DNV·GL

OFFSHORE STANDARDS

DNVGL-OS-D301 Edition July 2019

Fire protection

DNV GL AS

FOREWORD

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

Any comments may be sent by e-mail to *rules@dnvgl.com*

CHANGES – CURRENT

This document supersedes the July 2015 edition of DNVGL-OS-D301.

Changes in this document are highlighted in red colour. However, if the changes involve a whole chapter, section or subsection, normally only the title will be in red colour.

Changes July 2019

Topic	*Reference*	*Description*
Barrier notation performance standard description.	Ch.1 Sec.2	New Ch.1 Sec.2 describing barrier management principles and performance requirements as found in Ch.2 and the applicable performance standards.
Implementation of IMO MSC.435(98).	Ch.2 Sec.1 [3.3.1]	Added requirements for H-60 standard.
	Ch.2 Sec.6 [3.2]	Added requirements to drill floor fire extinguishing arrangements.
Simplified requirements for storage unit giving additional credit for the ship class/SOLAS requirements for units being converted from **Tanker for oil**.	Ch.2 Sec.8 [1]	Describe basis for requirements for floating storage units to be ship rules and SOLAS.
	Ch.2 Sec.8 [2]	Previous requirements to passive fire protection referred to MODU Code requirements and offshore practice. Added/ changed to corresponding SOLAS/ship rule requirements.
	Ch.2 Sec.8 [3.2]	Detailed requirements deleted and reference to identical requirements in Ch.2 Sec.7 added instead.
	Ch.2 Sec.8 [3.3]	Previous [3.5] *Fire fighting in offloading area and turret area* is deleted as covered by [3.3] *Other hydrocarbon containing areas*.
	Ch.2 Sec.8 [3]	Restructured section and renamed subsections for clarification. Withdrawn requirements for processing areas.
	Ch.2 Sec.8 [4]	Previous requirements to firewater pump systems was based on offshore production unit practice. Rewritten to only refer SOLAS requirements.
	Ch.2 Sec.8 [5]	Changed to refer SOLAS and ship rules. Requirements are simplified.

Editorial corrections

In addition to the above stated 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 shall:

— 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.

Guidance note:

See also IMO circular MSC/Circ. 1002 Guidelines on Alternative Design and Arrangements for Fire Safety.

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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

Reference	*Title*
DNVGL-RU-OU-0101	Offshore drilling and support units
DNVGL-RU-OU-0102	Floating production, storage and loading units
DNVGL-RU-OU-0103 Ch.1	Floating LNG/LPG production, storage and loading units
DNVGL-RU-OU-0104	Self-elevating units

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 Sec.1: Technical provisions for fire protection systems applicable to all types of offshore units and installations in Ch.2 Sec.1 to Ch.2 Sec.5, followed by supplementary requirements for
  — drilling/well intervention units (Ch.2 Sec.6)
  — oil and gas production and storage units (Ch.2 Sec.7)

- oil and gas storage units (Ch.2 Sec.8)
- LNG import and export terminals (and LNG production units) (Ch.2 Sec.9)
- other special service type units or installations (Ch.2 Sec.10).

— Ch.3 Sec.1: 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

Reference	*Title*
DNVGL-OS-A101	Safety principles and arrangement
DNVGL-OS-D101	Marine and machinery systems and equipment
DNVGL-OS-D201	Electrical installation
DNVGL-OS-D202	Automation, safety and telecommunication systems
DNVGL-OS-E101	Drilling facilities
DNVGL-OS-E201	Oil and gas processing systems
DNVGL-RP-C204	Design against accidental loads

2.3 Other references

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

Table 3 Normative references

Reference	*Title*
DNVGL-RU-SHIP	DNV GL rules for classification: Ships
ASTM 1529-14a	Standard Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies
BS EN 1363-2:1999	Fire resistance tests. Alternative and additional procedures
EN 54	Fire detection and fire alarm systems – (relevant parts as indicated in the main text)

Reference	*Title*
EN 1834, Part 1-3	Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres
FTP code	International Code for Application of Fire Test Procedures
NFPA codes	National Fire protection Association
FSS code	International Code for Fire Safety Systems
ISO/DIS 20902 1	Fire test procedures for divisional elements that are typically used in oil, gas and petrochemical industries - Part 1: General requirements
ISO 13702	Petroleum and natural gas industries - Control and mitigation of fires and explosions on offshore production installations - Requirements and guidelines
ISO 17631	Ships and marine technology - Shipboard plans for fire protection, life-saving appliances and means of escape
MODU code	Code for the Construction and Equipment of Mobile Offshore Drilling Units
SOLAS	International Convention for the Safety of Life at Sea

3 Definitions

3.1 Verbal forms

3.1.1 The following verbal forms are used throughout the standard.

Table 4 Verbal forms

Term	*Definition*
shall	verbal form used to indicate requirements strictly to be followed in order to conform to the document
should	verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others
may	verbal form used to indicate a course of action permissible within the limits of the document

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

Term	*Definition*
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. (see SOLAS Ch. 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. (see SOLAS Ch. 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. (see SOLAS Ch. II-2/3.10)

Term	*Definition*
H-class divisions	divisions which meet the same requirements as A-class divisions except that, when tested according to the Fire Test Procedure Code, the furnace control temperature curve is replaced with the furnace control temperature curve for hydrocarbon fires defined in national or international standards*. 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-0_{400} 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. * See national standards such as: — BS EN 1363-2:1999 — ASTM 1529-14a — ISO/DIS 20902 1 (see MODU Code 1.3.26)
accommodation spaces	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. (see MODU code 1.3.3) **Guidance note:** The accommodation area is normally used as the safe haven or temporary refuge. ---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
active fire protection	equipment and systems which are used to control, mitigate and extinguish fires

Term	*Definition*
control station or control room	general term for any location where emergency response functions are performed as a result of an emergency condition during transit or normal operation. Typical examples are: — central control room — radio room and/or room where main navigating equipment is located if not located in central control room — room where the fire and gas monitoring, main area for stop of hydrocarbon flow, fire control equipment or fire extinguishing system serving various locations is located, if not located in central control room — where the dynamic positioning control system is centralised — in the case of column-stabilised units a centralised ballast control station — the emergency source of power rooms. As for applying fire integrity of this room, it is not to be regarded as control station but machinery space, normally cat A. — other rooms where emergency response may be executed for operations/systems important for the integrity of the unit. For the purpose of this paragraph the drilling control room (drillers cabin) shall not be taken as a control station.
corridor	includes corridors and lobbies
deluge system	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.
draught stop	a close fitting hindering any smoke from passing
drilling areas	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.
embarkation area	area immediately adjacent to a transport means of escape or evacuation
enclosed spaces	any space bounded by floors, bulkhead and/or decks which may have doors, windows or other similar openings
escape	means for leaving the various workplaces on the unit or installation leading to a safe place and without directly entering the sea
essential services	generally defined as a service which needs to be, in continuous operation for maintaining the unit's manoeuvrability (if applicable), or whose loss or failure would create an immediate danger to the unit
evacuation	means for leaving the unit or installation and moving away from the vicinity in an emergency in a systematic manner
fire and gas detection system	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
fire area	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.
fire detection area	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&G logic

Term	*Definition*
fire detection system	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.
fire load	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
fire pump system	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
fixed water-spraying system	a system either connected to fire main or with its own water supply This can either be a deluge-, water mist- or sprinkler system.
flame retardant	property of a substance or treatment applied to a material to substantially suppress, reduce or delay the propagation of a flame
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	all areas in which a flammable or explosive gas and air mixtures is, or may normally be expected to be, present in quantities such as to require special precautions for the construction and use of electrical equipment and machinery
ignition sources	any object in relation to area classification and safety philosophy that could ignite an explosive gas and air atmosphere. Typical sources could be uncertified electrical apparatus, naked flame, sparks, static discharges, hot surfaces above ignition temperature etc.
important services	generally defined as a service which needs not necessarily be in continuous operation but whose failure or non-availability would not create an immediate danger but impairs the unit's safety **Guidance note:** Systems and equipment providing the service above are essential respectively important. This applies also to systems and equipment supporting these like control and electrical systems. ---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
inside air foam systems	a fixed high-expansion foam fire-extinguishing system with foam generators located inside the protected space and drawing air from that space. (see FSS code 6.2.9)
jet fire	an ignited release of pressurised and flammable fluid
liquefied natural gas export terminal	an offshore terminal which processes hydrocarbons and refrigerates gas to produce liquefied natural gas (LNG)

Term	*Definition*
liquefied natural gas import terminal	an offshore terminal which receives and regasifies LNG to provide gas to the market gas grid
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 (see SOLAS Ch.. II-2/3.29 as referred to by MODU Code 1.3.32)
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 (see MODU code 1.3.34)
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. (see MODU code 1.3.35) 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. (see IMO MSC/Circ.847 Annex)
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. (see MODU Code 1.3.41) ---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
mud processing area	to include spaces occupied by the mud circulating system which create hazardous areas. Moon pool area is normally not considered as part of the mud processing area. (see IACS UR D11.3.3)
muster area	a designated area where personnel gather for protection, instructions and final preparations before evacuation. A muster area shall be protected from the immediate effects of an emergency, and the primary muster area is normally within the temporary refuge.
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. (see SOLAS Ch. II-2/3.33)

Term	*Definition*
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/mm^2 (see SOLAS Ch. II-2/3.34).
open decks	open deck spaces, excluding hazardous areas
outside air foam systems	a fixed high-expansion foam system with foam generators installed outside the protected space that are directly supplied with fresh air (see FSS code 6.2.16)
passive fire protection	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
pool fire	combustion of flammable or combustible liquid spilled and retained on a surface
primary deck covering	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.
processing area	any area designated for separation, compression, treatment and disposal of reservoir fluids
production area	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.
public spaces	those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces (see SOLAS Ch. II-2/3.39)
rich glycol	glycol in the regeneration plant that is containing a high level of hydrocarbons, typically the stream from the glycol contactor, the flash vessel and including the stream to the regenerator
safety systems	systems, including required utilities, which are provided to prevent, detect/ warn of an accidental event/abnormal conditions and/or mitigate its effects **Interpretation:** The following should be considered as safety systems: — ESD, including blowdown where relevant — PSD — fire & gas detection — PA/GA and emergency communication — fire-fighting systems — BOP incl. control system — safety systems for essential or important services. Safety systems are normally considered as on-demand functions. ---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

Term	*Definition*
sanitary and similar spaces	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. (see MODU code 9.2.5.2.11)
service spaces	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 (see MODU code 1.3.50)
service spaces (high risk)	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 (see MODU code 9.2.5.2.9)
service spaces (low risk)	lockers, storerooms and working spaces in which flammable materials are not stored, drying rooms and laundries (see MODU code 9.2.5.2.5)
sprinkler system	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.
stairways	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. (see MODU code 9.2.5.2.4)
surface unit	a unit with a ship- or barge-type displacement hull of single or multiple hull construction intended for operation in the floating condition (see MODU code 1.3.55)
temporary refuge or shelter area	area provided to protect personnel from the effects of an emergency, which is beyond immediate control Protection shall be sufficient to allow controlled muster, emergency assessment, incident evaluation, and implementation of control emergency procedures, and evacuation etc. The temporary refuge should be provided with adequate command communication facilities to address an emergency and organise safe evacuation if necessary.
turret area	area containing mooring equipment, which enables the unit to rotate relative to fixed facilities or pipelines on the seabed Import and export risers are usually located within the turret area.
wellhead area	the deck area surrounding the wellheads including test, production, and injection manifolds and associated flowlines
working spaces	open or enclosed spaces containing equipment and processes, associated with drilling operations, which are not included in machinery spaces or hazardous areas

3.3 Abbreviations

The abbreviations in Table 6 are used.

Table 6 Abbreviations

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

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].

SECTION 2 BARRIER MANAGEMENT

1 Barrier management

1.1 General principles

1.1.1 The overall objective of this standard may be achieved through barrier management. The purpose of barrier management is to establish and maintain barriers so that the risk faced at any given time can be handled, by preventing an undesirable event from occurring, or by limiting the consequences should such an event occur. Barrier management is the coordinated activities to establish and maintain barriers at all times, and includes the processes, systems, equipment and measures which shall be in place to ensure the necessary risk reduction.

1.1.2 Barriers are technical and operational elements which are intended, individually or collectively, to reduce the possibility for a specific error, hazard or incident to occur, or which limit the consequences of an error, hazard or incident. A barrier function is the task or role of a barrier, e.g. preventing ignition, mitigating the consequence of leaks, reducing the consequences of a fire or explosion.

1.1.3 A barrier strategy is the result of a process that, based on the risk picture, describes and clarifies the barrier functions and elements that shall be implemented in order to establish barriers and reduce risk.

1.1.4 This standard provides technical requirements to operational and safety system barriers and technical barrier elements.

1.2 Performance requirements

1.2.1 Fire protection systems, including all components and utilities, shall be designed to minimise risk of hazards to personnel and property, by application of the technical requirements provided by this standard.

Guidance note:

Components and utilities include dedicated equipment, control and monitoring systems, hydraulic/pneumatic or electrical supply, etc.

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

1.2.2 Performance requirements to functions and systems/equipment are dependent on their role as barrier elements. Performance parameters necessary to comply with relevant performance requirements shall be specified for safety systems. System/equipment specific performance requirements are provided in Ch.2 and in the following generic performance standards:

— PS-02 Fire and Gas detection system, see [1.3]
— PS-04 Active Fire protection, see [1.4]
— PS-05 Passive fire protection, see [1.5]
— PS-11 Natural ventilation and HVAC system
— PS-19 Helideck
— PS-23 Layout and explosion barriers.

1.3 PS-02 Fire and gas detection system

1.3.1 Role of the performance standard

The fire and gas detection system shall:

— Monitor continuously for the presence of flammable or toxic gases, to alert personnel and allow control actions to be initiated manually or automatically to minimise the probability of personnel exposure, explosion and fire.
— Monitor continuously for the presence of a fire to alert personnel and allow control actions to be initiated manually or automatically to minimise the likelihood of fire escalation and probability of personnel exposure.
— The fire detection system shall, relevant to specific equipment and areas, monitor continuously for the presence of an incipient fire condition to alert personnel and allow control actions to be initiated manually to minimise the probability of a fire condition to develop.

1.3.2 Safety critical equipment/systems associated with the fire and gas detection system

The fire and gas detection system will typically include the following equipment and systems:

— flammable gas detectors
— hydrogen gas detectors
— H_2S gas detection
— manual alarm call points (MACs)
— flame detectors
— smoke detectors
— heat detectors
— logic solver
— alarm, status and operator interface
— power supply.

1.3.3 Reference to requirements

This document together with statutory and, where relevant, shelf state requirements will provide technical basis for the performance requirements for fire and gas detection system. Typical references are:

— DNVGL-OS-A101
— DNVGL-OS-D201
— DNVGL-OS-D202
— DNVGL-OS-E101
— DNVGL-OS-E201
— MODU Code
— SOLAS
— FSS Code
— IMO MSC. 1/1370
— IEC 60945, 61000, 60092-504, 60092-505
— EN 54-2/54-4/54-5/54-7/54-10.

1.4 PS-04 Active fire protection

1.4.1 Role of the performance standard

The role of the active fire protection system is to supply and distribute adequate firefighting media at sufficient pressure to relevant systems to bring under control fire and explosion events in all areas of the unit to enable personnel to respond to and, if necessary, prepare for evacuation.

1.4.2 Safety critical equipment/systems associated with active fire protection

The active fire protection systems include the following equipment:

— pressurised fire main
— fire pumps
— water deluge system

— fire monitors
— foam system
— sprinkler system
— fixed gaseous fire extinguishing system
— fixed foam fire extinguishing system
— water mist system
— helideck fire fighting system
— fire hydrants and hosereels
— portable fire extinguishers.

1.4.3 Reference to requirements

This document together with statutory and, where relevant, shelf state requirements will provide technical basis for the performance requirements for active fire protection systems. Typical references are:

— DNVGL-OS-A101
— DNVGL-OS-D101
— DNVGL-OS-D201
— DNVGL-OS-D202
— MODU Code
— SOLAS
— FSS Code
— FTP Code
— NFPA Code
— Civil Aviation Organization Airport Services Manual.

1.5 PS-05 Passive fire protection

1.5.1 Role of the performance standard

The role of the passive fire protection system is to ensure integrity of safety critical elements such as vessels, valves, piping, structures, local supports, etc. It shall provide protection of equipment and structures from exposure to the full fire load, thereby enabling the structures to withstand the heat exposure longer and maintain structural integrity.

1.5.2 Safety critical equipment/systems associated with passive fire protection

The passive fire protection system include the following equipment and systems:

— horizontal and vertical fire divisions
— fire doors and windows
— passive fire protection of ventilation ducts and penetrations
— passive fire protection of safety critical elements and load bearing structures.

1.5.3 Reference to requirements

This document together with statutory and, where relevant, shelf state requirements will provide technical basis for the performance requirements for passive fire protection systems. Typical references are:

— DNVGL-OS-A101
— DNVGL-RP-C204
— MODU Code
— SOLAS
— FSS Code
— FTP Code
— ISO 1716.

1.6 Performance standards and **Barrier** class notation

1.6.1 The performance standards listed in [1.2.2] are part of the performance standard list for the **Barrier** notation as specified in the relevant DNV GL rules for classification of Offshore units for the unit or installation.

1.6.2 Where the **Barrier** notation is selected the performance standards requirements specified in DNVGL-RU-OU-0101, DNVGL-RU-OU-0102, DNVGL-RU-OU-0103 and DNVGL-RU-OU-0104 (as relevant) shall be used. The performance standards will be made unit and notation specific. Where qualifier **Custom** is selected the performance standard will be made project specific considering the risks identified for the specific unit.

CHAPTER 2 TECHNICAL PROVISIONS

SECTION 1 PASSIVE FIRE PROTECTION

1 General

1.1 Objective

The objectives of passive fire protection (PFP) shall be 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.

(see 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.

(see MODU code 9.2.2)

Interpretation:

The equivalent standard of safety should be document and is subject to approval.

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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.

Table 1 Applicable reference codes and standards

Reference	*Title and test method*
API Spec 6FA	Fire Test for Valves
API Std 607	Fire Test for Quarter-Turn Valves and Valves with Non-metallic Seats
DIN 53436	Producing thermal decomposition products from materials in an air stream and their toxicological testing.
EN ISO 10497	Testing of valves. Fire type-testing requirements

Reference	*Title and test method*
FTP Code	International Code for Application of Fire Test Procedures
HSE (UK) Offshore safety reports OTO 93:028 OTI 95:634	Interim jet fire test for determining the effectiveness of passive fire protection materials
IEC 60331-11	Tests for electric cables under fire conditions - Circuit integrity - Part 11: Apparatus - Fire alone at a flame temperature of at least 750 °C
IEC 60331-21	Tests for electric cables under fire conditions - Circuit integrity - Part 21: Procedures and requirements - Cables of rated voltage up to and including 0,6/1,0 kV
IEC 60332-3-xx	Tests on electric and optical fibre cables under fire conditions
IMO res. A.653(16)	Recommendation on Improved Fire Test Procedures for Surface Flammability of Bulkhead, Ceiling and Deck Finish Materials.
FTP code Annex 1 Part 3	IMO res. A.754(18) Recommendation on fire resistance tests for A, B and F class divisions
ISO 834 Part 1-9	Fire resistance tests – Elements of building construction
ISO 1182	Reaction to fire tests for products - Non-combustibility test
ISO 1716	Reaction to fire tests for products - - Determination of the gross heat of combustion (calorific value)
ISO 5657	Reaction to fire tests - Ignitability of building products using a radiant heat source
ISO 5660-1	Reaction to fire tests - Heat release, smoke production and mass loss rate – Part I Heat release rate (cone calorimeter method)

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.

(see 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.

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2.2.2 Normally the critical temperatures with respect to structural integrity are as given in Table 2.

Table 2 Critical temperatures

Material	*Temperature*
Structural steel and ordinary reinforcing steel	400 to 450°C
Pre-stressed reinforcing steel	350°C
Aluminium	200°C

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 m^2 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.

(see 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 m^2 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 m^2 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 m^2, 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.

(see 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
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
6) the ducts are insulated to A-60 standard throughout the accommodation spaces, service spaces or control stations.

(see 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
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))
5) are insulated to A-60 standard within the machinery space or galley.

(see MODU code 9.3.16)

2.3.5 Ventilation ducts with a cross-sectional area exceeding 0.02 m^2 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.

(see 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.

(see 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
4) fixed means for extinguishing a fire within the duct.

(see 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.

(see 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.

(see 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 installed.

Interpretation:

Openings in bulkheads of H-class should be avoided.

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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 H-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.

(see MODU code 9.2.4)

Table 3 Fire integrity of bulkheads separating adjacent spaces

Spaces	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Control stations (1)	A-0(d)	A-0	A-60	A-0	A-15	A-60	A-15	A-60[e]	A-60	*)	A-0
Corridors (2)		C	B-0	B-0 A-0[(b)]	B-0	A-60	A-0	A-0[(e)]	A-0	*)	B-0
Accommodation spaces (3)			C	B-0 A-0[(b)]	B-0	A-60	A-0	A-0[(e)]	A-0	*)	C
Stairways (4)				B-0 A-0[(b)]	B-0 A-0[(b)]	A-60	A-0	A-0[(e)]	A-0	*)	B-0 A-0[(b)]
Service spaces (low risk) (5)					C	A-60	A-0	A-0	A-0	*)	B-0
Machinery spaces of category A (6)						*)[(a)]	A-0[(a)]	A-60	A-60	*)	A-0
Other machinery spaces (7)							A-0[(a) (c)]	A-0	A-0	*)	A-0
Hazardous areas (8)								-	A-0	-	A-0
Service spaces (high risk) (9)									A-0[(c)]	*)	A-0
Open decks (10)										-	*)
Sanitary and similar spaces (11)											C

3.2.3 See notes under Table 4.

Table 4 Fire integrity of decks separating adjacent spaces

Space - above below	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Control stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0[(e)]	A-0	*)	A-0
Corridors (2)	A-0	*)	*)	A-0	*)	A-60	A-0	A-0[(e)]	A-0	*)	*)
Accommodation spaces (3)	A-60	A-0	*)	A-0	*)	A-60	A-0	A-0[(e)]	A-0	*)	*)
Stairways (4)	A-0	A-0	A-0	*)	A-0	A-60	A-0	A-0[(e)]	A-0	*)	A-0
Service spaces (low risk) (5)	A-15	A-0	A-0	A-0	*)	A-60	A-0	A-0	A-0	*)	A-0
Machinery spaces of category A (6)	A-60	A-60	A-60	A-60	A-60	*) [(a)]	A-60	A-60	A-60	*)	A-0

Space - above below	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0 (a)	*) (a)	A-0	A-0	*)	A-0
Hazardous areas (8)	A-60(e)	A-0(e)	A-0(e)	A-0(e)	A-0	A-60	A-0	-	A-0	-	A-0
Service spaces (high risk) (9)	A-60	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0 (c)	*)	A-0
Open decks (10)	*)	*)	*)	*)	*)	*)	*)	-	*)	-	*)
Sanitary and similar spaces (11)	A-0	A-0	*)	A-0	*)	A-0	A-0	A-0	A-0	*)	*)

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/m^2, H-rated divisions shall be applied. See DNVGL-OS-A101 Ch.2 Sec.1.

(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) Additional provisions for fire boundaries shall be assessed 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 is not required to 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.

(see 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.

(see 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.

(see 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.

(see 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.

(see 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.

(see 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.

(see 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, control stations and spaces containing vital machinery and equipment should not be located adjacent to hazardous areas. However, where this is not practicable, an engineering evaluation should be performed in accordance with national or international standards 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. Where it is shown that these spaces may be exposed to a radiant heat flux in excess of 100 kW/m^2, the bulkhead or deck should be constructed to at least H-60 standard.

Guidance note:

Vital machinery and equipment are those that are essential to the safety of the MODU and all personnel onboard. They include, but are not limited to, fire pumps, emergency sources of power, dynamic positioning systems, remote blowout preventer activation controls, and other operational or safety systems the sudden failure of which may result in hazardous situations. This does not include spaces (e.g. drillers cabin) located on the drill floor.

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Guidance note:

See standards such as ISO 13702:2015 or API RP 2 FB.

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(see 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.

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

(see 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 m^2. 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.

(see MODU code 9.3.3)

3.3.4 Stairs shall be constructed of steel or equivalent material.

(see 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.

(see 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.

(see 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.

(see 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).

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

(see 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.

(see 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/m^2 of the area for the thickness.

(see 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 combustion.

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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.

(see 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.

(see MODU code 9.3.12)

4 Cables

For fire resistance requirements for cables see DNVGL-OS-D201 Ch.2 Sec.10 as applicable.

Guidance note:

See MODU code 5.6.9 and 5.6.10.

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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.

(see MODU code 9.10.1)

Interpretation:

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

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2.1.2 Table 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.

(see MODU code 9.10.2)

Table 1 Recommended number and distribution of additional portable extinguishers

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

Type of space	*Minimum number of extinguishers* [1)]	*Class(es) of extinguisher(s)*
Machinery spaces of category A which are periodically unattended	At each entrance in accordance with section [2.2][2)]	B
Main switchboards	2 in the vicinity	C
Mud pits, mud processing areas	1 for each enclosed space (Travel distance to an extinguisher not to exceed 10 m for open space)	B

Note:

1) Minimum size shall be in accordance with paragraph 3.1.1 of chapter 4 of the FSS code.
2) A portable extinguisher provided for that space may be located outside near the entrance to that space. A portable fire extinguisher placed outside near to that space may also be considered as satisfying the provisions for the space in which it is located.

(see MODU code 9.10.2)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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 Ch. 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.

(see MODU code 9.9.1)

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

(as based on SOLAS Ch. II-2/10.5.1.2.3)

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

Guidance note:

Electrical rooms are a machinery space as defined Ch.1 Sec.1 [3.2]. A deluge system is not recommended for use in these rooms.

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

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)
— 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.

(see MODU code 9.9.2)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

Guidance note:

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

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

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.

(see MODU code 9.9.3)

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 Ch. II-2/10.5.3.1)

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see MODU code 9.9.4)

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].

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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 m^2 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/m^3
— a water spraying or sprinkler system, designed for 5 l/min/m^2. 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.

(see SOLAS Ch. II-2/10.6.3.1)

2.3.3 For lockers of a deck area less than 4 m^2, 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.

(see SOLAS Ch. 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.

(see MODU code 9.17.2)

Interpretation:

These areas shall be protected by a fixed water protection system, which shall be activated upon confirmed fire detection in relevant areas. The capacity of this system shall be at least 10 l/min/m^2 of space to be protected.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

SECTION 3 FIRE-FIGHTING SYSTEMS

1 General

1.1 Objective

The objectives of this section shall 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 shall 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].

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see 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.

(see MODU code 9.7.3)

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

(see MODU code 9.7.4)

Guidance note:

The above should be understood to mean the capacity of each of the two independently driven power pumps.

---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/mm^2 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/mm^2 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.

(see 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.

(see MODU Code 9.7.6)

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.

(see 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.

(see 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.

(see MODU code 9.7.9)

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

(see FSS code 8.2.5.1, 8.2.5.3 and MSC Circ. 1165)

Interpretation:

Fire main shall be pressurized, and the required fire pump(s) should be put automatically into action by a pressure drop.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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 Ch.2 Sec.2 [4]. Hydraulic and compressed air systems should be in accordance with NFPA 20 or equivalent.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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].

(see 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.

(see 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

2.3.6 The fire main shall not have connections other than those necessary for fire-fighting purposes.
(see 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.
(see 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.
(see MODU code 9.7.17)

2.3.9 For use of GRE/GRP material in firewater ring main, see DNVGL-OS-D101 Ch.2 Sec.2 [2.5.6] .

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.
(see 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.
(see 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.
(see 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.
(see SOLAS Ch. II-2/10.2.3.1.1)

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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
3) 25 m for open decks with a maximum breadth in excess of 30 m.

(see 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.

(see 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

Guidance note:

For recommended hose size, see NFPA 14, 2-7.2.

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

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.

(see 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

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

(see. 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.

(see FSS code Ch.2.2.2)

3 Local fire-fighting systems

3.1 Fixed gas fire-extinguishing system

Fixed gas fire-extinguishing system, steam extinguishing systems and equivalent fixed gas fire-extinguishing systems shall meet the requirements of FSS code Ch.5.

3.2 Fixed foam fire-extinguishing system

Fixed foam fire-extinguishing systems and fixed low-expansion foam fire extinguishing systems shall meet the requirements of FSS code Ch. 6.

3.3 Water mist

Water mist systems shall meet the requirements of FSS code Ch.7.

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 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. The remote activation should be at the control station where the operating status of the systems is monitored. The local activation should have safe access from the emergency control station and located outside the fire zone protected by the actual system.

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 shall 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

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

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.

See the Improved Guidelines for marine portable fire extinguishers, adopted by the Organization by resolution A.951(23).

(FSS code Ch.4.2)

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)

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.

(see MODU code 9.3.23)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see IACS UR D11.6 and MODU code 9.11.1)

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.

(see IACS UR D11.6.1 – 11.6.5)

Interpretation:

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

Table 1 Location of fire detectors

Area	*Detection principle*
Major hazard areas	
Wellhead	Flame or heat
Drill floor/ well intervention area	Flame
Process areas, degasser room, shale shaker room, active mud tank room, turret, hazardous pump room, tank deck, well test area, moon pool/ cellar deck	Flame or heat
Other areas	
Mechanically ventilated non-hazardous 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	Smoke
Turbine/ generator areas/rooms	Flame or smoke
Air compressor rooms	Smoke or heat
Sack or bulk storage area, workshops	Flame or heat
Paint store	Flame or heat
Fuel oil storage, turbine hood, water injection treatment area, cementing unit room, diesel engine room	Flame or heat
Accommodation areas	
Cabins, corridors, rooms/offices, staircases, public rooms, , radio room, laundry, HVAC inlets	Smoke
Galley	Heat

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

2.1.3 Sufficient manual fire alarm stations shall be installed throughout the unit. One manually operated call point shall be located at each exit.

(see MODU code 9.11.2 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.

(see MODU code 9.11.3)

2.1.5 Manually operated call points shall 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.

(see IACS UR D11.6.6)

2.1.6 Measures shall be taken to prevent inadvertent operation of the manual call alarm system.

(see IACS UR D11.6.6)

2.1.7 Detectors and manually operated call points shall be grouped into sections.

(see FSS code Ch.9.2.4.1.1)A section of fire detectors which covers a control station, a service space or 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see FSS ode 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.

(see 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].

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

2.1.10 Notwithstanding 3.1.10, 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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
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
    10) other fire safety systems.

(see FSS code Ch. 9.2.1.2 and UR D11.6.1.3)

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
3) any malfunction of the interfaced and connected equipment shall not propagate under any circumstance to the fire detection system.

(see 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.

(see 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 (see DNVGL-OS-D202 Ch.2 Sec.4, B900).

(see FSS code 9.2.1.5 and UR D11.6.1.2)

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

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.

(see 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.

(see FSS code Ch. 9.2.3.1.1 and UR D11.6.1)

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.

(see FSS code Ch.9.2.3.1.2 and 9.2.3.1.5)

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.

(see 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.

(see FSS code Ch. 9.2.3.1.6)

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

(see 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.

(see 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.

(see 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 an transitional source of power/ UPS.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see FSS code Ch. 9.2.2.3)

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 Ch. 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. 9.2.2.2 & 4)

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.

(see 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 2 Maximum spacing of detectors

Type of detector	*Maximum floor area per detector*	*Maximum distance between centres*	*Maximum distance away from bulkheads*
Heat	37 m²	9 m	4.5 m
Smoke	74 m²	11 m	5.5 m

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

(see 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.

(see 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.

(see FSS code Ch. 9.2.4.2.4)

2.4.5 Where a fixed fire detection and fire alarm system is required by SOLAS Ch. II-2/7.5 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.

(see 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.

(see 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.

(see 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

2.5.2 The control panel shall be located on the navigation bridge or in the fire control station.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see 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.

(see 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
— 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.

(see 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.

(see 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.

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see 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.

(see 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 [6].
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.

(see 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---o-f---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.

(see 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.

(see 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.

(see MODU code 9.20.3)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see 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 areas of the unit in which an accumulation of flammable gas may be expected to occur.

(see 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) 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].

3) When it is intended that a particular section or detector shall be temporarily switched off, this state should be clearly indicated.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.
  (see IACS UR D11.7.1)

For a more service unit specific description, 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
— gas detectors are located in all zone 1 and 2 areas.

---e-n-d---o-f---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.
(see MODU code 9.12.2 and UR D11.7.3)

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.

Guidance note:

For hazardous areas the alarm level should be 25% and 60% of lower explosion limit whereas for ventilation inlets it is common to have 10% and 30% of lower explosion limit (or less). Unconfirmed level is normally a single low level detection. Confirmed can either be one high level detection or two detectors at any level in a voting configuration. Similar for line detectors, the setpoints should be 1 and 3 LELm (or less). See DNVGL-OS-A101 Ch.2 Sec.3 [3.5] for alarm levels for rooms with dilution ventilation..

---e-n-d---o-f---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.

Guidance note:

For additional effects upon confirmed gas detection, see DNVGL-OS-A101 Ch.2 Sec.4

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

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.
(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

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

3.3 System control requirements

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

(see MODU code 9.12.1 and UR D11.7.2)

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 .

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

3.4 Maintainability

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

(see MODU code 9.20.3.1)

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.

(see FSS code Ch. 9.2.5.2)

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see MODU code 9.14.1)

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.

(see MODU code 9.14.2)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see MODU code 9.14.3)

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.

(see MODU code 9.15.1)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

3.1.2 The apparatus shall be suitably located in a sheltered space above main deck level of the unit.

(see MODU code 9.15.2)

3.1.3 Intakes for air compressors shall draw from a source of clear air.

(see MODU code 9.15.3)

3.1.4 The air shall be filtered after compression to eliminate compressor oil contamination.
(see MODU code 9.15.4)

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.
(see MODU code 9.16.1)

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.
(see MODU code 9.16.2)

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.
(see MODU code 9.16.3)

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.
(see MODU code 9.17.1.2)

5.1.2 The deckhouse top and bulkheads under the helideck shall have no openings.
(see MODU code 9.17.2.2.1)

5.1.3 Windows under the helideck shall be provided with steel shutters.
(see MODU code 9.17.2.2.2)

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/m^2 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

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
j) crowbar.

(see MODU code 9.17.4 and UR D11.4.3)

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
   — ensure suitable drainage.

(see MODU code 9.17.1)

Interpretation:

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

Guidance note:

For the fire-extinguishing arrangements as required for gas cylinder storage areas, see Sec.2 [2.4].

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

7 Fire control plan

7.1 General

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

(see MODU code 9.19)

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.

(see SOLAS Ch 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 fire-fighting personnel i.a.w. IMO MSC/Circ. 451.

(see SOLAS Ch 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.

(see FSS code Ch. 3, 2.2.1.2)

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

(see 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

— 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).

(see 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 shall be provided for each person in working areas where hydrogen sulphide may be encountered, and each person in other areas shall be provided with a SCBA rated for a minimum of 15 minutes

(see 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 shall be provided for each person on board the unit.

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

(a) living quarter

(b) muster/evacuation area

(c) drilling areas

(d) mud processing areas

(e) other working areas.

(see 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 shall 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.

(see MODU code 9.3.22)

3 Active fire protection of specific areas

3.1 General

3.1.1 See 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/Well intervention areas

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

(see IACS UR D11.3)

Interpretation:

This should cover the following areas and equipment:

— wellhead area/surface BOP
— drill floor
— well intervention area.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

3.2.2 A fixed water spray system shall be provided to protect drilling areas. The minimum water application rate is not less than 20 l/min/m^2.

(see 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.

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

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 m^3/h.

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

(see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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

3.2.4 For the hazardous mud processing area, a suitable fixed foam system shall be provided. The system shall be capable of delivering foam solution at a rate of not less than 6.5 $l/min/m^2$ (4.1 $l/min/m^2$ 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.

(see IACS UR D11.3)

3.2.5 The drill floor shall be protected by a fixed pressure water-spraying system designed to provide a minimum water application rate of 20 $l/min/m^2$ to the drill floor and related equipment, including emergency shutdown equipment, critical structural components, and enclosure fire barriers. Alternatively, multiple fixed monitors discharging at a minimum flow rate and pressure 1,900 l/min at 1 N/mm^2 may be provided and arranged such that all areas and equipment can be reached by at least two monitors which are widely separated.

(see MODU Code 9.8.1)

3.2.6 The system shall be designed for manual release from release stations located outside the protected area. Any section valves necessary for the operation of the system shall be located outside the protected area. Automatic release may be accepted by the Administration.

(see MODU Code 9.8.2)

3.2.7 Nozzles, piping, fittings and related components shall be designed to withstand exposure to temperature up to 925^oC.

(see MODU Code 9.8.3)

3.2.8 The main fire pumps may be used to supply the fixed pressure water-spraying system if they have sufficient capacity to simultaneuosly supply the fire main at the required flow and pressure.

(see MODU Code 9.8.4)

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.

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

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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---o-f---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/m^2 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.

(see IACS UR D11.7.1)

4.1.3 The executive actions as mentioned in Sec.4 [3.1.4] and Sec.4 [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.

(see MODU code 9.13.1)

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.

(see MODU code 9.13.1 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.

(see IACS UR D11.8.2)

Interpretation:

The high level should be set to 20 ppm.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

(see MODU code 9.13.1/ 13.5.26and 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

4.2.5 At least two portable hydrogen sulphide monitoring devices shall be provided on the unit.

(see MODU code 9.13.2)

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 shall 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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 spaces.

6.3.2 Effects upon detection

Upon unconfirmed hydrocarbon gas detection, all welding sockets and temporary equipment shall be tripped.

Guidance note:

The executive actions as mentioned above need not take place on confirmed hydrocarbon 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---o-f---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 shall 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, shall 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 Sec.1 Table 3 and Sec.1 Table 4.

2.3.2 Bulkheads between crude oil pump rooms, including their trunks, and machinery spaces shall be class A, and shall 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 Sec.1 Table 3 and Sec.1 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 See 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
- equipment containing rich glycol
- 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 shall 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

Area	*Capacity*
Wellhead area	20 l/min/m^2
Turret area	10 l/min/m^2
Processing area/offloading area	10 l/min/m^2
Well test/well intervention area	10 l/min/m^2
Water curtain	10 l/min/m^2

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 100m^3/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 floor area.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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 shall 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/m^2 of the exposed surfaces in addition to area protection unless safety measures (see Guidance note) justifies lower rates. See also Sec.1 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---o-f---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 shall 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/m^2 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/m^2 of the horizontal sectional area of the single tank having the largest such area
3) 3 litre/minute/m^2 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 suitable type.

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 shall 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) shall 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 one of the following 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

3.5.1 The offloading area shall have the following fire-fighting equipment:

— foam monitors or foam deluge covering the offloading area. Number, location and type of monitors/deluge nozzles shall be optimised with regard to fire-fighting efficiency.

3.6 Fire-fighting in turbine hood

Turbine hoods/enclosures, for topside purpose, 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 Sec.2 Table 1.

Interpretation:

In determining the single largest fire area, the limitations of the area may be based on fire divisions, see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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 1.

Guidance note:

It is recommended to establish special precautions during maintenance periods.

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

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 (see 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.

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

4.1.8 The pumps shall be designed to supply 150% of rated capacity at not less than 65% of rated head, see 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

4.2.3 The deluge valve system shall be activated by a signal from the fire and gas detection system and shall 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.

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

5 Detection and alarm systems

5.1 Basic provisions

Automatic shutdown of ventilation shall 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 shall 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.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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

Installation of detectors

5.3.1 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 DNVGL-RU-SHIP Pt.5 Ch.5 Sec.9 [6] to DNVGL-RU-SHIP Pt.5 Ch.5 Sec.9 [8].

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].

5.3.4 If the alarm at the main control points is unanswered within 2 min. the toxic gas (hydrogen sulphide) alarm and the helideck status light shall be automatically activated.

(MODU code 9.13.1/13.5.26 and IACS UR D11.8.2)

Interpretation:

Confirmed detection should result in an immediate toxic gas alarm.

---e-n-d---o-f---i-n-t-e-r-p-r-e-t-a-t-i-o-n---

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

(see FSS code 16.1.2)

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

(see FSS code 16.2.1.1)

5.3.7 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.

(see FSS code 16.2.1.2)

5.3.8 The system may be integrated with the cargo pump-room gas detection system, provided that the spaces referred to in paragraph [5.3.7] are sampled at the rate required in paragraph [5.3.16]. Continuous sampling from other locations may also be considered provided the sampling rate is complied with.

(see FSS code 16.2.1.3)

5.3.9 Common sampling lines to the detection equipment shall not be fitted, except the lines serving each pair of sampling points as required in paragraph [5.3.11].

(see FSS code 16.2.2.1.1)

5.3.10 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.

(see FSS code 16.2.2.1.2)

5.3.11 The configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in paragraphs [5.3.12] and [5.3.13], 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.

(see FSS code 16.2.2.1.3)

5.3.12 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.

(see FSS code 16.2.2.1.4)

5.3.13 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.

(see FSS code 16.2.2.1.5)

5.3.14 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.

(see FSS code 16.2.2.1.6)

5.3.15 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 shall 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 shall be automatically shut down.
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 shall be routed on their shortest ways.

(see FSS code 16.2.2.2.1)

5.3.16 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.

(see FSS code 16.2.2.3.1)

5.3.17 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.

(see FSS code 16.2.2.3.2)

5.3.18 Audible and visual alarms shall 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.

(see FSS code 16.2.2.3.3)

5.3.19 The gas detection equipment shall be so designed that it may readily be tested and calibrated.

(see FSS code 16.2.2.3.4)

Effects upon detection

5.3.20 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

The requirements in this section are based on DNVGL-RU-SHIP Pt.4 Ch.11, DNVGL-RU-SHIP Pt.5 Ch.5 and SOLAS requirements for Cargo Ships and are applicable for class notation **Oil storage(Unit)** and **Oil storage(Installation).**

2 Passive fire protection

2.1 Protection of spaces or areas

2.1.1 Exterior boundaries of superstructures and deckhouses enclosing accommodation and including any overhanging decks which support such accommodation, shall be constructed of steel and insulated to A-60 standard for the whole of the portions which face the cargo area and on the outward sides for a distance of 3 m from the end boundary facing the cargo area.

(See SOLAS Ch. II-2/.9.2.4.2.5)

2.1.2 Skylights to cargo pump-rooms shall be of steel, shall not contain any glass and shall be capable of being closed from outside the pump-room.

(See SOLAS Ch. II-2/.9.2.4.2.6)

2.1.3 Bulkheads between crude oil pump rooms, including their trunks, and machinery spaces shall be class A, and shall have no penetration 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 SOLAS Ch. II-2 Table 9.7 and 9.8.)

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.

3.2 Deck fire-fighting systems

3.2.1 Storage units shall have a fixed deck foam fire-extinguishing system in accordance with the requirements of Sec.7 [3.3].

3.3 Other hydrocarbon containing areas

3.3.1 Fixed water protection systems shall be installed to cover the following areas and equipment as applicable:

— turret area
— VOC plant
— offloading and metering area.

3.3.2 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.

3.3.3 The horizontal extent of the area requiring protection may be limited by adjacent vertical A- or H-class 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 shall 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

Area	*Capacity*
Turret area	10 l/min/m^2
VOC area, offloading and metering area	10 l/min/m^2

3.3.4 Instead of a fixed water spray system, as given in [3.3.3], 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 m^3/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.

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3.3.5 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 shall have capacity for application of foam over the protected area for not less than 15 minutes.

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.

(See SOLAS Ch. II-2/10.9.1)

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.

(See SOLAS Ch. II-2/10.4.1.1)

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 shall not be more than the maximum required for the largest compartment.

(See SOLAS Ch. II-2/10.9.2)

3.5 Fire-fighting in engine and boiler rooms

3.5.1 Machinery spaces of category A containing oil-fired boilers or oil fuel units shall be provided with any one of the fixed fire-extinguishing systems, see [3.4.2].

(See SOLAS Ch. II-2/10.5.1.1)

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

3.5.3 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.

(See SOLAS Ch. II-2/10.5.1.2.1)

3.5.4 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.

(See SOLAS Ch. II-2/10.5.1.2.2)

Interpretation:

50 kg dry powder or 45 kg CO_2 is considered as equivalent to 135 l foam liquid.

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4 Fire-water systems

4.1 Fire-water supply system

4.1.1 Storage unit's shall be provided with fire pumps, fire mains, hydrants and hoses complying with the applicable requirements of SOLAS Ch. II-2/10.2.

5 Detection and alarm systems

5.1 Fire detection

5.1.1 An automatic fire detection system shall be installed in areas required by SOLAS Ch. II-2/7 and other areas onboard containing hydrocarbons such as turret, offloading and metering areas and VOC plant.

5.1.2 The fixed fire detection and fire alarm system and sample extraction smoke detection system shall be of an approved type and comply with the FSS Code Ch.9 and 10.

5.1.3 Detected fire in turret, crude oil tank area or offloading areas shall initiate shutdown of import/export valves.

5.2 Gas detection

5.2.1 Gas detection in cargo pump rooms and double hull spaces shall be arranged in accordance with principles given in DNVGL-RU-SHIP Pt.5 Ch.5 Sec.9 [6] to DNVGL-RU-SHIP Pt.5 Ch.5 Sec.9 [7]. Fixed gas detection shall also be provided for the turret.

5.2.2 The fixed hydrocarbon gas detection system shall comply with SOLAS Ch.II-2/4.5.7 and MSC.1/1370.

(see FSS code 16.2.1.1)

5.2.3 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 double bottom spaces adjacent to the cargo tanks, including the forepeak tank and any other tanks and spaces under the bulkhead deck adjacent to cargo tanks.

(see FSS code 16.2.1.2)

5.2.4 The system may be integrated with the cargo pump-room gas detection system, provided that the spaces referred to in [5.2.3] are sampled at the rate required in [5.2.12]. Continuous sampling from other locations may also be considered provided the sampling rate is complied with.

(see FSS code 16.2.1.3)

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

(see FSS code 16.2.2.1.1)

5.2.6 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.

(see FSS code 16.2.2.1.2)

5.2.7 The configuration of gas sampling lines shall be adapted to the design and size of each space. Except as provided in [5.2.8] and [5.2.9], 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.

(see FSS code 16.2.2.1.3)

5.2.8 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.

(see FSS code 16.2.2.1.4)

5.2.9 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.

(see FSS code 16.2.2.1.5)

5.2.10 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.

(see FSS code 16.2.2.1.6)

5.2.11 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 shall 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 shall 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 shall be automatically shut down.
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 shall be routed on their shortest ways.

(see FSS code 16.2.2.2.1)

5.2.12 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.

(see FSS code 16.2.2.3.1)

5.2.13 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.

(see FSS code 16.2.2.3.2)

5.2.14 Audible and visual alarms shall 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.

(see FSS code 16.2.2.3.3)

5.2.15 The gas detection equipment shall be so designed that it may readily be tested and calibrated.

(see FSS code 16.2.2.3.4)

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 shall be applied supplementary to the requirements given by Sec.1 to Sec.5.

1.1.2 Design of the fire protection system shall 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

See 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, shall 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 Sec.1 Table 3 and Sec.1 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 See 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 SOLAS Ch. II-2/10.3 and FSS code Ch.4.2 (see Sec.3 [3.1]).

3.4 Fire-fighting in turbine hood

Turbine hoods/enclosures, for topside purpose, 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

General

3.5.1 The effectiveness and necessity of a foam system shall be determined in the fire analysis. Where a foam system is fitted it shall be generally in accordance with Sec.7 [3.2].

Water spray system

3.5.2 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 shall 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/min/m^2 for horizontal projected surfaces and 4 l/min/m^2 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/min/m^2 or
— actual surface x 4 l/min/m^2.

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 shall 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.

Dry chemical powder fire-extinguishing system

3.5.8 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] shall 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 shall 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, shall 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-kink able 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 housing or 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

Monitors	*Capacity of fixed monitors (kg/s)*
For coverage of up to 10 m	10
For coverage of up to 30 m	25
For coverage of up to 40 m	45

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

Compressor and pump rooms

3.5.16 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 Sec.2 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.

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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 shall 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.

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

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

5.2.3 Automatic shutdown of ventilation shall 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 shall 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.

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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 DNVGL-RU-SHIP Pt.5 Ch.5 Sec.6, DNVGL-RU-SHIP Pt.5 Ch.5 Sec.7 and DNVGL-RU-SHIP Pt.5 Ch.5 Sec.9.

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 shall be automatically shut down. See also DNVGL-OS-A101 Ch.2 Sec.4.

6 Personnel protection

Protective and safety equipment shall be provided in accordance with DNVGL-RU-SHIP Pt.5 Ch.7 Sec.14.

SECTION 10 SUPPLEMENTARY REQUIREMENTS FOR OFFSHORE LOADING BUOYS

1 Introduction

This section gives additional fire protection requirements for offshore loading buoys that shall be applied supplementary to the requirements given by Sec.1 to Sec.5.

2 Special requirements for offshore loading buoys

2.1 Fire control and extinguishing

2.1.1 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.

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

2.1.3 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.

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2.1.4 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
— provision for helicopter facilities.

2.2 Provision for helicopter facilities

2.2.1 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

No.	*Title*
DNVGL-RU-OU-0101	Offshore drilling and support units
DNVGL-RU-OU-0102	Floating production, storage and loading units
DNVGL-RU-OU-0103	Floating LNG/LPG production, storage and loading units
DNVGL-RU-OU-0104 Ch.3 Sec.1	Self-elevating units

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

No.	*Title*
DNVGL-OS-A101	Safety principles and arrangements
DNVGL-OS-D101	Marine and machinery systems and equipment
DNVGL-OS-D202	Automation, safety and telecommunication systems
DNVGL-OS-D301	Fire protection

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

Description	*Reference*
Active fire protection for moon pool	, Ch.2 Sec.6 and Ch.2 Sec.7
Enhanced fixed fire protection	
Detectors on ventilation intake	
Automatic shutdown on gas detection	
Additional H2S detectors	

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 shall 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-RU-SHIP Pt.1 Ch.3.

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

Category I = equipment important for safety and for which a DNV GL certificate is required.

Category II = equipment important for safety and for which a works certificate prepared by the manufacturer is accepted

1.1.2 Equipment category I

For equipment category I, the following certification procedure shall be followed:

— design approval, documented by a design verification report (DVR) or type approval certificate
— fabrication survey, documented by issue of a product certificate.

Specific requirements:

— pre-production meeting prior to the start of fabrication as relevant
— survey during fabrication, as applicable
— witness final functional, pressure and load tests, as applicable
— review of fabrication records.

These requirements are typical and the final extent of DNV GL survey required, will be decided based on:

— complexity, size and previous experience of equipment type
— manufacturer's QA/QC system
— manufacturing survey arrangement (MSA) with DNV GL
— type of fabrication methods.

1.1.3 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.

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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

Component	*Category*	
	I	*II*
Fire dampers, penetrations [2]		
Fire-water pump housing		X
Fire-water pumps driver [3]		
Fire-water pump for production units (incl. capacity)[5]	X	
Self-contained fire-water driver for production units[6]	X	
Components in fire-extinguishing system [1]		
Fire hose		X
Hose reels and associated equipment		X
Monitors		X
Other fire-fighting installations, e.g. deluge, powder or systems not covered by IMO [4]	X	
Insulation materials in fire resisting divisions[2]		
Fire rated doors [2]		
Fire rated windows [2]		
Fire and gas detectors [2]		
Wheeled and portable extinguishing system		X

[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] Witness final functional, pressure and load tests, as applicable. Normally function test to be carried out at yard. Review of fabrication records.

[5] Witness final functional, pressure and load tests, as applicable. Review of fabrication records.

[6] Pre-production meeting prior to the start of fabrication as relevant. Review of fabrication records.

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.

CHANGES – HISTORIC

January 2017 edition

Main changes January 2017, entering into force 1 July 2017

• Ch.1 Sec.1 Introduction
Ch.1 Sec.1 Table 5: Definitions of terms are aligned with DNVGL-OS-A101.

• Ch.2 Sec.1 Passive fire protection
Ch.2 Sec.1 [4]: Detailed requirements to cables are deleted, as these are described in DNVGL-OS-D201.

• Ch.2 Sec.3 Fire-fighting systems
Ch.2 Sec.3 [2.2.3]: Interpretation is deleted.

Ch.2 Sec.3 [2.2.4]: Fire pump capacity requirement is clarified to avoid misunderstandings.

Ch.2 Sec.3 [2.2.6]: Interpretation is deleted.

Ch.2 Sec.3 [3.1], [3.2] and [3.3]: Detailed requirements for local fire fighting systems are replaced by reference to the FSS Code. No changes to technical requirements.

Ch.2 Sec.3 [3.7]: Former clauses for spare charges to extinguishers are deleted.

• Ch.2 Sec.4 Fire and/or gas detection and alarm systems
Ch.2 Sec.4 [3.1.1]: Item 2 in interpretation is deleted.

Ch.2 Sec.4 [3.3]: Guidance note is deleted.

• Ch.2 Sec.6 Supplementary requirements for drilling and well intervention units
Ch.2 Sec.6 [6.3.1]: Requirement for smoke detection in air intakes is limited to accommodation areas. Requirement for H2S detection in air intakes is deleted.

Ch.2 Sec.6 [6.3.2]: Requirement related to helicopter decks is deleted.

• Ch.2 Sec.7 Supplementary requirements for oil and gas production and storage units
Ch.2 Sec.7 [table 1]: Requirement for deluge capacity in turret areas is reduced from 20 (l/min)/m2 to 10 (l/min)/m2.

Ch.2 Sec.7 [3.3.5]: New clause.

Ch.2 Sec.7 [3.5]: Turret requirement is removed from this paragraph, as these are considered as process areas. Fire fighting requirements in engine and boiler rooms are deleted from this paragraph. Such arrangements are covered in Ch.2 Sec.3.

Ch.2 Sec.7 [5.3.4]: New clause.

• Ch.2 Sec.10 Supplementary requirements for offshore loading buoys
Former sub-section [2] covering diving systems are deleted, as these systems are no longer described in the offshore standard.

• Ch.3 Sec.2 Certification of equipment
Ch.3 Sec.2 [1] and Ch.3 Sec.2 [2]: Categories for certification of equipment is aligned in the offshore standards.

July 2015 edition

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

— Sec.7 [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

— Sec.8 [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.

About DNV GL

DNV GL is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.

SAFER, SMARTER, GREENER