

4.1.12 The pumps shall be capable of 18 hours autonomous operation. However, this period can be considered in relation to availability of external assistance.
Interpretation:

The power source for the fire water pump or the room in which it is located, should be arranged for cooling as required to assure continued operation in case of ventilation failure. Combustion air inlet to diesel engine should be separate from the room ventilation.

------------------- end of Interpretation -------------------

4.2 Fire-water distribution

4.2.1 An area shall be supplied by at least two well separated branch pipes on the fire main.

4.2.2 Fixed fire-fighting systems, including deluge valve and fire water distribution pipework shall be designed so that fire water protection is readily available.

Interpretation:

1) For normal production plant this implies that the protection should be effective within 30 sec of the demand.
2) For production plant with high protection requirements e.g. jet fires or thin wall pressure vessels, shorter response times or passive fire protection should be considered to ensure the effectiveness of the system.

------------------- end of Interpretation -------------------

4.2.3 The deluge valve system shall be activated by a signal from the fire and gas detection system and is to have local energy source for the valve actuator. The overall control system shall be designed to minimise the possibility of unintended valve opening if associated utilities are damaged, while a high degree of availability is maintained.

Guidance note:

As an example, for pneumatic control systems, unintended valve opening due to failure of main instrument air supply could be prevented by installation of a local air accumulator with a check valve in the air line. Solenoid valves for activation could be ‘fail fixed’ on loss of signal. The fail safe function can be provided by installing fusible bulbs in the protected fire zone to depressurise the control system and activate the deluge valve directly.

---end---of---guidance---note---

5 Detection and alarm systems

5.1 Basic provisions

Automatic shutdown of ventilation is to take place upon:

— detection of fire in enclosed spaces, unless this is in conflict with overall smoke control strategy.
— smoke detection in ventilation air inlets.
— confirmed gas detection in affected air inlets.

Shutdown of ventilation shall include shutdown of fan and closing of fire damper. For gas detection the shutdown shall also include possible heating elements of the ventilation system.

Shutdown of ventilation is to ensure that the detected gasses or smoke are isolated from the ventilated space.

Interpretation:

The response time of detection and shutdown should be evaluated against the transport time of gas in the ventilation duct.

------------------- end of Interpretation -------------------
5.2 Fire detection

5.2.1 An automatic fire detection system shall be installed in machinery spaces, service spaces, accommodation spaces, production areas and in any space containing equipment in petroleum or any other flammable substance is stored, conveyed, processed or consumed.

5.2.2 Fire detection in areas containing production facilities is normally to result in automatic shut-down of hydrocarbon flow and ventilation for the area.

5.2.3 Detected fire in wellhead, turret, oil production, crude oil tank or offloading areas shall initiate automatic shutdown of wellhead valves and oil production facilities.

5.3 Gas detection

5.3.1 Installation of detectors

For general requirements wrt installation of detectors see Sec.4 [3.1].

5.3.2 Gas detection in cargo pump rooms and double hull spaces shall be arranged in accordance with principles given in DNV Rules for ships Pt.5 Ch.3 Sec.9 F - H.

5.3.3 If hazardous concentrations of H2S may occur, equipment to measure H2S shall be installed in accordance with the requirements as given in Sec.6 [4.2] and [6.3.2].

5.3.4 A combined gas detection system required by SOLAS II-2/4.5.7.3 and II-2/4.5.10 may be accepted in cases where the system fully complies with the requirement of regulation II-2/2 of SOLAS.

(Ref. FSS Code 16.1.2)

5.3.5 The fixed hydrocarbon gas detection system shall comply to MSC.1/1370.

(Ref. FSS Code 16.2.1.1)

5.3.6 The system shall be comprised of a central unit for gas measurement and analysis and gas sampling pipes in all ballast tanks and void spaces of double-hull and doublebottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks.

(Ref. FSS Code 16.2.1.2)

5.3.7 The system may be integrated with the cargo pump-room gas detection system, provided that the spaces referred to in paragraph [5.3.6] are sampled at the rate required in paragraph [5.3.15]. Continuous sampling from other locations may also be considered provided the sampling rate is complied with.

(Ref. FSS Code 16.2.1.3)

5.3.8 Common sampling lines to the detection equipment shall not be fitted, except the lines serving each pair of sampling points as required in paragraph [5.3.10].

(Ref. FSS Code 16.2.2.1.1)

5.3.9 The materials of construction and the dimensions of gas sampling lines shall be such as to prevent restriction. Where non-metallic materials are used, they shall be electrically conductive. The gas sampling lines shall not be made of aluminium.

(Ref. FSS Code 16.2.2.1.2)

5.3.10 The configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in paragraphs [5.3.11] and [5.3.12], the sampling system shall allow for a minimum of two hydrocarbon gas sampling points, one located on the lower and one on the upper part where sampling is required. When required, the upper gas sampling point shall not be located lower than 1 m from the tank top. The position of the lower located gas sampling point shall be above the height of the girder of bottom shell platting but at least 0.5 m from the bottom of the tank and it shall be provided with means to be closed when clogged. In positioning the fixed sampling points, due regard shall also be given to the density of vapours of the oil products intended to be transported and the dilution from space purging or ventilation.

(Ref. FSS Code 16.2.2.1.3)
5.3.11 For mobile offshore units and offshore installations with deadweight of less than 50 000 tonnes, installation of one sampling location for each tank for practical and/or operational reasons is allowed.
(Ref. FSS Code 16.2.2.1.4)

5.3.12 For ballast tanks in the double-bottom, ballast tanks not intended to be partially filled and void spaces, the upper gas sampling point is not required.
(Ref. FSS Code 16.2.2.1.5)

5.3.13 Means shall be provided to prevent gas sampling lines from clogging when tanks are ballasted by using compressed air flushing to clean the line after switching from ballast to cargo loaded mode. The system shall have an alarm to indicate if the gas sampling lines are clogged.
(Ref. FSS Code 16.2.2.1.6)

5.3.14 The gas analysis unit shall be located in a safe space and may be located in areas outside the ship’s cargo area; for example, in the cargo control room and/or navigation bridge in addition to the hydraulic room when mounted on the forward bulkhead, provided the following requirements are observed:

1) sampling lines shall not run through gas safe spaces, except where permitted under item 5;
2) the hydrocarbon gas sampling pipes shall be equipped with flame arresters. Sample hydrocarbon gas is to be led to the atmosphere with outlets arranged in a safe location, not close to a source of ignitions and not close to the accommodation area air intakes;
3) a manual isolating valve, which shall be easily accessible for operation and maintenance, shall be fitted in each of the sampling lines at the bulkhead on the gas safe side;
4) the hydrocarbon gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc., shall be located in a reasonably gas-tight cabinet (e.g., fully enclosed steel cabinet with a door with gaskets) which is to be monitored by its own sampling point. At a gas concentration above 30% of the lower flammable limit inside the steel enclosure the entire gas analysing unit is to be automatically shut down; and
5) where the enclosure cannot be arranged directly on the bulkhead, sample pipes shall be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing unit, and are to be routed on their shortest ways.
(Ref. FSS Code 16.2.2.2)

5.3.15 The gas detection equipment shall be designed to sample and analyse from each sampling line of each protected space, sequentially at intervals not exceeding 30 min.
(Ref. FSS Code 16.2.3.1)

5.3.16 Means shall be provided to enable measurements with portable instruments, in case the fixed system is out of order or for system calibration. In case the system is out of order, procedures shall be in place to continue to monitor the atmosphere with portable instruments and to record the measurement results.
(Ref. FSS Code 16.2.3.2)

5.3.17 Audible and visual alarms are to be initiated in the cargo control room, navigation bridge and at the analysing unit when the vapour concentration in a given space reaches a pre-set value, which shall not be higher than the equivalent of 30% of the lower flammable limit.
(Ref. FSS Code 16.2.3.3)

5.3.18 The gas detection equipment shall be so designed that it may readily be tested and calibrated.
(Ref. FSS Code 16.2.3.4)

5.3.19 Effects upon detection
Upon unconfirmed gas detection, all welding sockets and temporary equipment shall be tripped.
Guidance note:
For effects upon confirmed gas detection, see DNVGL-OS-A101 Ch.2 Sec.7

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6 Conversions
Alternative solutions to the requirements for fire safety as stipulated in this section may be considered, e.g. for conversion of existing vessels to oil production and storage vessels, provided the required level of safety is maintained.
SECTION 8 SUPPLEMENTARY REQUIREMENTS FOR FLOATING STORAGE UNITS

1 General
This section gives fire technical requirements applicable to floating storage units. The requirements are to be applied supplementary to the requirements given by Sec.1 to Sec.5.

For specific requirements for ESD and fire and gas detection systems, see DNVGL-OS-A101 and DNVGL-OS-D202.

2 Passive fire protection

2.1 Systems and equipment
Reference is made to DNVGL-OS-A101 for general requirements for protection of systems and equipment.

2.2 Protection of spaces or areas
Protection of spaces and areas shall comply with Sec.7 [2.3].

3 Active fire protection of specific areas

3.1 General
3.1.1 Attention shall be given to any statutory requirements of the national authority having jurisdiction in the waters where the vessel is located during operation.

3.1.2 Reference is made to Sec.2 and Sec.3 for general requirements for protection of systems and equipment.

3.2 Storage areas
3.2.1 Fixed water protection systems shall be installed to cover the following areas and equipment as applicable:
- Turret areas
- crude oil and gas manifolds or piping on deck
- glycol regeneration plant
- areas containing equipment or piping through which hydrocarbon fluids is flowed for the purpose of production, export or offloading and storage
- VOC plant
- Tank deck.

3.2.2 The quantity of water supplied to areas requiring protection including equipment surfaces shall be sufficient to provide exposure protection to equipment within that area. See Table 1 for recommended capacity.

3.2.3 The horizontal extent of the area requiring protection may be limited by adjacent vertical class A or H divisions and/or the external boundaries of the installation.

Fixed water protection systems may consist of
- automatic deluge or
- water monitors or
- a combination of both.

Water monitors are only considered suitable for protection of equipment in open areas and provided they can be activated without any risk from the fire. The layout is to ensure that all protected surfaces are wetted in all weather conditions. The minimum capacity given in Table 1 shall be applied for area coverage of automatic operated deluge systems.
3.2.4 Instead of a fixed water spray system, as given in [3.2.3], at least two dual-purpose (jet/spray) fire monitors may be installed to cover the relevant areas. The minimum capacity of each monitor shall not be less than 100 m³/h.

The monitors may be operated either remotely or locally. Monitor arranged for local operation shall be sited on an accessible protected position.

Interpretation:

The required capacity should be rated at a discharge pressure of 3.5 bar.

---end---of---Interpretation---

3.2.5 In areas where liquid pool fires can be predicted, manual or fixed facilities shall be provided for application of foam of suitable type. The foam system is to have capacity for application of foam over the protected area for not less than 15 minutes.

3.2.6 Exposed pipework, pressure vessels and tanks containing inflammable gas or liquids shall have dedicated protection of minimum 10 (l/min)/m² of the exposed surfaces in addition to area protection unless safety measures (see Guidance note) justifies lower rates. See also Table 2.

**Guidance note:**
The rate may be adjusted in line with the design criteria, any passive fire protection and the capacity of the depressurising system.

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3.3 Deck fire-fighting systems

3.3.1 Storage units are to have a fixed deck foam fire-extinguishing system in accordance with the requirements in this subsection.

3.3.2 The arrangement for providing foam shall be capable of delivering foam to the entire tank deck area as well as into any crude oil tank with ruptured deck.

3.3.3 The deck foam system shall be capable of simple and rapid operation. The main control station for the system shall be suitably located outside the area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.

3.3.4 The rate of supply of foam solution shall be not less than the greatest of the following:

1) 0.6 litre/minute/m² of storage tank deck area, where crude oil tank deck area means the maximum breadth of the ship multiplied by the total longitudinal extent of the cargo tank spaces;
2) 6 litre/minute/m² of the horizontal sectional area of the single tank having the largest such area, or;
3) 3 litre/minute/m² of the area protected by the largest monitor, such area being entirely forward of the monitor, but not less than 1250 litre/minute.

3.3.5 The foam concentrate shall be of recognised type and delivered with product certificate.

3.3.6 The foam system shall be designed to ensure at least 20 minutes of foam generation in tankers fitted with an inert gas installation, and 30 minutes of foam generation in tankers not fitted with an inert gas installation when using solution rates given in [3.3.4][1), 2), or 3), whichever is the greatest.

3.3.7 The foam expansion ratio (i.e. the ratio of the volume of foam produced to the volume of the mixture of water and foam-making concentrate supplied) is generally not to exceed 12 to 1. Where systems essentially produce low-expansion foam but at an expansion ratio slightly in excess of 12 to 1, the quantity of foam solution available is to be calculated as for 12 to 1 expansion ratio systems. When medium-
expansion ratio foam (between 50 to 1 and 150 to 1 expansion ratio) is employed the application rate of the foam and the capacity of a monitor installation will be specially considered.

3.3.8 Foam from the fixed foam system shall be supplied by means of monitors and foam applicators. At least 50% of the foam solution supply rate required in [3.3.4]1), 2), or 3) is to be delivered from each monitor.

3.3.9 The distance from the monitor to the farthest extremity of the protected area forward of that monitor is not to be more than 75% of the monitor-throw in still air conditions.

3.3.10 A monitor and hose connection for a foam applicator shall be situated both port and starboard at the front of the poop or accommodation spaces facing the storage tank deck.

3.3.11 Applicators shall be provided to ensure flexibility of action during fire-fighting operations and to cover areas screened from the monitors. The capacity of any applicator shall not be less than 400 litres/minute and the applicator throw in still air condition shall not be less than 15 m. No less than four foam applicators shall be provided.

The number and disposition of foam main outlets shall be such that foam from at least two applicators can be directed to any part of the storage tank deck area.

3.3.12 Valves shall be provided in the foam main, and in the fire main when this is an integral part of the deck foam system, immediately forward of any monitor position to isolate damaged sections of those mains.

3.3.13 Operation of a deck foam system at its required output shall permit the simultaneous use of the minimum required number of jets of water at the required pressure from the fire main.

3.4 Fire-fighting in stored product or crude oil pump rooms

3.4.1 Each stored product and/or crude oil pump room shall be provided with one of the following fixed fire-extinguishing systems operated from a readily accessible position outside the pump room.

3.4.2 Stored product pump rooms shall be provided with a system suitable for machinery spaces of category A.

— A fixed gas fire-extinguishing system (see Sec.3 [3.1]).
— A high expansion foam system provided that the foam concentrate supply is suitable for extinguishing fires involving the products stored.
— A fixed pressure water-spraying system.

3.4.3 Where the extinguishing medium used in the stored product pump room system is also used in systems serving other spaces, the quantity of medium provided or its delivery rate need not be more than the maximum required for the largest compartment.

3.5 Fire-fighting in offloading area and turret area

3.5.1 The offloading and turret areas shall have the following fire-fighting equipment:

— water jets and foam monitors covering the offloading and mooring area. Number, location and type of monitors are to be optimised with regard to fire-fighting efficiency. The foam system is to be independent from the vessel's main foam system
— deluge system covering the mooring chain, fairlead and the exterior of the bow control station, if fitted
— foam-based sprinkler system for the offloading connector room.

3.5.2 Fixed fire-extinguishing system in the turret area shall be according to the requirements in stored product, see [3.3].

3.6 Fire-fighting in engine and boiler rooms

3.6.1 An additional fire-extinguishing system shall be fitted in the engine and boiler rooms when auxiliary boilers and turbines are fuelled by crude oil or gas. The system shall be installed in such a way that it is possible for an approved fire-extinguishing medium to be directed on to the gas turbines, boiler fronts and
on to the spill tray. The emission of extinguishing medium is automatically to stop the exhaust fan of the boiler hood.

3.6.2 For boilers and engines/turbines located above the tank deck, a similar additional fire-extinguishing system shall be fitted with the similar functionalities as above with documented capacities in all environmental conditions.

3.6.3 There shall be in each boiler room or at an entrance outside of the boiler room at least one portable foam applicator unit complying with the provisions of the Fire Safety Systems Code.

(Ref. SOLAS reg. II-2/10.5.1.2.1)

3.6.4 There shall be at least two portable foam extinguishers or equivalent in each firing space in each boiler room and in each space in which a part of the oil fuel installation is situated. There shall be not less than one approved foam type extinguisher of at least 135 l capacity or equivalent in each boiler room. These extinguishers shall be provided with hoses on reels suitable for reaching any part of the boiler room. In the case of domestic boilers of less than 175 kW an approved foam-type extinguisher of at least 135 l capacity is not required.

(Ref. SOLAS reg. II-2/10.5.1.2)

Interpretation:

50 kg dry powder or 45 kg CO₂ is considered as equivalent to 135 l foam liquid.

------------------ end of Interpretation ------------------

4 Fire-water systems

4.1 Fire-water pump system

4.1.1 The fire-water pump systems shall be selected to deliver the pressure and flow requirements for the operation of the water based systems, such as the deluge, sprinkler, monitors, hoses etc. The required capacity will be the single largest fire area, which will have fixed-firewater extinguishing system installed and additionally manual fire-fighting demand from two hose streams and any relevant monitors. See also Table 1.

Interpretation:

In determining the single largest fire area, the limitations of the area may be based on fire divisions, ref. Ch.1 Sec.1 [3.2]. If however distance is used as a criterion for determining the extent of fire area, both consequences of fire loads and potential for automatic detection of fire and subsequent release in the neighboring area should be taken into account.

------------------ end of Interpretation ------------------

4.1.2 Measures to minimize the effect of pressure surge in the fire water main ring shall be considered.

4.1.3 The pumps required in Sec.3 [2.2.1] shall be dedicated for fire-fighting duty and be available at all time. The pumps shall be arranged such that one incident does not put all pumps out of action.

Guidance note:

It is recommended to establish special precautions during maintenance periods.

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4.1.4 Water treatment may be necessary to prevent marine growth from impairing fire water system performance. Inlet strainers shall be installed to prevent damage of the pump.

4.1.5 The status of the fire pump systems shall at all times be available at the central control station.

4.1.6 In addition to the automatic start at low pressure in the fire main (ref. Sec.3 [2.2.10]), the fire pump shall start either on confirmed fire detection or by activation of manual pushbutton in main control room.

4.1.7 Each pump system shall have a rated capacity of 100% of the anticipated fire water demand, see [4.1.1] and Sec.3 [2.2.1]. Each pump system shall preferably consist of 2 x 50% pump units.

---e-n-d---
5 Detection and alarm systems

5.1 Fire detection

5.1.1 An automatic fire detection system shall be installed in machinery spaces, service spaces, accommodation spaces, production areas and in any space containing equipment in petroleum or any other flammable substance is stored, conveyed, processed or consumed.

5.1.2 Detected fire in turret, crude oil tank or offloading areas shall initiate automatic shutting of import/export valves.

5.2 Gas detection

5.2.1 Gas detectors shall be installed on open deck to detect possible migration of gas from cargo area towards accommodation.

5.2.2 Gas detection in cargo pump rooms and double hull spaces shall be arranged in accordance with principles given in DNV Rules for ships Pt.5 Ch.3 Sec.9 F - H.

5.2.3 A combined gas detection system required by SOLAS II-2/4.5.7.3 and II-2/4.5.10 may be accepted in cases where the system fully complies with the requirement of regulation II-2/2 of SOLAS.

(Ref. FSS Code 16.1.2)

5.2.4 The fixed hydrocarbon gas detection system shall comply to MSC.1/1370.

(Ref. FSS Code 16.2.1.1)

5.2.5 The system shall be comprised of a central unit for gas measurement and analysis and gas sampling pipes in all ballast tanks and void spaces of double-hull and doublebottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks.

(Ref. FSS Code 16.2.1.2)

5.2.6 The system may be integrated with the cargo pump-room gas detection system, provided that the spaces referred to in paragraph [5.2.5] are sampled at the rate required in paragraph [5.2.14]. Continuous sampling from other locations may also be considered provided the sampling rate is complied with.

(Ref. FSS Code 16.2.1.3)

5.2.7 Common sampling lines to the detection equipment shall not be fitted, except the lines serving each pair of sampling points as required in paragraph [5.2.9].

(Ref. FSS Code 16.2.1.1)

5.2.8 The materials of construction and the dimensions of gas sampling lines shall be such as to prevent restriction. Where non-metallic materials are used, they shall be electrically conductive. The gas sampling lines shall not be made of aluminium.

(Ref. FSS Code 16.2.2.1.2)

5.2.9 The configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in paragraphs [5.2.10] and [5.2.11], the sampling system shall allow for a minimum of two hydrocarbon gas sampling points, one located on the lower and one on the upper part where sampling is required. When required, the upper gas sampling point shall not be located lower than 1 m from the tank top. The position of the lower located gas sampling point shall be above the height of the girder of bottom shell plating but at least 0.5 m from the bottom of the tank and it shall be provided with means to be closed...
when clogged. In positioning the fixed sampling points, due regard shall also be given to the density of vapours of the oil products intended to be transported and the dilution from space purging or ventilation. (Ref. FSS Code 16.2.2.1.3)

5.2.10 For mobile offshore units and offshore installations with deadweight of less than 50 000 tonnes, installation of one sampling location for each tank for practical and/or operational reasons is allowed. (Ref. FSS Code 16.2.2.1.4)

5.2.11 For ballast tanks in the double-bottom, ballast tanks not intended to be partially filled and void spaces, the upper gas sampling point is not required. (Ref. FSS Code 16.2.2.1.5)

5.2.12 Means shall be provided to prevent gas sampling lines from clogging when tanks are ballasted by using compressed air flushing to clean the line after switching from ballast to cargo loaded mode. The system shall have an alarm to indicate if the gas sampling lines are clogged. (Ref. FSS Code 16.2.2.1.6)

5.2.13 The gas analysis unit shall be located in a safe space and may be located in areas outside the ship’s cargo area; for example, in the cargo control room and/or navigation bridge in addition to the hydraulic room when mounted on the forward bulkhead, provided the following requirements are observed:

1) sampling lines shall not run through gas safe spaces, except where permitted under item 5
2) the hydrocarbon gas sampling pipes shall be equipped with flame arresters. Sample hydrocarbon gas is to be led to the atmosphere with outlets arranged in a safe location, not close to a source of ignitions and not close to the accommodation area air intakes;
3) a manual isolating valve, which shall be easily accessible for operation and maintenance, shall be fitted in each of the sampling lines at the bulkhead on the gas safe side;
4) the hydrocarbon gas detection equipment including sample piping, sample pumps, solenoids, analysing units etc., shall be located in a reasonably gas-tight cabinet (e.g., fully enclosed steel cabinet with a door with gaskets) which is to be monitored by its own sampling point. At a gas concentration above 30% of the lower flammable limit inside the steel enclosure the entire gas analysing unit is to be automatically shut down; and
5) where the enclosure cannot be arranged directly on the bulkhead, sample pipes shall be of steel or other equivalent material and without detachable connections, except for the connection points for isolating valves at the bulkhead and analysing unit, and are to be routed on their shortest ways. (Ref. FSS Code 16.2.2.2)

5.2.14 The gas detection equipment shall be designed to sample and analyse from each sampling line of each protected space, sequentially at intervals not exceeding 30 min. (Ref. FSS Code 16.2.3.1)

5.2.15 Means shall be provided to enable measurements with portable instruments, in case the fixed system is out of order or for system calibration. In case the system is out of order, procedures shall be in place to continue to monitor the atmosphere with portable instruments and to record the measurement results. (Ref. FSS Code 16.2.3.2)

5.2.16 Audible and visual alarms are to be initiated in the cargo control room, navigation bridge and at the analysing unit when the vapour concentration in a given space reaches a pre-set value, which shall not be higher than the equivalent of 30% of the lower flammable limit. (Ref. FSS Code 16.2.3.3)

5.2.17 The gas detection equipment shall be so designed that it may readily be tested and calibrated. (Ref. FSS Code 16.2.3.4)
6 Conversions
Alternative solutions to the requirements for fire safety as stipulated in this section may be considered, e.g. for conversion of existing vessels to oil production and storage vessels, provided the required level of safety is maintained.
SECTION 9 SUPPLEMENTARY REQUIREMENTS FOR LNG IMPORT AND EXPORT TERMINALS (AND LNG PRODUCTION UNITS)

1 General

1.1 Introduction

1.1.1 This section gives fire technical requirements applicable to LNG import and export terminals. The requirements are to be applied supplementary to the requirements given by Sec.1 to Sec.5.

1.1.2 Design of the fire protection system is to be based on a fire and explosion analysis. The analysis shall consider the credible identified hazards. It shall determine aspects such as type and capacity of fire-fighting systems, number, and location and rating of passive fire protection.

1.1.3 For specific requirements for ESD and fire and gas detection systems, see DNVGL-OS-A101 and DNVGL-OS-D202.

1.1.4 The requirements of relevant international standards for gas terminals on shore shall be taken into account as part of the fire analysis. These codes include NFPA 59A and EN 1473.

2 Passive fire protection

2.1 Structural elements

The requirements of Sec.7 [2.1] apply.

2.2 Systems and equipment

Reference is made to DNVGL-OS-A101 for general requirements for protection of systems and equipment.

2.3 Protection of spaces or areas

Exterior boundaries of superstructures and deckhouses enclosing accommodation spaces, service spaces and control stations, including any overhanging decks which support such accommodation, are to be protected against heat, for the portions facing the storage or processing area, including 3 m of the side boundary, by insulation. The rating of the passive fire protection shall be determined by the fire and blast analysis but shall be to minimum class ”A-60” standard. See Sec.1 Table 3 and Table 4.

3 Active fire protection of specific areas

3.1 General

3.1.1 Attention shall be given to any statutory requirements of the national authority having jurisdiction in the waters where the terminal is located.

3.1.2 Reference is made to Sec.2 and Sec.3 for general requirements for protection of systems and equipment.

3.2 Production and processing areas

Active fire protection systems for production and processing areas shall comply with Sec.7 [3.2].

3.3 Fire-fighting in engine and boiler rooms

3.3.1 An additional fire-extinguishing system shall be fitted in the machine and boiler rooms when auxiliary boilers and turbines are fuelled by crude oil or gas. The system shall be installed in such a way that it is possible for an approved fire-extinguishing medium to be directed on to the gas turbines, boiler fronts and on to the spill tray. The emission of extinguishing medium is automatically to stop the exhaust fan of the area.
3.3.2 For boilers and engines/turbines located above the tank deck a similar additional fire-extinguishing system shall be fitted with the similar functionalities as above with documented capacities in all environmental conditions.

3.3.3 There shall be in each boiler room at least one set of portable foam applicator unit complying with the provisions of regulation II-2/10.3 of SOLAS and FSS Code Ch.4.2 (see Sec.3 [3.1]).

3.4 Fire-fighting in turbine hood

Turbine hood(s) shall be adequately protected by a fixed fire-fighting system according to NFPA750 or another recognised standards.

3.5 Special requirements for areas for treatment and storage of liquefied gases

3.5.1 General

The effectiveness and necessity of a foam system is to be determined in the fire analysis. Where a foam system is fitted it shall be generally in accordance with Sec.7 [5.2].

3.5.2 Water spray system

A water spray system for cooling, fire prevention and personnel protection shall be installed to cover:

a) Exposed storage tank domes and exposed parts of storage tanks.

b) Exposed on-deck storage vessels for flammable or toxic products.

c) LNG liquid and vapour discharge and loading manifolds and the area of their control valves and any other areas where essential control valves are situated and which is to be at least equal to the area of the drip trays provided.

d) Boundaries of superstructures, deckhouses normally manned, LNG compressor rooms, LNG pump rooms, store rooms containing high fire risk items and control rooms facing the storage area.

e) Gas pre-treatment and liquefaction plant.

f) Connections for risers and turret areas (as appropriate).

3.5.3 The system shall be capable of covering all areas mentioned in [3.5.2] with a uniformly distributed water spray of at least 10 l/minute/m² for horizontal projected surfaces and 4 l/minute/m² for vertical surfaces. For structures having no clearly defined horizontal or vertical surfaces, the capacity of the water spray system shall be determined by the greater of the following:

- projected horizontal surface x 10 l/minute/m² or
- actual surface x 4 l/minute/m².

On vertical surfaces, spacing of nozzles protecting lower areas may take account of anticipated rundown from higher areas. Stop valves shall be fitted at intervals in the spray main for the purpose of isolating damaged sections.

3.5.4 The capacity of the water spray pump shall be sufficient to deliver the required amount of water to all areas simultaneously or, where the system is divided into sections, the arrangements and capacity shall be such as to simultaneously supply water to any one section and to the surfaces specified in [3.5.2]. Alternatively, the main fire pumps may be used for this service, provided that their total capacity is increased by the amount needed for the spray system. In either case, a connection through a stop valve shall be made between the fire main and water spray main outside the storage and process area.

3.5.5 Water pumps normally used for other services, may be arranged to supply the water spray main.

3.5.6 The pipes, valves, nozzles and other fittings in the water spray system are to be resistant to corrosion by seawater and to the effect of fire.

3.5.7 Remote starting of pumps supplying the water spray system and remote operation of any normally closed valves in the system shall be arranged in suitable locations outside the storage and process area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.
3.5.8 Dry chemical powder fire-extinguishing system

Terminals shall be provided with a fixed dry chemical powder type extinguishing system for the purpose of fighting fire in the LNG storage area, the LNG process area and the LNG transfer area. The system shall be of approved type and tested for its purpose.

3.5.9 The capacity of the system shall be determined by the fire and explosion analysis. The principles given in [3.5.10] to [3.5.15] are to be taken into account. The numeric values quoted below may be adjusted based on the analysis.

3.5.10 The system shall be capable of delivering powder from at least two hand hose lines or a combination monitor or hand hose line(s) to any part of the terminal where an LNG fire may occur. The system shall normally be activated by an inert gas, such as nitrogen, used exclusively for this purpose and stored in pressure vessels adjacent to the powder containers.

3.5.11 The system is to consist of at least two independent, self-contained dry chemical powder units with associated controls, pressurising medium, fixed piping, monitors or hand hose lines. A monitor shall be provided and so arranged as to protect the transfer area and be capable of actuation and discharge locally and remotely. The monitor is not required to be remotely aimed if it can deliver the necessary powder to all required areas of coverage from a single position. All hand hose lines and monitors shall be capable of actuation at the hose storage reel or monitor.

3.5.12 A fire-extinguishing unit having two or more monitors, hand hose lines, or combinations thereof, is to have independent pipes with a manifold at the powder container. Where two or more pipes are attached to a unit the arrangement shall be such that any or all of the monitors and hand hose lines shall be capable of simultaneous or sequential operation at their rated capacities.

3.5.13 The capacity of a monitor is normally not to be less than 10 kg/s. Hand hose lines shall be non-kinkable and be fitted with a nozzle capable of on or off operation and discharge at a rate not less than 3.5 kg/s. The maximum discharge rate shall be such as to allow operation by one person. The length of a hand hose line is not to exceed 33 m. Where fixed piping is provided between the powder container and a hand hose line or monitor, the length of piping is not to exceed that length which is capable of maintaining the powder in a fluidised state during sustained or intermittent use, and which can be purged of powder when the system is shut down. Hand hose lines and nozzles shall be of weather resistant construction or stored in weather resistant covers and be readily accessible.

3.5.14 A sufficient quantity of dry chemical powder shall be stored in each container to provide a minimum of 45 s discharge time for all monitors and hand hose lines attached to each powder unit. Coverage from fixed monitors shall be in accordance with Table 1.

Table 1 Coverage from fixed monitors

<table>
<thead>
<tr>
<th>Monitors Capacity of fixed monitors (kg/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For coverage of up to 10 m 10</td>
</tr>
<tr>
<td>For coverage of up to 30 m 25</td>
</tr>
<tr>
<td>For coverage of up to 40 m 45</td>
</tr>
</tbody>
</table>

3.5.15 Hand hose lines are to be considered to have a maximum effective distance of coverage equal to the length of hose. Special consideration is to be given in cases where areas to be protected are substantially higher than the monitor or hand hose reel locations.

3.5.16 Compressor and pump rooms

Compressor and pump rooms shall be provided with a carbon-dioxide system or equivalent.
4 Fire-water

4.1 Pump system

4.1.1 The fire-water pump systems shall be selected to deliver the pressure and flow requirements for the operation of the water based systems, such as the deluge, sprinkler, monitors, hoses etc. The required capacity will be the single largest fire area, which will have fixed firewater extinguishing system installed and additionally manual fire-fighting demand from two hose streams and any relevant monitors. See also Table 1.

4.1.2 The status of the fire pump systems shall at all times be available at the central control station.

4.1.3 Firewater pumps shall start automatically upon fire detection in any area they are serving, as well as upon low pressure in the fire-water ring main.

4.1.4 Each pump system shall have a supply capacity of 100% of the anticipated fire-water demand, see [3.1.1] and Sec.3 [2.2.1]. Each pump system shall preferably consist of 2 × 50% pump units.

4.2 Distribution

4.2.1 An area shall be supplied by at least two well separated branch pipes on the fire main.

4.2.2 Fixed fire-fighting systems, including deluge valve and fire-water distribution pipework shall be designed so that fire-water protection is readily available.

Interpretation:

1) For normal production plant this implies that the protection should be effective within 30 sec of the demand.
2) For production plant with high protection requirements e.g. jet fires or thin wall pressure vessels, shorter response times or passive fire protection should be considered to ensure the effectiveness of the system.

----------- end of Interpretation -----------

4.2.3 The deluge valve system shall be activated by a signal from the fire and gas detection system and is to have local energy source for the valve actuator. The overall control system shall be designed to minimise the possibility of unintended valve opening if associated utilities are damaged, while a high degree of availability is maintained.

Guidance note:
As an example, for pneumatic control systems, unintended valve opening due to failure of main instrument air supply could be prevented by installation of a local air accumulator with a check valve in the air line. Solenoid valves for activation could be 'fail fixed' on loss of signal. The fail safe function can be provided by installing fusible bulbs in the protected fire zone to depressurise the control system and activate the deluge valve directly.

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5 Detection and alarm systems

5.1 Fire detection

5.1.1 An automatic fire detection system shall be installed in machinery spaces, service spaces, accommodation spaces, production areas and in any space containing equipment in which hydrocarbons or any other flammable substance is stored, conveyed, processed or consumed.

5.1.2 In areas containing gas and LNG processing facilities fire detection is normally to result in automatic shut-down of hydrocarbon flow and if applicable ventilation for the area.

5.1.3 Automatic shutdown of ventilation is to take place upon:
— detection of fire in enclosed spaces, unless this is in conflict with overall smoke control strategy.
— smoke detection in ventilation air inlets.
5.1.4 Detected fire in wellhead, turret, process plant, storage tank area or offloading area shall initiate automatic shutdown of wellhead valves and process facilities.

5.2 Gas detection

5.2.1 The requirements for fixed automatic combustible gas detection and alarm systems are given in Sec.4 [3.1.2].

Guidance note:
On units and installations where the sources of leakage of inflammable and toxic gases are concentrated in a small area, gas detectors in the air inlets of mechanically ventilated areas may be omitted provided that:
— the ventilation systems are shut down automatically in the event of gas detection anywhere, and
— the gas detectors are located in all zone 1 and 2 areas.

External air inlets for accommodation spaces shall always be fitted with gas detectors.

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5.2.2 Automatic shutdown of all hydrocarbon flow is to take place when gas is detected.

5.2.3 Automatic shutdown of ventilation is to take place upon confirmed detected gas in the air inlets to non-hazardous areas. Shutdown of ventilation shall include shutdown of fan, any heating element and closing of fire damper. Shutdown of ventilation is to ensure that the detected gas is isolated from ignition sources in the ventilated space.

Interpretation:
The response time of detection and shutdown should be evaluated against the transport time of gas in the ventilation duct.

----------------- end of Interpretation -----------------

5.2.4 Gas detection in product pump rooms and double hull spaces on floating installations shall be arranged in accordance with principles given in DNV Rules for ships Pt.5 Ch.3 Sec.9 F and G.

5.2.5 Upon confirmed detection of hydrocarbon gas in the area of wellhead, turret, production facilities and storage tanks, the wellhead valves and production facilities are to be automatically shut down. See also DNVGL-OS-A101 Ch.2, Sec.4.4.

6 Personnel protection

Protective and safety equipment shall be provided in accordance with DNV Rules for ships Pt.5 Ch.5 Sec.19 A.
SECTION 10  SUPPLEMENTARY REQUIREMENTS FOR OTHER SPECIAL SERVICE TYPE UNITS OR INSTALLATIONS

1  Introduction
This section gives additional fire protection requirements for special service units or installations that shall be applied supplementary to the requirements given by Sec.1 to Sec.5.

2  Special requirements for units with diving systems

2.1  Passive fire protection
Enclosed spaces for diving systems shall be separated from adjacent rooms or spaces by bulkheads and deck with fire resistance defined as "A-60" division. Such spaces shall not be adjacent to any hazardous areas.

2.2  Fire-extinguishing
Enclosed spaces for diving systems shall be equipped with manually actuated extinguishing system with such a layout as to cover the whole system. For rooms intended for pressurised gas storage containers, the extinguishing system shall be a fixed pressure water-spraying system. The capacity requirements shall be 10 (l/min)/m².

Open deck areas where diving systems are located, shall be provided with fire-extinguishing equipment, which shall be considered in each case.

3  Special requirements for offshore loading buoys

3.1  Fire control and extinguishing

3.1.1  The arrangement of fire control and extinguishing shall be adequate for the buoy during its intended operation. Compensating procedures and measures, e.g. standby vessel with fire-fighting equipment during manned periods shall be credited.

3.1.2  All fire-extinguishing appliances shall be kept in good order and shall be available for immediate use.

3.1.3  Unmanned buoys
An unmanned buoy does not require permanent arrangement for fire control and extinction.

Guidance note:
Examples are simple buoys without helicopter deck, boat-landing or working platforms.

3.1.4  Not permanently manned buoys
A buoy that may be manned for maintenance or testing purposes shall be equipped with fire control and fire extinction systems, including:

— approved portable fire extinguishers shall be provided in service and working spaces;
— emergency shelter and other enclosed areas for e.g. machinery, electrical power generation and distribution shall be arranged with a fixed fire-extinguishing system as outlined in this section; and
— provision for helicopter facilities.

3.2  Provision for helicopter facilities

3.2.1  Helicopter facilities shall in principle comply with the requirements in Sec.5.
For installations where adequate arrangement of fire control and fire extinction for the buoy is achieved without the provision of a fire pump, fixed dry powder system of capacity 250 kg is at least to be installed.
CHAPTER 3 CERTIFICATION AND CLASSIFICATION

SECTION 1 CLASSIFICATION

1 General

1.1 Introduction

1.1.1 As well as representing DNV GL’s recommendations on safe engineering practice for general use by the offshore industry, the offshore standards also provide the technical basis for DNV GL classification, certification and verification services.

1.1.2 This chapter identifies the specific documentation, certification and surveying requirements to be applied when using this standard for certification and classification purposes.

1.1.3 A complete description of principles, procedures, applicable class notations and technical basis for offshore classification is given by the DNV GL Rules for Classification of offshore units, see Table 1.

Table 1 DNV GL Rules for classification - Offshore units

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNVGL-RU-OU-0101</td>
<td>Offshore drilling and support units</td>
</tr>
<tr>
<td>DNVGL-RU-OU-0102</td>
<td>Floating production, storage and loading units</td>
</tr>
<tr>
<td>DNVGL-RU-OU-0103</td>
<td>Floating LNG/LPG production, storage and loading units</td>
</tr>
<tr>
<td>DNVGL-RU-OU-0104</td>
<td>Self-elevating units</td>
</tr>
</tbody>
</table>

1.2 Applicable requirements

1.2.1 Requirements as covered by classification are governed by class notations. A complete description of these and their related scope can be found in the above listed Offshore Service Specifications.

1.2.2 Requirements applicable only for vessels with the voluntary notation ES can be found in the following Offshore Standards.

Table 2 DNV GL Offshore Standards including ES requirements

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNVGL-OS-A101</td>
<td>Safety principles and arrangements</td>
</tr>
<tr>
<td>DNVGL-OS-D101</td>
<td>Marine and machinery systems and equipment</td>
</tr>
<tr>
<td>DNVGL-OS-D202</td>
<td>Automation, safety, and telecommunication systems</td>
</tr>
<tr>
<td>DNVGL-OS-D301</td>
<td>Fire protection</td>
</tr>
</tbody>
</table>

1.2.3 Requirements applicable only for vessels with the voluntary notation ES as given in this standard are listed in Table 3.

Table 3 Requirements applicable for ES only

<table>
<thead>
<tr>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active fire protection for moon pool</td>
<td>Ch.2, Sec.6, Sec.7</td>
</tr>
<tr>
<td>Enhanced fixed fire protection</td>
<td></td>
</tr>
<tr>
<td>Detectors on ventilation intake</td>
<td></td>
</tr>
<tr>
<td>Automatic shutdown on gas detection</td>
<td></td>
</tr>
<tr>
<td>Additional H2S detectors</td>
<td></td>
</tr>
</tbody>
</table>

1.3 Application

1.3.1 Where codes and standards call for the extent of critical inspections and tests to be agreed between contractor or manufacturer and client, the resulting extent is to be agreed with DNV GL.
1.3.2 DNV GL may accept alternative solutions found to represent an overall safety level equivalent to that stated in the requirements of this standard.

1.3.3 Any deviations, exceptions and modifications to the design codes and standards given as recognised reference codes shall be approved by DNV GL.

1.4 Documentation
Documentation for classification shall be in accordance with the NPS DocReq (DNV GL Nauticus Production System for documentation requirements) and DNVGL-CG-0168.
SECTION 2 CERTIFICATION OF EQUIPMENT

1 General

1.1 General

1.1.1 Equipment shall be certified consistent with its functions and importance for safety.

1.1.2 Equipment referred to in this standard will be categorised as follows:

Category I:
— equipment related to safety for which a DNV GL certificate is required.

Category I equipment is subdivided into IA and IB categorisation.

Category II:
— equipment related to safety for which a works certificate prepared by the manufacturer is accepted.

1.1.3 For equipment category I, the following approval procedure shall be followed:
— design approval, followed by a design verification report (DVR) or type approval certificate
— fabrication survey followed by issuance of a product certificate.

1.1.4 Depending on the required extent of survey, category I equipment is subdivided into IA, IB and IC with the specified requirements as given below:

Category IA:
— pre-production meeting, as applicable
— class survey during fabrication
— witness final functional, pressure and load tests, as applicable
— review fabrication record.

Category IB:
— pre-production meeting, as applicable, witness final functional, pressure and load tests, as applicable
— review fabrication record.

Category IC:
— Witness final functional, pressure and load tests, as applicable.
— Review fabrication record.

The extent of required survey by DNV GL is to be decided on the basis of manufacturer’s QA/QC system, manufacturing survey arrangement (MSA) with DNV GL and type of fabrication methods.

Guidance note:
It should be noted that the scopes defined for category IA and IB are typical and adjustments may be required based on considerations such as:
— standard type approved products / MSA agreement
— complexity and size of a delivery
— previous experience with equipment type
— maturity and effectiveness of manufacturer’s quality assurance system
— degree of subcontracting.

1.1.5 Equipment of category II is normally accepted on the basis of a works certificate prepared by the manufacturer. The certificate shall contain the following data as a minimum:
— equipment specification or data sheet
— limitations with respect to operation of equipment
— statement (affidavit) from the manufacturer to confirm that the equipment has been constructed, manufactured and tested according to the recognised methods, codes and standards.

Guidance note:
Independent test certificate or report for the equipment or approval certificate for manufacturing system may also be accepted.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2 Equipment categorisation

Categorisation of safety critical equipment is given in Table 1. Equipment that is considered important for safety, which is not listed, shall be categorised after special consideration.

Table 1 Categories for fire protection equipment

<table>
<thead>
<tr>
<th>Component</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IB</td>
</tr>
<tr>
<td>Fire dampers, penetrations 2</td>
<td></td>
</tr>
<tr>
<td>Fire-water pump housing</td>
<td></td>
</tr>
<tr>
<td>Fire-water pumps driver 3</td>
<td></td>
</tr>
<tr>
<td>Fire-water pump for production units (incl. capacity)</td>
<td></td>
</tr>
<tr>
<td>Self-contained fire-water driver for production units</td>
<td></td>
</tr>
<tr>
<td>Components in fire-extinguishing system 1</td>
<td></td>
</tr>
<tr>
<td>Fire hose</td>
<td></td>
</tr>
<tr>
<td>Hose reels and associated equipment</td>
<td></td>
</tr>
<tr>
<td>Nozzles</td>
<td></td>
</tr>
<tr>
<td>Monitors</td>
<td></td>
</tr>
<tr>
<td>Fixed fire-fighting installations, ref. Ch.2, Sec.3 2</td>
<td></td>
</tr>
<tr>
<td>Other fire-fighting installations, e.g. deluge, powder or systems not covered by IMO 4</td>
<td></td>
</tr>
<tr>
<td>Insulation materials in fire resisting divisions 2</td>
<td></td>
</tr>
<tr>
<td>Fire rated doors 2</td>
<td></td>
</tr>
<tr>
<td>Fire rated windows 2</td>
<td></td>
</tr>
<tr>
<td>Fire and gas detectors 2</td>
<td></td>
</tr>
<tr>
<td>Wheeled and portable extinguishing system</td>
<td></td>
</tr>
<tr>
<td>Fire-extinguishing media</td>
<td></td>
</tr>
</tbody>
</table>

1 To follow requirements as given in DNVGL-OS-D101 and/or type approval certificate
2 Shall be type approved
3 To follow driver category as given in DNVGL-OS-D201
4 Normally function test to be carried out at yard
SECTION 3 SURVEYS AT COMMISSIONING AND START-UP

1 General
Commissioning and start-up shall be in accordance with the submitted procedures reviewed and approved by DNV GL in advance of the commissioning. Commissioning and start-up testing shall be witnessed by a surveyor and is considered complete when all systems, equipment and instrumentation are operating satisfactorily.

2 System and equipment checks/surveys
During commissioning, all items of pipework and equipment shall be checked for compliance with approved documentation and commissioning procedures. Pressure vessels and connecting piping shall be pressure and leak tested in accordance with DNVGL-OS-D101. Electrical systems shall be checked for proper grounding and resistivity. Surveys are also to cover passive fire protection.

3 Functional testing
3.1 General
3.1.1 During commissioning, the following systems shall be functionally tested, as practicable in accordance with approved procedures.
3.1.2 Piping and equipment
— purging/blow through
— pressure and leak test
— pipe supports.
3.1.3 Utility systems
— power supply (main and emergency)
— support systems
— control system (local and remote).
3.1.4 Fire-fighting and lifesaving systems
— fire pumps incl. protection of fire pump room
— fixed systems
— manual equipment
— fire-fighter’s outfit
— Lifesaving equipment.
3.1.5 Detection and alarm systems (including protective actions)
— fire detection
— gas detection
— fire and gas panel
— ESD systems.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.