



RULES FOR BUILDING AND CLASSING

MOBILE OFFSHORE DRILLING UNITS 2017

PART 5 FIRE AND SAFETY – MEASURES AND FEATURES

(Updated April 2017 – see next page)

**American Bureau of Shipping
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the State of New York 1862**

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Updates

April 2017 consolidation includes:

- January 2017 version plus Corrigenda/Editorials

Rule Change Notice (2017)

The effective date of each technical change since 1993 is shown in parenthesis at the end of the subsection/paragraph titles within the text of each Part. Unless a particular date and month are shown, the years in parentheses refer to the following effective dates:

(2000) and after	1 January 2000 (and subsequent years)	(1996)	9 May 1996
(1999)	12 May 1999	(1995)	15 May 1995
(1998)	13 May 1998	(1994)	9 May 1994
(1997)	19 May 1997	(1993)	11 May 1993

Listing by Effective Dates of Changes from the 2016 Rules

EFFECTIVE DATE 1 January 2017 – shown as (2017)

(based on the contract date for new construction between builder and Owner)

<i>Part/Para. No.</i>	<i>Title/Subject</i>	<i>Status/Remarks</i>
5-1-1/3.5	Details, Materials and Methods of Construction	To align the requirements with the current version of the International Code for the Application of Fire Test Procedures (FTP Code 2010).
5-1-1/3.7	Fire Integrity of Bulkheads and Decks	To mitigate the effects of hydrocarbon fires and explosions, in line with USCG recommendations.
5-1-1/Table 1	Fire Integrity of Bulkheads Separating Adjacent Spaces	To mitigate the effects of hydrocarbon fires and explosions, in line with USCG recommendations.
5-1-1/3.9.2 Note 1	<No Title>	To clarify the Control Station Definition for MODU Structural Fire Protection.
5-1-1/3.17iii)	<No Title>	To align the requirements with the current version of the International Code for the Application of Fire Test Procedures (FTP Code 2010).
5-1-1/3.17iv)	<No Title>	To align the requirements with the current version of the International Code for the Application of Fire Test Procedures (FTP Code 2010).
5-1-1/5.1.3 (New)	<No Title>	To mitigate the effects of hydrocarbon fires and explosions, in line with USCG recommendations.
5-1-1/5.27iv) (New)	<No Title>	To align the requirements with 7-2-4/1.1.3 of the ABS <i>MODU Rules</i> .
5-2-2/1.1.5(a)	General	To clarify the pump capacity requirement for each fire main pump utilized for the other fire protection or fire-fighting purposes.
5-2-3/1.3.1	Fixed Fire Extinguishing Systems on Drilling Area and Temporary Well Test Area	To align the requirements with IACS UR D11.3.2. To require wellheads with maximum shut-in tubing pressures exceeding 600 psi to be protected with a water spray system.
5-2-3/3.1.2	Design	To align the requirements with FSS Code Chapter 5, adopted by Resolution MSC.206(81) and amended by Resolution MSC.339(91).
5-2-3/3.1.3	Alarm	To align the requirements with FSS Code Chapter 5, adopted by Resolution MSC.206(81) and amended by Resolution MSC.339(91).
5-2-3/7	Fixed Pressure Water Spraying and Automatic Sprinkler Systems	To include automatic sprinkler systems.
5-2-3/8.7.3	Controls	To align the requirements with FSS Code Chapter 5, adopted by Resolution MSC.206(81) and amended by Resolution MSC.339(91).
5-2-3/9.3.2	Portable Extinguishers	To specify that semi-portable fire extinguishers can be provided on the helicopter deck as portable extinguishers, in line with 9.16.4.1 of the 2009 IMO MODU Code.
5-2-4/3.1	Number	To align the requirements with 9.13.1 of the IMO MODU Code.
5-2-4/3.17 (New)	Fire-fighter's Outfit	To align the requirements with SOLAS II-2/Reg.10.4.
5-3-1/7	Emergency Control Stations	To specify that the gas detectors are to have indicators at the emergency control station.

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Fire and Safety – Measures and Features

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CHAPTER 1 Passive Fire Protection

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CHAPTER 1 Passive Fire Protection

SECTION 1 General

1 General (1993)

All mobile offshore drilling units are to meet the requirements of this Chapter with regard to structural fire protection, protection of accommodation spaces, service spaces and control stations.

1.1 Administration Review

When a Mobile Offshore Drilling Unit Safety Certificate is issued to a MODU by an Administration or its agent other than ABS, such certificate will be accepted as evidence that the unit is in accordance with the requirements of this Chapter.

1.3 ABS Review

In all other cases, the required information and plans are to be submitted to ABS for review.

1.5 Materials Containing Asbestos (2011)

Installation of materials, which contain asbestos, is prohibited.

1.7 Alternative Design and Arrangements (2012)

When fire safety design or arrangements deviate from the prescriptive provisions of the Rules, including innovative means of passive fire protection, an engineering analysis, evaluation and approval of the alternative design and arrangements has to be carried out in accordance with SOLAS Regulation II-2/17 and ABS *Guidance Notes on Alternative Design and Arrangements for Fire Safety*.

3 Structural Fire Protection (1993)

3.1 Construction Materials

These requirements apply to mobile offshore drilling units with their hulls, superstructures, structural bulkheads, decks and deckhouses constructed of steel.

3.3 Alternate Materials

Construction of other materials may be accepted, provided that they provide an equivalent standard of safety.

3.5 Details, Materials and Methods of Construction (2017)

Structural fire protection details, materials and methods of construction are to be in accordance with the International Code for Application of Fire Test Procedures (Resolution MSC.307(88)) (FTP Code), as applicable, and SOLAS Regulations II-2/5.3 and II-2/6, as applied to cargo ships.

3.7 Fire Integrity of Bulkheads and Decks (2017)

In addition to complying with the specific provisions for fire integrity of bulkheads and decks in this Section and in 5-1-1/5, the minimum fire integrity of bulkheads and decks is to be as prescribed in 5-1-1/Table 1 and 5-1-1/Table 2. These requirements apply to all **normally occupied permanent structures, temporarily installed modular building** and portable accommodation modules. The exterior boundary of **normally occupied superstructures, deckhouses enclosing accommodations and modular building**, including any overhanging decks supporting such accommodations, are to be an “H-60” Class boundary for the whole of the portion which faces and is within 30 m (98 ft) of the center of the rotary table. The 30 m (98 ft) is measured with the rotary at its closest drilling position to the **normally occupied permanent structures, modular building, and accommodation**. **If worst fire risk analysis indicates the radiant heat flux of exterior boundaries of such buildings are not exceeding 100 kW/m², “A-60” standard can be considered.**

Notes:

- 1 Class “A” or Class “B” divisions and their associated insulation index are as defined in SOLAS Regulation II-2/3.2 or 3.4, respectively.
- 2 H-class divisions are fire barriers that have been tested to a fire test using the hydrocarbon time-temperature furnace heating curve as defined in ISO 834/1363-2 or ASTM E 1529. They are rated similarly to “A” class divisions as defined in SOLAS regulation II-2/3.2.

TABLE 1
Fire Integrity of Bulkheads Separating Adjacent Spaces (2017)

Spaces	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control Stations (1)	A-0 ⁽⁴⁾	A-0	A-60	A-0	A-15	A-60	A-15	A-60 ⁽⁵⁾	A-60	*	A-0
Corridors (2)		C	B-0	B-0 A-0 ⁽²⁾	B-0	A-60	A-0	A-0 ⁽⁵⁾	A-0	*	B-0
Accommodation Spaces (3)			C	B-0 A-0 ⁽²⁾	B-0	A-60	A-0	A-0 ⁽⁵⁾	A-0	*	C
Stairways (4)				B-0 A-0 ⁽²⁾	B-0 A-0 ⁽²⁾	A-60	A-0	A-0 ⁽⁵⁾	A-0	*	B-0 A-0 ⁽²⁾
Service Spaces (low risk) (5)					C	A-60	A-0	A-0	A-0	*	B-0
Machinery Spaces of Category A (6)						*Note 1	A-0 ⁽¹⁾	A-60	A-60	*	A-0
Other Machinery Spaces (7)							A-0 ^(1,3)	A-0	A-0	*	A-0
Hazardous Areas (8)								—	A-0	—	A-0
Service Spaces (high risk) (9)									A-0 ⁽³⁾	*	A-0
Open Decks (10)										—	*
Sanitary and Similar Spaces (11)											C

Notes: To be applied to both 5-1-1/Table 1 and 5-1-1/Table 2, as appropriate.

- 1 Where the space contains an emergency power source or components of an emergency power source that adjoins a space containing a unit’s service generator or the components of a unit’s service generator, the boundary bulkhead or deck between those spaces is to be an “A-60” Class division.
- 2 For clarification as to which note applies, see paragraphs 5-1-1/5.5 and 5-1-1/5.9.
- 3 (2012) Where spaces are of the same numerical category and superscript (3) 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. Where a bulkhead is installed between two spaces of the same numerical category which are for the same purpose, the separating bulkhead is to be made of non-combustible material (except for spaces separated for redundancy in units with **DPS-3** notation, where the separating bulkhead is to be “A-60” rating).
- 4 Bulkheads separating the navigation bridge, chart room and radio from each other may be “B-0” rating.
- 5 (2017) An engineering evaluation is to be conducted in accordance with 5-1-1/5.1. In no case should the bulkhead or deck rating be less than the value indicated in the table. **Where it is shown that normally occupied spaces may be exposed to a radiant heat flux in excess of 100 kW/m², the bulkhead or deck should be constructed to at least an “H-60” standard.**
- * When an asterisk appears in the tables, the division is required to 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 should be made tight to prevent the passage of flame and smoke.

TABLE 2
Fire Integrity of Decks Separating Adjacent Spaces (2012)

Spaces ↓ Below	Space → Above	(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 ⁽⁵⁾	A-0	*	A-0
Corridors	(2)	A-0	*	*	A-0	*	A-60	A-0	A-0 ⁽⁵⁾	A-0	*	*
Accommodation Spaces	(3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0 ⁽⁵⁾	A-0	*	*
Stairways	(4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0 ⁽⁵⁾	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	*Note 1	A-60	A-60	A-60	*	A-0
Other Machinery Spaces	(7)	A-15	A-0	A-0	A-0	A-0	A-0 ⁽¹⁾	*Note 1	A-0	A-0	*	A-0
Hazardous Areas	(8)	A-60 ⁽⁵⁾	A-0 ⁽⁵⁾	A-0 ⁽⁵⁾	A-0 ⁽⁵⁾	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-60	A-0	A-0	A-0 ⁽³⁾	*	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: See Notes under 5-1-1/Table 1.

3.9 Application of Tables

The following requirements govern application of the tables:

3.9.1

5-1-1/Table 1 and 5-1-1/Table 2 apply, respectively, to the bulkheads and decks separating adjacent spaces.

3.9.2

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) **(2017) Control Stations** are those spaces in which
- Radio or main navigation equipment is located, or
 - Where the fire monitoring or fire control equipment is centralized, or
 - Where the dynamic positioning system controls or **activation of** fire-extinguishing systems serving various location are situated, or
 - Centralized ballast control station in column-stabilized units.

For the purpose of the application of 5-1-1/Table 1 and 5-1-1/Table 2, fixed gas fire-extinguishing system storage rooms are to be treated as control stations.

- (2) **Corridors** means corridors and lobbies.
- (3) **Accommodation Spaces** are those used for public spaces, cabins, offices, hospitals, cinemas, game and hobby rooms and similar spaces. Public spaces are those portions of the accommodation which are used for meeting halls, dining rooms, lounges and similar permanently enclosed spaces.
- (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 is regarded as part of the space from which it is not separated by a fire door.
- (5) **(1999) Services Spaces (low risk)** are lockers, storerooms and working spaces in which flammable materials are not stored; drying rooms, laundries; refrigerating, ventilation and air-conditioning machinery spaces with motors having an aggregate capacity not greater than 7.5 kW (10 hp).

- (6) *Machinery Spaces of Category A* are all spaces which contain internal combustion type machinery used either:
- For main propulsion or
 - For other purposes where such machinery has in the aggregate a total power of not less than 375 kW (500 hp) or which contain any oil-fired boiler or oil fuel unit; and trunks to such spaces.
- (7) *(1999) Other Machinery Spaces* are those spaces, including trunks to such spaces, containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery (SCR, MCC and switchgear); oil filling station; refrigerating, ventilation and air-conditioning machinery with motors having an aggregate capacity greater than 7.5 kW (10 hp); and similar spaces, but are not machinery spaces of Category A.
- (8) *Hazardous Areas* are all those areas where, due to the possible presence of a flammable atmosphere arising from the drilling operation, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion. See Section 4-3-6.
- (9) *Services Spaces (high risk)* are lockers, storerooms 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 spaces.
- (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.

3.11

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

3.13 (2012)

Structural fire protection details are to avoid the risk of heat transmission at intersections and terminal points of required thermal barriers. The insulation of a deck or bulkhead is to be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminum 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 is to continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

3.15

Windows and sidescuttles, with the exception of navigation bridge windows, are to be of the non-opening type. Navigation bridge windows may be of the opening type, provided the design of such windows permits rapid closure. Windows and sidescuttles outside of hazardous areas may be of the opening type.

3.17 (2011)

- i) The fire resistance of doors are to be equivalent to that of the division in which they are fitted.
- ii) (2015) External doors in superstructures and deckhouses are to be self-closing and at least “A-0” class standard. Where external doors in bulkheads of superstructures and deckhouses are required to be watertight, they need not be self-closing; however, they are to be fitted with a notice on both sides of the door stating that the doors are to be kept closed unless an adjacent self-closing fire rated door is provided.
- iii) (2017) Watertight doors in a watertight division fitted below the bulkhead deck need not be tested to the Fire Test Procedure Code (Resolution MSC.307(88)) requirements for the fire rating of the division in which the door is fitted. The bulkhead deck is the highest deck to which watertight bulkheads extend and are made effective.

- iv) (2017) Watertight doors fitted in a fire rated division above the bulkhead deck are to be tested to the Fire Test Procedure Code (Resolution MSC.307(88)) requirements for the fire rating of the division in which the door is fitted and, if applicable, the watertight door are to meet the self-closing requirements. Watertight doors are to meet the requirements of ii), when applicable.
- v) Where a watertight door is located adjacent to a fire door, both doors are to be capable of independent operation, remotely if required and from both sides of each door.
- vi) (2012) Self-closing doors in fire rated bulkheads are not to be fitted with hold-back hooks. However, hold-back arrangements incorporating remote release fittings of the fail-safe type may be utilized.

3.19 (1999)

Arrangements are to be made to ensure that the fire resistance is not impaired when

- i) “A” and “B” class divisions are penetrated for the passage of electrical cables, pipes, trunks, ducts, etc.
- ii) “A” class divisions are penetrated for girders, beams or other structural members, or
- iii) “B” class divisions are penetrated for the fitting of ventilation terminals, lighting fixtures and similar devices.

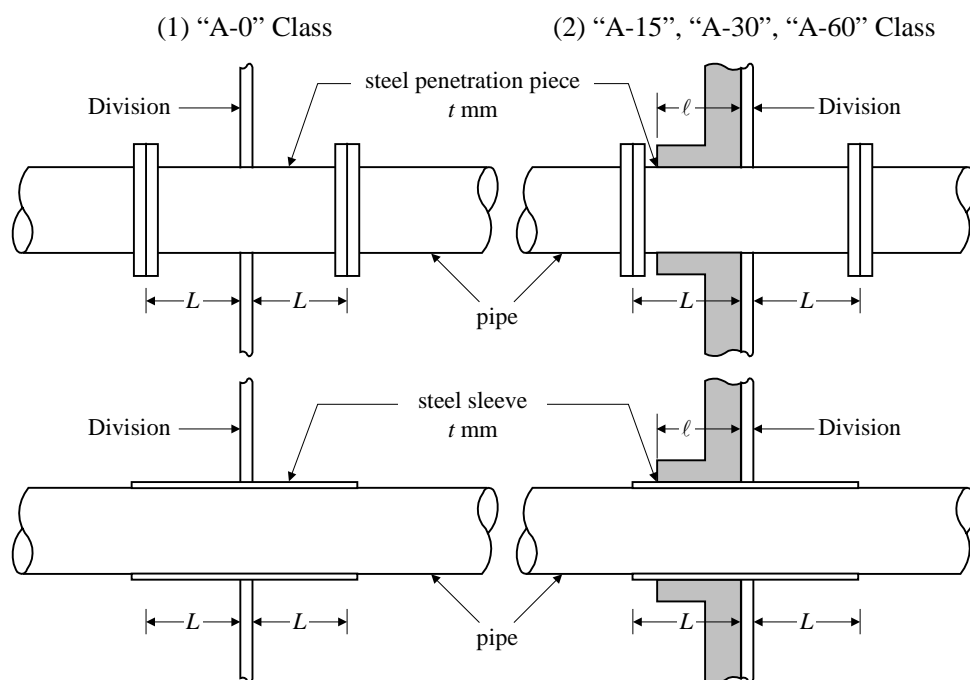
3.21 (2011)

Where pipes penetrate “A” class divisions, such penetrations are to be tested in accordance with the Fire Test Procedures Code. If the penetration is constructed of steel or fitted with a steel sleeve at least 3 mm (0.12 in.) thick and at least 900 mm (35.4 in.) long (preferably 450 mm (17.7 in.) on each side of the division) and provided with fire insulation having the same length and fire integrity as the division, testing is not required. See 5-1-1/Figure 1.

Uninsulated metallic pipes penetrating “A” class divisions are to be of materials having a melting temperature which exceeds 950°C (1742°F).

**FIGURE 1
 Pipes Penetrating “A” Class Divisions (2011)**

“A” Class Division (Pipe material: Steel, Copper, Al-alloy)



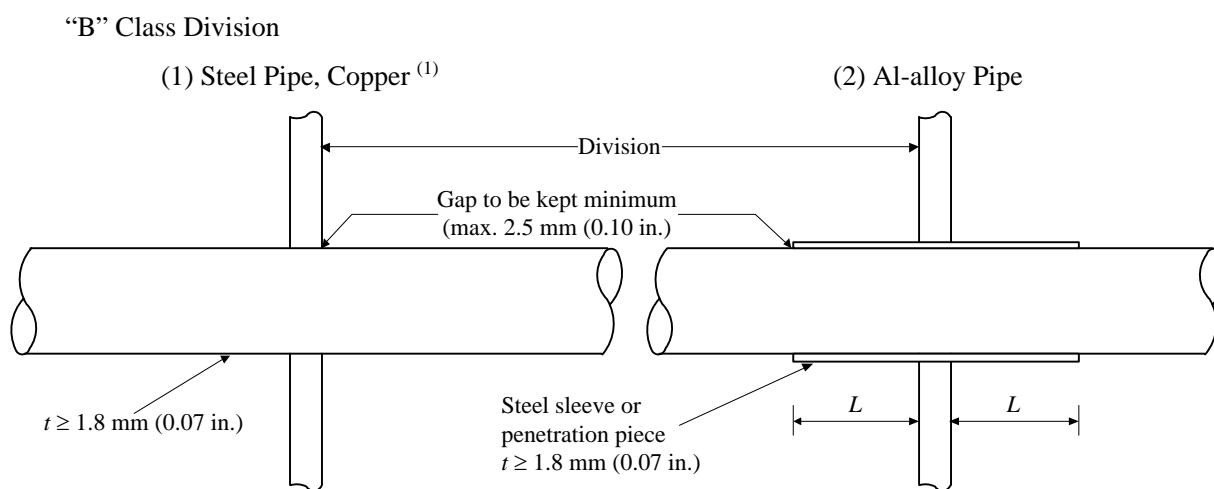
	L_{min} mm (in.)	l_{min} mm (in.)	t mm (in.)
All sizes	450 (17.7)	450 (17.7)	3.0 (0.12)

3.23 (2011)

Where pipes penetrate “B” class divisions, such penetrations are to be tested in accordance with the Fire Test Procedures Code. Testing is not required however if:

- i) Pipes having diameters greater than or equal to 150 mm (5.91 in.) penetrating “B” class divisions are steel or lined with steel sleeves at least 1.8 mm thick and at least 900 mm (35.4 in.) long (preferably 450 mm (17.7 in.) on each side of the division). See 5-1-1/Figure 2.
- ii) Pipes having diameters less than 150 mm (5.91 in.) are to be steel or lined with steel sleeves at least 1.8 mm thick and at least 600 mm (23.6 in.) long (preferably 300 mm (11.81 in.) on each side of division). See 5-1-1/Figure 2.
- iii) Pipes other than steel or copper are connected to the ends of the sleeve defined in i) and ii) by flanges or couplings; or the clearance between the sleeve and the pipe is not to exceed 2.5 mm; or any clearance between pipe and sleeve is to be made tight by means of non-combustible or other suitable material. Uninsulated metallic pipes (including copper) penetrating “B” class divisions have a melting temperature which exceeds 850°C (1562°F).

**FIGURE 2
 Pipes Penetrating “B” Class Divisions (2011)**



$L = 450$ mm (17.7 in.) for diameters of 150 mm (5.9 in.) or more

$L = 300$ mm (11.8 in.) for diameters of less than 150 mm (5.9 in.)

1 Copper penetrations are required to have a melting temperature which exceeds 850°C (1562°F).

5 Protection of Accommodation Spaces, Service Spaces and Control Stations (1993)

5.1 (2016)

In addition to the requirements of 5-1-1/3.7, accommodation spaces, service spaces and control stations, in general, are not to be located adjacent to hazardous areas. However, where this is not practicable, an engineering evaluation is to be performed to verify 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. A Risk Analysis is to be submitted for review addressing the possible fire and explosion hazardous and identifying the worst foreseen hazards (fire and/or explosion). Depending on the type of hazard as determined from the risk analysis a Fire Load Analysis and/or a Blast Analysis are to be submitted for review with the mitigation measures (where needed) to allow safe operations.

5.1.1

Where a blast analysis is needed based on the risk analysis, the analysis is to show for the worst foreseen blast scenario that the space is protected.

- i) Plastic deformation of the spaces' structure is acceptable.
- ii) Attention is to be paid to penetrations through the bulkheads such as doors and HVAC openings.
- iii) No penetration of the blast overpressure is allowed to enter the space through the division panels. Overpressures of 0.07 bar (0.07 kgf/cm²; 1 psi) are allowable through penetrations of the division; the point of measurement of the overpressure is where the overpressure enters the open air of the space (i.e., the vent duct grill). Unmanned service spaces can have higher overpressures through penetrations if justified.
- iv) Windows subject to blast overpressures are to remain intact.

For simplified blast analysis, the overpressure values in API RP 2FB, Table C.6.4.1 may be used. Justification for the level of congestion (congested/non-congested) that an area has must be provided. Justification on the duration of the assumed blast impulse must be provided.

5.1.2

Where a fire analysis is needed based on the risk analysis, the analysis is to show that for the worst foreseen fire scenario the following internal temperature and structural criteria:

- i) The temperature of the protected side of the fire division (bulkhead or deck) does not increase more than:
 - a) 139°C (282°F) on average above ambient temperature for the time period of the event, but need not exceed 120 minutes and
 - b) 180°C (356°F) at any point above ambient temperature for the time period of the event, but need not exceed 120 minutes
- ii) The structure of the division (bulkhead or deck) is to remain intact with the main structure of the vessel, and is to maintain its structural integrity for two (2) hours. Structural Integrity means that the structure will not fall under its own weight, nor will it crumble or break upon normal contact after exposure to a fire lasting two (2) hours.

Buildings with bulkheads and decks that are H-120 Class fire divisions facing hazardous areas would not need a fire analysis; thus, only blast loads would need to be considered. Division sides not facing the fire hazard but which share a common edge with a division that faces the hazard are to have a 3 meter extension of the H-120 Class fire rated division. See Chapter 2, Section 1 of the *ABS Rules for Building and Classing Facilities on Offshore Installations (Facilities Rules)* for the definition of “H-120” divisions.

5.1.3 (2017)

Where it is shown that normally occupied spaces may be exposed to a radiant heat flux in excess of 100 kw/m², the bulkhead or deck should be constructed to at least an “H-60” standard.

5.3 (2012)

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

5.5 (2012)

All bulkheads forming “B” Class divisions are to extend from deck to deck and to the deckhouse side or other boundaries, unless continuous “B” Class ceilings and/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 are to be provided only in and under the doors of cabins, public spaces, offices and sanitary spaces. The openings are to be provided only in the lower half of the door. Any such opening in or under a door is to

have a total net opening no larger than 0.05 m² (0.54 ft²) and is to be fitted with a noncombustible grill. Such openings are not to be provided in a door in a division forming a stairway enclosure.

5.7 (2012)

Stairs are to be constructed of steel or other equivalent material which would not be rendered ineffective by heat.

5.9 (2012)

Stairways which penetrate only a single deck are to 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. Elevator trunks are to be protected by “A” Class divisions. Stairways and elevator trunks which penetrate more than a single deck are to be surrounded by “A” Class divisions and protected by “A” Class self-closing doors at all levels.

5.11 (2012)

Air spaces enclosed behind ceilings, paneling or linings are to be divided by close fitting draft stops spaced not more than 14 m (46 ft) apart. In the vertical direction, such enclosed air spaces, including those behind linings of stairways, trunks, etc., are to be closed at each deck.

5.13 (2012)

Except for insulation in refrigerated compartments, insulating materials, including pipe and vent duct lagging, ceilings, linings and bulkheads are to be of non-combustible material. Vapor barriers and adhesive used in conjunction with insulation, as well as insulation of pipe fittings for cold service systems need not be noncombustible, but they should be kept to a minimum and their exposed surfaces are to have low flame spread characteristics. In spaces where penetration of oil products is possible, the insulation surfaces are to be impervious to oil or oil vapors.

5.15

The framing, including grounds and the joint pieces of bulkheads, linings, ceilings and draft stops are to be of noncombustible material.

5.17

In accommodation and service spaces and control stations, the following surfaces are to have low flame-spread characteristics:

- i) All exposed surfaces in corridors and stairway enclosures;
- ii) Surface in concealed or inaccessible spaces;
- iii) Exposed surfaces of ceilings.

5.19 (2012)

Bulkheads, linings and ceilings may have combustible veneers, provided that the thickness of such veneers does not exceed 2.5 mm (0.10 in.) within any space other than corridors, stairway enclosures and control stations where the thickness is not to exceed 1.5 mm (0.06 in.). Combustible materials used on these surfaces are to have a calorific value not exceeding 45 MJ/m² of the area for the thickness used.

5.21 (2012)

Primary deck coverings, if applied, within accommodation and service spaces and control stations, are to be of approved materials which will not readily ignite, this being determined in accordance with the *FTP Code*.

5.23 (2012)

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

5.25

Ventilation ducts are to be of a noncombustible material, unless they are no more than 2 m (6.6 ft) long and have a cross-sectional area no more than 0.02 m² (0.22 ft²) and:

- i) Are of a material which has a low fire risk
- ii) Are used only at the end of the ventilation device
- iii) Are not situated less than 600 mm (23.5 in.), measured along the duct, from its penetration of any “A” or “B” class division, including continuous “B” class ceilings

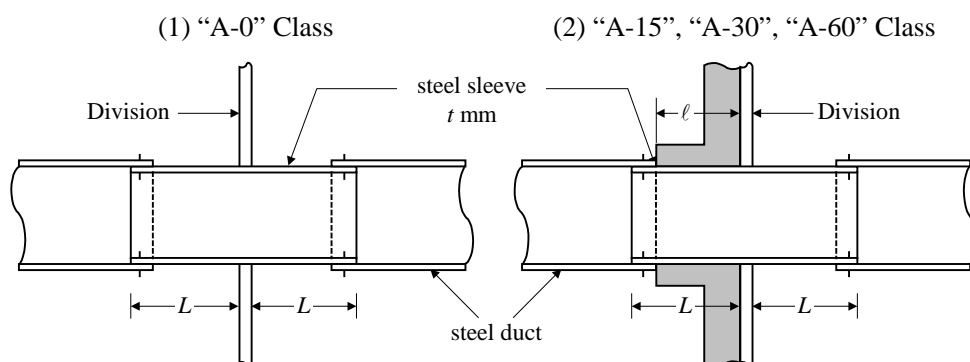
5.27 (2012)

Ventilation ducts having an internal cross-sectional area greater than 0.02 m² (0.22 ft²) penetrating “A” class divisions are to be steel or lined with a steel sheet sleeve that:

- i) Are at least 3 mm (0.118 in.) thick and at least 900 mm (35.4 in.) long (preferably 450 mm (17.7 in.) on each side of the division), provided with fire insulation having the same fire integrity as the division; and
- ii) Those exceeding 0.075 m² (0.81 ft²), except those serving hazardous areas, are to also have automatic fire damper capable of being closed manually from both sides of the bulkhead or deck and with a position indicator which shows whether the damper is open or closed. The fire dampers are not required 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 penetrate.
- iii) For control stations, where the duct line serves other category spaces, a fire damper is to be provided regardless of size.
- iv) (2017) Where a fire damper is located within a ventilation coaming and cannot be examined by other means, an inspection port or opening at least 150 mm (6 in.) in diameter is to be provided in the coaming to facilitate survey of the damper without disassembling the coaming or the ventilator. The closure provided for the inspection port or opening is to maintain structural integrity of the coaming and, if appropriate, the fire integrity of the coaming.

Ventilation ducts less than or equal to 0.02 m² (0.22 ft²) penetrating “A” class divisions are to be steel or lined with steel sheet sleeves that are at least 3 mm (0.12 in.) thick and at least 200 mm (7.88 in.) long (preferably 100 mm (3.93 in.) on each side of bulkhead or, in the case of the deck, wholly laid on the lower side of the deck pierced) and provided with fire insulation having the same fire integrity as the division. See 5-1-1/Figure 3.

FIGURE 3
Ventilation Ducts Penetrating “A” Class Divisions (2012)



	L mm (in.)	l mm (in.)	t mm (in.)	Automatic Damper**
$S > 750 \text{ cm}^2$	450 (17.7)	450 (17.7)	3.0 (0.12)	Required *
$750 \text{ cm}^2 \geq S > 200 \text{ cm}^2$	450 (17.7)	450 (17.7)	3.0 (0.12)	Not required
$200 \text{ cm}^2 \geq S$	min. 100 (3.94)	min. 100 (3.94)	3.0 (0.12)	Not required

* Not required if duct passes through spaces surrounded by "A" class divisions, without serving those spaces, provided the duct has the same fire integrity as the divisions it pierces.

** Automatic fire damper capable of being closed manually from both sides of the division.

S = Sectional area of duct

5.29 (2016)

Ventilation systems include the air handling units and/or fans, associated supply, return and/or exhaust ducting, and miscellaneous components.

Ventilation systems for machinery spaces of category A, galleys, and hazardous areas are to be separated from each other and from the ventilation systems serving other spaces, (see also 4-3-6/9.1).

Ducts serving hazardous areas are to not pass through accommodation spaces, service spaces, or control spaces.

Ducts provided for the ventilation of machinery spaces of category A and galleys are not to pass through accommodation spaces, control stations or service spaces unless:

- i) Constructed of steel at least 3 mm (0.12 in.) thick for ducts 300 mm (12 in.) wide or less, and at least 5 mm (0.20 in.) for ducts 760 mm (30 in.) wide and over.
 The minimum thickness is to be interpolated for widths or diameters between 300 and 760 mm (12 and 30 in.);
 - ii) Fitted with an automatic fire damper close to the boundaries penetrated;
 - iii) Insulated to “A-60” standard from the machinery space or galleys to a point at least 5 m (16.4 ft) beyond each fire damper; and
 - iv) The ducts are to be suitably supported and stiffened;
- or
- v) Constructed of steel in accordance with 5-1-1/5.29i) and 5-1-1/5.29iv) above; and
 - vi) Insulated to “A-60” standard throughout the accommodation spaces, service spaces or control stations.

5.29.1

The galley ventilation system may also serve other spaces associated to the galley (pantry with no cooking appliances, provisions store, dry goods store, scullery room) if all the following conditions are satisfied:

- i) The galley and the associated space have a common boundary,
- ii) The associated space is surrounded by A-rated divisions,
- iii) An automatic fire damper with manual closures from both sides and fitted with position indicator is to be installed at the common boundary penetrated, regardless of the size of the duct,
- iv) The fire damper is to be connected to the Air-conditioning and Heating Unit (AHU) control panel such that upon loss of power to the AHU fan, the fire damper closes,
- v) Fire detection in accordance with the requirements of 5-2-5/1.1 is to be installed in the associated space, such that upon detection of fire, the AHU shuts down and the fire damper in the common bulkhead closes, and
- vi) At least one means of egress for the associated space, independent from the galley egress, is to be provided.

5.31

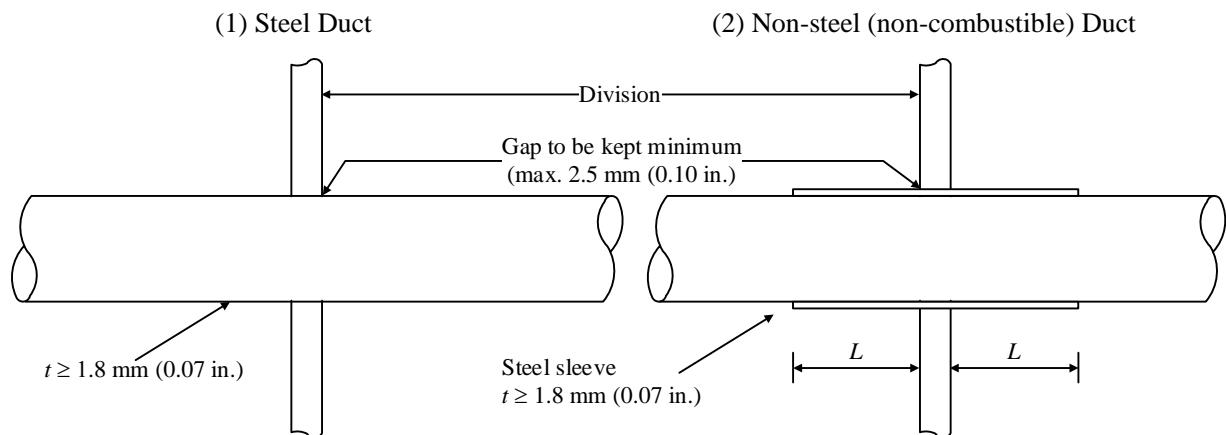
Ducts provided for ventilation of accommodation and service spaces or control stations are not to pass through machinery spaces of Category A hazardous areas or galleys. However, a relaxation from this requirement, except for the ducts passing through hazardous areas, will be considered, provided:

- i) The ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with 5-1-1/5.29i) and 5-1-1/5.29iv).
 - ii) Automatic fire dampers are fitted close to the boundaries penetrated; and
 - iii) The integrity of the machinery space or galley boundaries is maintained at the penetrations;
- or
- iv) The ducts where they pass through a machinery space of category A or a galley are constructed of steel in accordance with 5-1-1/5.29i) and 5-1-1/5.29iv); and
 - v) Are insulated to “A-60” standard within the machinery space or galley.

5.33 (2011)

Ventilation ducts having an internal cross-sectional area greater than or equal to 0.02 m² (0.22 ft²) penetrating “B” class bulkheads are to be steel or lined with steel sheet sleeves at least 1.8 mm thick and at least 900 mm (35.4 in.) long (preferably 450 mm (17.7 in.) on each side of the division). Ventilation ducts having an internal cross-sectional area less than 0.02 m² (0.22 ft²) are to be steel or lined with steel sheet sleeves at least 1.8 mm (0.07 in.) thick and at least 200 mm (7.88 in.) long (preferably 100 mm (3.93 in.) on each side of division). See 5-1-1/Figure 4.

FIGURE 4
Ventilation Ducts Penetrating “B” Class Divisions (2011)



L = 450 mm for sectional area of 200 cm² or more
 = 100 mm for sectional area of less than 200 cm²

5.35

Exhaust ducts from galley ranges are to be “A” class fire division integrity or equivalent where they pass through accommodation spaces or spaces containing combustible materials.

5.37 (2012)

Each galley exhaust duct is to be fitted with:

- i) A grease trap readily removable for cleaning;
- ii) A fire damper located in the galley end of the duct which is automatically and remotely operated and, in addition a remotely operated fire damper located in the exhaust end of the duct;
- iii) Arrangements, operable from within the galley, for shutting off the exhaust fans; and
- iv) Fixed means for extinguishing a fire within the duct.

5.39

All ventilation systems’ main inlets and outlets are to be capable of being closed from outside the space being ventilated.

5.41

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

5.43

Windows and sidescuttles in boundaries which are required to meet an “A-60” standard which face the drill floor area are to be:

- i) Constructed to an “A-60” standard; or
- ii) (1999) Protected by a water curtain system on the exposed wall. The water curtain system should be designed to provide a discharge rate of 6.0 liters per minute per square meter (0.15 gpm per square foot); or
- iii) Fitted with shutters of steel or equivalent material.

5.45

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

5.47 (2012)

In addition to the air balancing openings as permitted in 5-1-1/5.5, air balancing ducts (jumper ducts) may be fitted only when all the following conditions are complied with:

- i) The air balancing ducts are connecting two service spaces or a service space with a machinery space other than a Category A machinery space or two machinery spaces other than Category A machinery spaces.
- ii) The spaces connected are located outside the accommodation deckhouse.
- iii) The air balance duct is 3 mm (0.12 in.) thick, 900 mm (35.4 in.) long (preferably 450 mm (17.7 in.) on each side) and fitted with a fire damper close to the boundary penetrated.
- iv) The fire damper is to be automatically operated upon detection of smoke in any of the spaces connected and remotely operated from a normally manned control station where the fire-detection main indicator board for the spaces concerned is located. In addition, the fire damper is to be capable of being closed locally.

Air balancing openings between hazardous areas, such as openings between mud tank room and mud tanks, will be specially considered.

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CHAPTER 2 Active Fire Protection Systems and Equipment

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CHAPTER 2 Active Fire Protection Systems and Equipment

SECTION 1 General

1 Governmental Authority (1999)

Attention is drawn to the appropriate governmental authority in each case, as there may be additional requirements, depending on the size, type and intended service of the unit, as well as other particulars and details. Consideration will be given to fire extinguishing systems which comply with the published requirements of the governmental authority in which the unit is to be registered, as an equivalent alternative or addition to the requirements of this section.

3 Plans and Specifications

3.1 General

The following plans together with supporting data and particulars are to be submitted.

- Arrangement and details of fire main systems
- Foam smothering systems
- Other fire extinguishing arrangements.
- Fire control plans
- Fire detection systems
- Fixed fire extinguishing systems
- Fire extinguishing appliances
- Control station for emergency closing of openings and stopping machinery
- Gas detection systems
- Fireman's outfits
- (2010) The most severe service condition for the operation of the emergency fire pump (e.g., lightest draft as shown in Trim and Stability Booklet, etc.)
- (2010) Calculations and pump data demonstrating that the emergency fire pump system can meet the operational requirements specified in 5-2-2/1.1 with the proposed pump location and piping arrangements (e.g., adequate suction lift, discharge pressure, capacity, etc.) at the most severe service condition

3.3 Fire Control Plans (2013)

Fire control plans are to be permanently exhibited for the guidance of operating personnel, showing clearly for each deck provision, location, controls and particulars, as applicable, of the following:

- i) Locations of fire control stations
- ii) Various fire sections enclosed by various classes of fire divisions
- iii) Arrangement of fire detectors and manual fire alarm stations
- iv) Arrangement of combustible gas detectors

- v) Arrangement of hydrogen sulfide gas detectors
- vi) Locations of respiratory protection equipment for hydrogen sulfide
- vii) General alarm actuating positions
- viii) Arrangement of various fire-extinguishing appliances
- ix) Locations of firefighter's outfits
- x) Location of helicopter crash kit
- xi) Arrangement of water spray nozzles and sprinklers (if fitted)
- xii) Locations of emergency shutdown (such as oil fuel source shutdown, engine shutdown, etc.) stations
- xiii) The Ventilating system including fire dampers positions, ventilating fans control positions with indication of identification numbers of ventilating fans serving each section
- xiv) Arrangement of fire/watertight doors and their remote control positions
- xv) Blowout preventer control positions
- xvi) Escape route and means of access to different compartments, decks, etc.
- xvii) Locations of Emergency Escape Breathing Devices (EEBD); and
- xviii) Arrangement of emergency muster stations and life-saving appliances.

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CHAPTER 2 Active Fire Protection Systems and Equipment

SECTION 2 Fixed Fire Fighting Systems

1 Fire Main Systems

1.1 Fire Pumps

1.1.1 Number of Pumps (2012)

There are to be at least two independently-driven fire pumps. The pumps, their source of power, and piping and valves are to be arranged so that a fire in any one compartment will not put all fire pumps out of action. See 4-2-6/25 for raw water systems in self-elevating units.

1.1.2 Location of Pumps

1.1.2(a) Location. The two main fire pumps are to be in separate compartments having no direct access between them. Where this is impracticable, special consideration will be given to accesses as follows,

- i)* A watertight door capable of being operated locally from both sides of the bulkhead, and from a safe and accessible location outside of these spaces. For unattended propulsion machinery space operation, this door is to be operable from the fire fighting station; or
- ii)* An air lock consisting of two gastight steel doors. The doors are to be self-closing without any hold back arrangements.
- iii)* In addition to the arrangements specified in *i)* or *ii)* above, a second protected means of access is to be provided to the space containing the fire pumps.

Common boundaries are to be at least A-0 construction, except if more than one bulkhead or deck is common, the boundaries are to be at least A-60 construction.

1.1.2(b) Remote Operation. Valves and pumps in the fire-fighting system which are not readily accessible are to be provided with means for remote operation.

1.1.3 Type of Pumps

Sanitary, ballast, bilge or general-service pumps may be accepted as one of the fire pumps, provided that they are not normally used for pumping oil and that if they are subject to occasional duty for the transfer or pumping of fuel oil, suitable changeover arrangements are fitted.

1.1.4 Pressure (1996)

The pressure for the purpose of determining fire pump capacity in accordance with 5-2-2/1.1.5(a) is to be at least 3.5 bar (3.5 kgf/cm², 50 psi) at the hydrant.

The maximum pressure at any hydrant shall be such that the effective control of a fire hose can be demonstrated.

1.1.5 Pump Capacity

1.1.5(a) General (2017). Each of the fire pumps required by 5-2-2/1.1.1 is to have a capacity sufficient to deliver, while maintaining the pressure specified in 5-2-2/1.1.4, two jets of water from nozzles that are connected to the two hydrants at which the pressure drop from the fire pump discharge pressure will be the greatest.

Where a fire pump is utilized for the foam system provided for helicopter deck protection, the pump is also to be capable of maintaining a pressure at the foam station as specified in 5-2-3/9.3.4. If the water consumption for any other fire protection or fire-fighting purposes exceed the rate of the helicopter deck foam installation, this consumption is to be the determining factor in calculating the required capacity of **each of the** fire pumps.

In no case is the single pump capacity to be less than 25 m³/hr (110 gal/min.).

1.1.5(b) Ship-Type Drilling Units.

- i) Total Pump Capacity.* For ship-type units, the fire pumps required by 5-2-2/1.1.1 are to be capable of delivering for fire-fighting purposes a quantity of water, at the appropriate pressure prescribed, not less than four-thirds of the quantity required under 4-2-4/7.3 to be dealt with by each of the independent bilge pumps when employed on bilge pumping, using in all cases L = length of the unit as defined in 3-1-1/3 of the *ABS Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*, except that the total required capacity of the fire pumps need not exceed 180 m³/hr (792 gal/min.).
- ii) Individual Pump Capacity.* Each of the fire pumps required by 5-2-2/1.1.1 is to have a capacity not less than 80% of the total required capacity divided by the number of required pumps but not less than that required by 5-2-2/1.1.5(a) above. Where more pumps than required are installed, their capacity will be subject to special consideration.

1.1.6 Relief Valves

In conjunction with all fire pumps, relief valves are to be provided if the pumps are capable of developing a pressure exceeding the design pressure of the water-service pipes, hydrants and hoses. These valves are to be so placed and adjusted as to prevent excessive pressure in any part of the fire main system. In general, the relief valve is to be set to relieve at no greater than 1.7 bar (1.75 kgf/cm², 25 psi) in excess of the pump pressure necessary to maintain the requirements of 5-2-2/1.1.4.

1.1.7 Water Supply (2013)

1.1.7(a) Water Supply Sources. At least two water supply sources (sea chests, valves, strainers and pipes) are to be provided and so arranged that one supply source failure will not put all supply sources out of action.

1.1.7(b) Additional Measures. For self-elevating units, the following additional fire water supply measures are to be provided:

- i)* Water is to be supplied from sea water main filled by at least two submersible pumping systems. One system failure will not put the other system(s) out of function, and
- ii)* Water is to be supplied from drill water system while unit is lifting or lowering. Water stored in the drill water tank(s) is to be not less than 40 m³ (10567 gallons) plus engine cooling water consumption before unit lifting or lowering. Alternatively, water may be supplied from buffer tank(s) in which sea water stored is not less than the quantity as the above mentioned.

1.1.8 Pressurized Main Water Supply

Where fire pumps take suction from a pressurized water main system (i.e., a system not utilizing an intermediate tank supply as on self-elevating units), precautions are to be taken to ensure that an adequate supply of water is maintained. The arrangement of water supply, their source of power, valves, their control means and piping are to be arranged so that a fire in one compartment will not jeopardize the essential supply of water.

1.3 Fire Main

1.3.1 Size

The diameter of the fire main and water-service pipes is to be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously, except that the diameter need only be sufficient for the discharge of 140 m³/hr (616 gal/min.).

1.3.2 Cocks or Valves

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

1.3.3 Isolation (2013)

Isolating valves and other arrangements, as necessary, are to be provided so that if a fire pump and its associated piping within its compartment are rendered inoperable, the fire main can be pressurized with a fire pump located in another compartment.

In addition, the fire main is to be provided with isolation valves located such that damage to any part of the system (e.g., by fire or explosion) would result in the loss of a minimum number of hydrants, water spray branches or foam water supplies, as practicable, and permit the optimum utilization of the remaining fire main.

1.3.4 Cold Weather Protection

Fire main systems are to be provided with drains, circulation loops or other means for cold weather protection.

1.3.5 Materials (1997)

Materials readily rendered ineffective by heat are not to be used for fire mains unless adequately protected. In order to be considered not “readily rendered ineffective by heat”, a component is to be certified as having passed an applicable recognized fire test, or the material is to have a melting temperature higher than the test temperature specified in an applicable fire test.

1.3.6 Connections (2009)

In general, the fire main should not have connections other than those necessary for fire fighting purposes. Connections to non-continuous services will be specially considered on the basis of the fire main system being able to supply the required fire fighting services in conjunction with simultaneous operations of the other connected services. Isolation valves are to be installed for all open deck fire main branches used for purposes other than fire fighting.

1.5 Hydrants, Hoses and Nozzles

1.5.1 Hydrants (1997)

The number and position of the hydrants are to be such that at least two jets of water not emanating from the same hydrant, one of which is to be from a single length of hose, may reach any part of the unit normally accessible to the passengers or crew while the unit is being navigated.

The pipes and hydrants are to be so placed that the fire hoses may be easily coupled to them. In units where equipment or stores may be carried on deck, the positions of the hydrants are to be such that they are always readily accessible and the pipes are to be arranged, as far as practicable, to avoid risk of damage by such equipment or stores.

Materials readily rendered ineffective by heat are not to be used for hydrants. See 5-2-2/1.3.5.

1.5.2 Hoses (2012)

Each of the hydrants required by 5-2-2/1.5.1 is to be provided with a fire hose complete with couplings and nozzles. Additionally, at least one complete fire hose assembly is to be carried as a spare.

Fire hoses are to be certified by a competent independent testing laboratory as being constructed of nonperishable material to recognized standards. Fire hoses are to have a length of at least 10 m (33 ft), but not more than:

- i) 15 m (50 ft) in machinery spaces;
- ii) 20 m (66 ft) in other spaces and open decks; and
- iii) 25 m (82 ft) for open decks with a maximum width in excess of 30 m (98 ft).

Each hose is to be provided with a dual purpose nozzle in accordance with 5-2-2/1.5.3 and necessary couplings. Fire hoses together with any necessary fittings and tools are to be kept ready for use in conspicuous positions near the water-service hydrants or connections.

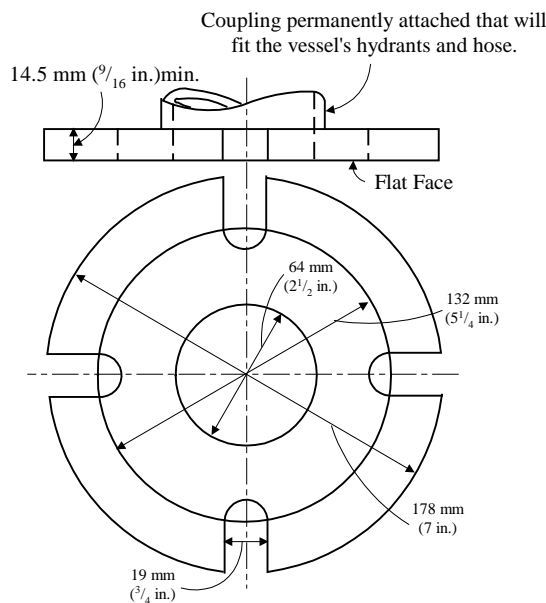
1.5.3 Nozzles (2013)

Dual purpose combined jet spray nozzles are to be fitted throughout the unit with a minimum nozzle diameter of 12 mm (1/2 in.) for accommodation and service spaces and with a maximum diameter of 19 mm (3/4 in.) for machinery spaces and exterior locations. Fire hose nozzles of plastic type material such as polycarbonate may be accepted, subject to review of their capacity and serviceability as marine use fire hose nozzles.

1.5.4 International Shore Connection

For surface type units, at least one international shore connection, as shown in 5-2-2/Figure 1, is to be provided and kept aboard the unit together with gasket, bolts and eight washers. Facilities are to be available enabling such a connection to be used on either side of the unit.

FIGURE 1
International Shore Connection



Bolts: 4, each of 16 mm (5/8 in.) diameter, 50 mm (2 in.) in length
 Flange Surface: Flat face
 Material: Any suited for 10 bar (10.5 kgf/cm², 150 psi)
 Gasket: Any suited for 10 bar (10.5 kgf/cm², 150 psi) service

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CHAPTER 2 Active Fire Protection Systems and Equipment

SECTION 3 Additional Fixed Fire Fighting Systems

1 Fixed Fire Fighting Systems (2013)

1.1 Spaces Containing Specific Equipment (2014)

A fixed firefighting system complying with 5-2-3/3, 5-2-3/5 or 5-2-3/7 is to be provided in each space containing the following equipment:

- i)* Main or auxiliary oil-fired boilers and other processes of equivalent thermal rating.
- ii)* Oil fuel units (as defined by 5-3-1/9.7)
- iii)* Internal combustion machinery used for main propulsion
- iv)* Internal combustion machinery used for purposes other than main propulsion having a total power output of not less than 750 kW (1000 hp).
- v)* Settling tanks for boilers
- vi)* Equipment with oil filled capacitors.

Where a fixed fire extinguishing system not required by *i)* through *v)* is installed, such system is to meet the applicable requirements of 5-2-3/3, 5-2-3/5, or 5-2-3/7 and is to be submitted for approval.

1.3 Drilling and Industrial Areas (2015)

1.3.1 Fixed Fire Extinguishing Systems on Drilling Area and Temporary Well Test Area (2017)

The Drilling Area is the drill floor area extending to each corner of the derrick **including choke & kill manifold**. The following firefighting arrangement is to be provided for the area:

- i)* A fixed water spray system is to be provided to protect drilling area **and temporary well test area**. The minimum water application rate is not less than 20.4 l/min/m² (0.5 gpm/ft²), or
- ii)* At least two dual-purpose (jet/spray) fire monitors are to be installed to cover drilling, **well test area, and temporary well test area**. The minimum capacity of each monitor is not less than 100 m³/h (440 gpm). The monitors may be operated either remotely or locally. Monitor arranged for local operation should be sited on an accessible protected position.

1.3.2 Fixed Fire Extinguishing Systems on Mud Processing Area

The Mud Processing Area includes:

- i)* Spaces occupied by the open mud circulating system which contain hazardous areas, such as spaces containing gumbo box, shale shaker, degasser, desander, desilter, centrifuge, mud cleaner, etc.
- ii)* Spaces with open-top mud pits which will be used for oil-based mud.

The following firefighting arrangement is to be provided for the area:

A suitable fixed foam system is to be provided. The system is to be capable of delivering foam solution at a rate of not less than 6.5 l/min/m² (0.16 gpm/ft²) [(4.1 l/min/m² (0.10 gpm/ft²) 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 areas.

3 Gas Smothering

3.1 General

3.1.1 Storage (2013)

Where the gas smothering medium is stored outside of the protected space, the storeroom is to be situated in a safe and readily accessible position and is to be effectively ventilated by a ventilation system independent of all other spaces.

Spaces for storage of cylinders or tanks for extinguishing gas are not to be used for other purposes. These spaces are not to be located forward of the forward collision bulkhead, when fitted. Access to these spaces is to be possible from the open deck. Spaces situated below the deck are to be located no more than one deck below the open deck.

Spaces where entrance from the open deck is not provided or which are located below deck are to be fitted with mechanical ventilation. The exhaust duct (suction) is to be lead to the bottom of the space. Such spaces are to be ventilated with at least six air changes per hour.

3.1.2 Design (2017)

Containers and associated pressure components are to be designed based upon an ambient temperature of 55°C (131°F).

For CO₂ fire extinguishing systems, the wall thickness of steel piping is to be suitable for the pressure and not less than the thickness identified in 5-2-3/Table 1. Column A is for piping from storage containers to distribution station, and column B is for piping from distribution station to nozzles. For other fixed gas fire extinguishing systems, calculations showing compliance with 4-2-2/5.7 are to be submitted for approval.

Where the fire-extinguishing medium is used as the power source for the pre-discharge alarm, the piping to the alarm is to comply with Column B of 5-2-3/Table 1.

The relief valve of a CO₂ fire extinguishing system is to discharge outside of the CO₂ container storage compartment, in a safe area. **In addition, in piping sections where valve arrangements introduce sections of closed piping, such sections are to be fitted with a pressure relief valve and the outlet of the valve is to be led to open deck.**

Gray cast iron piping components are not to be used for fixed gas fire extinguishing systems. **All discharge piping, fittings and nozzles in the protected spaces are to be constructed of materials having a melting temperature which exceeds 925°C (1697°F). The piping and associated equipment are to be adequately supported.**

Threaded joints in CO₂ systems are to be allowed only inside protected spaces and in CO₂ cylinder rooms.

TABLE 1
Minimum Steel Pipe Wall Thickness for CO₂
Medium Distribution Piping (2013)

Nominal size, mm	OD mm	A mm	B mm	Nominal size, in.	OD in.	A in.	B in.
15	21.3	2.8	2.6	1/2	0.840	0.110	0.102
20	26.9	2.8	2.6	3/4	1.050	0.110	0.102
25	33.7	4.0	3.2	1	1.315	0.157	0.126
32	42.4	4.0	3.2	1 1/4	1.660	0.157	0.126
40	48.3	4.0	3.2	1 1/2	1.9	0.157	0.126
50	60.3	4.5	3.6	2	2.375	0.177	0.142
65	76.1	5.0	3.6	2 1/2	2.875	0.197	0.142
80	88.9	5.5	4.0	3	3.5	0.220	0.157
90	101.6	6.3	4.0	3 1/2	4.0	0.248	0.157
100	114.3	7.1	4.5	4	4.5	0.28	0.177
125	139.7	8.0	5.0	5	5.563	0.315	0.197
150	168.3	8.8	5.6	6	6.625	0.346	0.22

Notes:

- 1 The above minimum thicknesses are derived from those thicknesses available in ISO 4200 Series 1 (OD), JIS (N.P.S.), or ASTM (N.P.S.). Diameter and thickness according to other recognized standards will be accepted.
- 2 For threaded pipes, where approved, the thickness is to be measured to the bottom of the thread.
- 3 The internal surface of pipes outside of the engine room is to be galvanized.
- 4 For larger diameters the minimum wall thickness will be subject to special consideration by ABS.
- 5 In general, the minimum thickness is the nominal wall thickness and no allowance need be made for negative tolerance or reduction in thickness due to bending.

3.1.3 Alarm (1995)

(2017) Means are to be provided for automatically giving audible and visual warning of the release of fire extinguishing gas into any space to which personnel normally have access. **The audible alarms are to be located so as to be audible throughout the protected space with all machinery operating, and the alarms are to be distinguished from other audible alarms by adjustment of sound pressure or sound patterns.** The alarm is to operate for at least a 20 second period before the gas is released. Alarms may be pneumatically (by the extinguishing medium or by air) or electrically operated.

3.1.3(a) Electric. If electrically operated, the alarms are to be supplied with power from the main and an emergency source of electrical power.

3.1.3(b) Pneumatic. If pneumatically operated by air, the air supply is to be dry and clean, and the supply reservoir is to be automatically kept charged at all times and is to be fitted with a low pressure alarm. The air supply may be taken from the starting air receivers. Any stop valve fitted in the air supply line is to be locked or sealed in the open position. Any electrical components associated with the pneumatic system are to be powered from the main and an emergency source of electrical power.

3.1.3(c) Uninterruptible Power Supply (2013). For fire extinguishing systems that protect the machinery space containing the main source of power, instead of the power supply arrangements required above for electrically operated alarms and electrical components associated with pneumatic alarms, an uninterruptible power supply which is supplied with power from the emergency switchboard is to be provided.

3.1.4 Controls

Except as otherwise permitted herein two independent manual control arrangements are to be provided, one of them being positioned at the storage location and the other in a readily accessible position outside of the protected space.

3.3 Carbon Dioxide Systems (2013)

In addition to the applicable requirements of 4-7-3/3.3 of the *Steel Vessel Rules*, fixed carbon dioxide fire extinguishing systems are to be in accordance with Chapter II-2, Regulations 10.4.2 and 10.4.3 of the International Convention for the Safety of Life at Sea (SOLAS) 1974 and Amendments in force, and with Chapter 1.4 and Chapter 5 of the International Code for Fire Safety Systems. Fixed low pressure carbon dioxide systems are to be in accordance with 4-7-3/3.5 of the *Steel Vessel Rules*.

5 Foam

5.1 Fixed High Expansion Foam Systems (1 July 2009)

In addition to the applicable requirements of the Rules, fixed high expansion foam systems are to be in accordance with Chapter 6.2.1 and 6.2.2 of the International Code for Fire Safety Systems.

Fixed foam fire-extinguishing systems using inside air are to be designed, constructed and tested in accordance with the requirements identified in MSC.1/Circ. 1271 *Guidelines for the Approval of High-Expansion Foam Systems Using Inside Air for the Protection of Machinery Spaces and Cargo Pump-Rooms*.

Foam concentrates are to be of an approved type.*

* *Note:* Reference is made to the International Maritime Organization MSC/Circular 670 “Guidelines for the Performance and Testing Criteria, and Surveys of High-Expansion Foam Concentrates for Fixed Fire-Extinguishing Systems.”

5.3 Low Expansion Foam System

5.3.1 Application

Low expansion foam systems may be fitted in machinery spaces in addition to the required fixed fire extinguishing system.

5.3.2 Design (1998)

In addition to the applicable requirements of the Rules, fixed low expansion foam systems are to be in accordance with Chapter 6.2.1, 6.2.2, and 6.2.3 of the International Code for Fire Safety Systems. Foam concentrates are to be of an approved type.**

** *Note:* Reference is made to the International Maritime Organization MSC/Circular 582 “Guidelines for the Performance and Testing Criteria, and Surveys of Low-Expansion Foam Concentrates for Fixed Fire-Extinguishing Systems.”

7 Fixed Pressure Water Spraying and Automatic Sprinkler Systems (2017)

In addition to the applicable requirements of the Rules, fixed water spraying systems and automatic sprinkler systems are to be in accordance with Chapters 7 and 8 of the International Code for Fire Safety Systems.

8 Clean Agent Fire Extinguishing Systems (2013)

Fixed gas fire-extinguishing systems equivalent to those specified in 5-2-3/3 through 5-2-3/7 are to be submitted for approval, based on the guidelines specified in the IMO MSC/Circ. 848 as amended by MSC/Circ. 1267 and this subsection.

Fire extinguishing systems using Halon 1211, 1301, and 2402 and perfluorocarbons are prohibited. The use of a fire-extinguishing medium, which either by itself or under expected conditions of use gives off toxic gases, liquids and other substances in such quantities as to endanger persons, is not permitted.

8.1 Fire Suppression Agent

The agent is to be recognized as a fire extinguishing medium by NFPA Standard 2001 or other recognized standard. The minimum extinguishing concentration for net volume total flooding of the protected space at the lowest expected operating temperature, but not greater than 0°C (32°F), is to be determined by an acceptable cup burner test. The minimum design concentration is to be at least 30% above the minimum extinguishing concentration and is to be verified by full-scale test (see 5-2-3/8.3).

The fire extinguishing agent is to be acceptable for use in occupied spaces by U.S. EPA or other recognized organization. The concentrations for cardiac sensitization NOAEL (No Observed Adverse Effect Level), LOAEL (Lowest Observed Adverse Effect Level) and ALC (Approximate Lethal Concentration) are to be submitted.

8.3 Fire Tests

The system is to pass the fire tests in the Appendix of the IMO MSC/Circ. 848 as amended by MSC/Circ. 1267. The testing is to include the system components.

The system is to pass an additional fire test (number 1 in the Appendix of MSC/Circ. 848) with the agent storage cylinder at the lowest expected operating temperature, but not greater than 0°C (32°F).

8.5 System Components

The system is to be suitable for use in a marine environment. Major components (valves, nozzles, etc.) are to be made of brass or stainless steel, piping is to be corrosion resistant (stainless steel or galvanized) and the material is to have a melting point of not less than 927°C (1700°F).

The system and its components are to be designed, manufactured and installed in accordance with recognized standards.

Containers and associated pressure components are to be designed based upon an ambient temperature of 55°C (131°F).

Minimum wall thickness for distribution piping is to be in accordance with 5-2-3/Table 1 (Columns A or B, as applicable).

8.7 System Installation

8.7.1 Storage

As far as practicable, the fire suppression agent is to be stored outside the protected space in a dedicated storeroom. The storeroom is to be in accordance with 5-2-3/3.1.1, except that when mechanical ventilation is provided, the location of the exhaust duct (suction) is dependent on the density of the agent relative to air.

When allowed by the flag Administration, the fire suppression agent may be stored inside the protected space. In addition to the related instructions from the flag Administration, the installation is to be in accordance with paragraph 11 of IMO MSC/Circ. 848 as amended by MSC.1/Circ. 1267.

In the case of new installation in existing units, the storage of the fire suppression agent within a low fire risk space with a net volume at least two (2) times greater than the net volume of the protected space may be specially considered, based on the type of agent and the possible hazards for the personnel within the space.

8.7.2 Alarm

An audible and visual predischarge alarm in accordance with 5-2-3/3.1.3 and paragraph 6 of IMO MSC/Circ. 848 as amended by MSC.1/Circ. 1267 is to be provided.

8.7.3 Controls (2017)

Except as otherwise permitted herein two independent manual control arrangements are to be provided, one of them being positioned at the storage location and the other in a readily accessible position outside of the protected space.

Automatic actuation is not permitted when the protected space is normally **manned or interferes with the safety navigation of the vessel**. If the protected space is **normally unmanned and may be entered occasionally for brief periods such as** for repairs, maintenance **or other purpose**, automatic actuation may be allowed in addition to manual actuation, provided that the following conditions are met

- i) The egress from the protected space is horizontal. **Exit doors from the spaces are to be outward-swinging self-closing doors (i.e., opening in the direction of escape routes) which can be opened from the inside, including when the doors are locked from the outside.**
- ii) Notices that the space is protected by an automatic activation system are prominently posted at the entrance to the space.
- iii) A switch is provided near the entrance to disable the automatic release feature of the system. The switch is to have an indicator of its status such as red pilot light to indicate when the switch is activated (automatic release feature disabled). A sign is to be posted near the switch indicating that the automatic release feature is to be disabled when the space is occupied and that the automatic actuation is to be enabled when leaving the space. The sign is to also indicate that the manual release of the system remains enabled and the space is to be vacated immediately when the release alarm sounds.
- iv) When the automatic release feature is disabled, all other controls, alarms, etc., are to remain activated.
- v) An indicator at the control console is provided to indicate when the automatic release feature has been disabled.
- vi) **The medium release warning alarm is to operate for the length of time needed to evacuate the space, but in no case less than 30 seconds for space exceeding 6000 ft³ (170 m³) and 20 seconds for spaces 6000 ft³ (170 m³) or less before the medium is released.**
- vii) **The automatic release of a clean agent fire extinguishing system is to be approved by the vessel's flag Administration.**

8.7.4 Nozzles

The nozzle type, maximum nozzle spacing, maximum height and minimum nozzle pressure are to be within the limits to provide fire extinction as tested and verified in the appropriate fire test (see 5-2-3/8.3).

9 Protection of Helicopter Decks and Refueling Facilities (2011)

9.1 General

Where areas of a unit are designated for helicopter operations, details of the facilities are to be submitted and the firefighting systems of 5-2-3/9.3 are to be provided and stored near the access to those areas.

Deckhouse tops directly below helicopter decks are to have no openings. See 4-2-6/17 for helicopter deck drainage.

A firefighting system as required by 5-2-3/9.3 is to be provided and arranged so as to adequately protect both the helicopter deck and helicopter fuel storage areas where provided, see 4-2-6/7 for the fuel storage requirements.

9.3 Firefighting Systems

9.3.1 Hoses and Nozzles

At least two approved combination solid stream and water spray nozzles and detachable applicators and hoses sufficient in length to reach any part of the helicopter deck are to be provided.

9.3.2 Portable Extinguishers (2017)

The helicopter deck area is to be protected by at least two approved dry powder extinguishers of a total capacity of not less than 45 kg (100 lb) , **but not less than 9 kg each (see 5-2-4/Table 1 for semi-portable extinguishers)**. At least one portable extinguisher is to be located at each helicopter deck access point.

9.3.3 Back-up System

A back-up firefighting system is to be provided, consisting of CO₂ extinguishers of a total capacity of not less than 18 kg (40 lb) or equivalent, one of these extinguishers being equipped so as to enable it to reach the engine area of any helicopter using the deck. The back-up system is to be located so that the equipment would not be vulnerable to the same damage as the dry powder extinguishers required by 5-2-3/9.3.2.

9.3.4 Fixed-Foam System (2013)

A fixed-foam fire-extinguishing system consisting of monitors or hose streams or both is to be installed to protect the helicopter landing area in all weather conditions in which helicopters can operate and fuel storage areas, when provided onboard. The helicopter landing area is the area contained within a circle of diameter “D” where “D” is the distance across the main rotor and tail rotor in the fore and aft line of a helicopter with a single main rotor and across both rotors for a tandem rotor helicopter or the full area of the deck, whichever is less. The system is to be capable of delivering foam solution at a rate of 6.0 liters per square meter per minute (0.15 gpm per square foot) of the areas protected for at least five minutes. The pump is to be capable of maintaining a pressure of 7 bar (7 kgf/cm², 100 psi) at the foam installation. The foam agent is to meet the performance standards for Level B foam in the International Civil Aviation Organization’s Airport Services Manual (Part 1 Chapter 8, Paragraph 8.1.5, Table 8-1) and be suitable for use with sea water. Foam delivery at the minimum application rate is to start within 30 seconds of system activation.

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

9.3.5 Deck Integrated Fire Fighting System (DIFFS) (2015)

When permitted by the flag Administration, a deck integrated fire fighting system (DIFFS) may be provided as an alternative to the fixed-foam fire-extinguishing system protecting the helicopter landing area. DIFFS typically consist of a series of 'pop-up' nozzles, with both a horizontal and vertical component, designed to provide an effective spray distribution of foam to the whole of the landing area. DIFFS is to be capable of supplying performance level B foam solution at an application rate and for a duration which at least meets the minimum requirements stated in 5-2-3/9.3.4 above.

DIFFS performance criteria need to consider several pop-up nozzles rendered ineffective by the impact of a helicopter on the landing area. The number of pop-up nozzles rendered ineffective by a crash situation will depend on the pattern (spacing) of the nozzle arrangement and the type(s) of helicopters operating to the helicopter deck, but not less than 15% of the nozzles installed. The remaining pop-up nozzles are to be capable of delivering finished foam to the landing area at or above the minimum application rate, considering the individual supply pipes to the damaged pop-up nozzles ruptured.

DIFFS activation is to be initiated manually. Activation controls are to be located in at least two positions having immediate access to the helicopter landing area and separated as far as practicable. Foam delivery at the minimum application rate is to start within 30 seconds of system activation.

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

Where a DIFFS is used in tandem with a passive fire-retarding system demonstrated to be capable of removing significant quantities of unburned fuel from the surface of the helideck in the event of a fuel spill from a ruptured aircraft tank, it is permitted to select a seawater-only DIFFS to deal with any residual fuel burn. A seawater-only DIFFS, when permitted by the Flag Administration, is to meet the same application rate and duration as specified for a performance level B foam DIFFS in paragraphs 2.10 and 2.11 of CAP 437, as stated in this paragraph and 5-2-3/9.3.4 above.

11 Paint and Flammable Liquid Lockers (2001)

Paint and flammable liquid lockers or any similar service spaces used for the storage of flammable liquids (such as solvents, adhesives, lubricants etc.) are to be protected by a fire-extinguishing arrangement enabling the crew to extinguish a fire without entering the space. Unless required or permitted otherwise by the flag Administration, one of the following systems is to be provided:

11.1 Lockers of 4 m² (43 ft²) or More Floor Area and Lockers with Access to Accommodation Spaces

Paint lockers and flammable liquid lockers of floor area 4 m² (43 ft²) or more and also such lockers of any floor area with access to accommodation spaces are to be provided with one of the fixed fire-extinguishing systems specified below:

- i) CO₂ system, designed for 40 % of the gross volume of the space
- ii) Dry powder system, designed for at least 0.5 kg/m³ (0.03 lb/ft³)
- iii) Water spraying system, designed for 5 liters/m²/minute (0.12 gpm/ft²). The water spraying system may be connected to the unit's fire main system, in which case the fire pump capacity is to be sufficient for simultaneous operation of the fire main system as required in 5-2-2/1.1.5 and the water spray system. Precautions are to be taken to prevent the nozzles from being clogged by impurities in the water or corrosion of piping, nozzles, valves and pump.
- iv) Systems or arrangements other than those referenced above may be also considered, provided they are not less effective.

11.3 Lockers of Less Than 4 m² (43 ft²) Floor Area Having no Access to Accommodation Spaces

For paint lockers and flammable liquid lockers of floor area less than 4 m² (43 ft²) having no access to accommodation spaces, portable fire extinguisher(s) sized in accordance with 5-2-4/1.1 and which can be discharged through a port in the boundary of the lockers may be accepted. The required portable fire extinguishers are to be stowed adjacent to the port. Alternatively, a port or hose connection may be provided for this purpose to facilitate the use of water from the fire main.

13 Spaces Containing Equipment with Oil Filled Capacitors (2014)

Spaces containing equipment with flammable oil filled capacitors are to be provided with any one of the following fixed fire extinguishing systems:

- i) A gas system complying with the provisions of 5-2-3/3; or
- ii) Other approved fire extinguishing system suitable for the equipment voltage hazard.

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CHAPTER 2 Active Fire Protection Systems and Equipment

SECTION 4 Portable Fire Fighting Systems

1 Portable Fire Extinguishers and Sand

1.1 Extinguishers (2012)

As a minimum, portable and semi-portable extinguishers are to be provided in the quantities and locations indicated in 5-2-4/Table 1 and 5-2-4/Table 2. In all cases, the selection of the fire extinguishing medium is to be based on the fire hazard for the space protected. The fire extinguishers are to be visible and readily accessible.

1.3 Sand

On self-propelled units fitted with main or auxiliary oil-fired boilers, each firing space is to be provided with a receptacle containing at least 0.28 m³ (10 ft³) of sand, sawdust impregnated with soda or other dry material suitable for extinguishing oil fires. Alternatively, an approved portable extinguisher may be substituted therefore.

3 Fire-Fighters' Outfit (1993)

3.1 Number (2017)

At least two fire-fighters' outfits, each with portable instruments for measuring oxygen and flammable vapor concentrations acceptable of the Administration, consisting of a breathing apparatus, a lifeline, a safety lamp, an axe, nonconductive boots and gloves, a rigid helmet and protective clothing complying with the requirements of this paragraph are to be kept ready for use in an accessible location that is permanently and clearly marked. They are to be stored in two or more widely separated positions so that a fire in one location would not block access to other outfits.

3.3 Breathing Apparatus

The breathing apparatus is to be of an approved type and may be one of the following:

- i) A smoke helmet or smoke mask with a suitable air pump and a length of air hose sufficient to reach from the open deck, well clear of hatch or doorway, to any part of below deck spaces or machinery spaces. If, in order to comply with this requirement, an air hose exceeding 36 m (120 ft) in length would be necessary, a self-contained breathing apparatus is to be substituted or provided in addition.
- ii) (2016) A self-contained breathing apparatus which is capable of functioning for a period of at least 30 minutes. Other periods of time will be specially considered. At least two spare charges are to be carried for each required breathing apparatus carried onboard. 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 breathing apparatus.

3.5 Recharging of Air Cylinders (2012)

The apparatus for recharging air cylinders, if provided, is to have its power supplied from the emergency supply or be independently diesel-powered, or be so constructed or equipped that the air cylinders may be used immediately after recharging.

The apparatus is to be suitably located in a sheltered space above main deck level on the unit.

Intakes for air compressors are to draw from a source of clean air. The air is to be filtered after compression to eliminate compressor oil contamination.

The recharging capacity is to meet the requirements of SOLAS regulation II-2/10.10.2.6.

3.7 Lifeline

Each breathing apparatus is to have attached to its belt or harness, by means of a snap-hook, a fireproof lifeline of sufficient length and strength.

3.9 Safety Lamp and Axe

A safety lamp (hand lantern) of an approved type and an axe are to be provided. Such safety lamps are to be electric and are to have a minimum burning period of three hours.

3.11 Boots and Gloves

The boots and gloves are to be made of rubber or other electrically nonconductive material.

3.13 Helmet

A rigid helmet is to be supplied which will provide effective protection against impact.

3.15 Protective Clothing

The protective clothing is to be made of material that will protect the skin from the heat of fire and burns from scalding steam. The outer surface is to be water resistant.

3.17 Two-way Portable Radiotelephone (2017)

A minimum of two two-way portable radiotelephone apparatus for each fire party for fire-fighter's communication are to be carried on board. Those two-way portable radiotelephone apparatus are to be of an explosion-proof type or intrinsically safe.

TABLE 1
Classification of Portable and Semi-portable Extinguishers (2012)

Fire extinguishers are designated by types as follows: A, for fires in combustible materials such as wood; B, for fires in flammable liquids and greases; C, for fires in electrical equipment.

Fire extinguishers are designated by size where size II is the smallest and size V is the largest. Size II is a hand portable extinguisher, and sizes III, IV, and V are semi-portable extinguishers.

Classification		Water, liters (U.S. gallons)	Foam, liters (U.S. gallons)	Carbon Dioxide, kg (lb)	Dry Chemical, kg (lb)	Wet Chemical, liters (U.S. gallons)
Type	Size					
A	II	9 (2.5)	9 (2.5)	—	5 (11) ⁽²⁾	9 (2.5)
B	II	—	9 (2.5)	5 (11)	5 (11)	—
B	III	—	45 (12)	15.8 (35)	9.0 (20)	—
B	IV	—	76 (20)	22.5 (50)	22.5 (50)	—
B	V	—	152 (40)	45 (100) ⁽¹⁾	22.5 (50) ⁽¹⁾	—
C	II	—	—	5 (11)	5 (11)	—
C	III	—	—	15.8 (35)	9.0 (20)	—
C	IV	—	—	22.5 (50)	13.5 (30)	—
F or K	II	—	—	—	—	9 (2.5)

Notes:

- 1 For outside use, double the quantity of agent that must be carried.
- 2 Must be specifically approved as type A, B, or C extinguisher.

TABLE 2
Hand Portable Fire Extinguishers and Semi-portable Fire-Extinguishing Systems (2012)

<i>Space</i>	<i>Classification*</i>	<i>Quantity and Location</i>
Accommodation Spaces		
Cabins, lavatories, offices, pantries with no cooking appliances, and similar spaces.	—	None required.
Public spaces	A-II	1 for each 250 m ² (2,691 ft ²) or fraction thereof
Stairway and elevator enclosure	—	None required.
Corridors	A-II	Travel distance to an extinguisher not to exceed 25 m (82 ft) within each deck (May be located in stairways)
Hospital	A-II	1 required.
Service Spaces		
Galleys	B-II	1 for each 250 m ² (2,691 ft ²) or fraction thereof located in vicinity of exits, either inside or outside the spaces (see Note 2).
	F-II or K-II	1 additional for galleys with deep fat fryers
Pantries with cooking appliances and laundry drying rooms	A-II or B-II	1 for each 250 m ² (2,691 ft ²) or fraction thereof suitable for hazards involved.
Paint and lamp rooms	B-II	1 outside each room in vicinity of exit. (See Note 2)
Lockers and storerooms (deck area of 4 m ² or more)	B-II	1 for each 250 m ² (2,691 ft ²) or fraction thereof located in vicinity of exits, either inside or outside the spaces. (See Note 2)
Small lockers and storerooms (deck area less than 4 m ²)	—	None required.
Workshops (not part of machinery spaces, galley) and similar spaces	B-II	1 outside each space in vicinity of an exit. (See Note 2)
Control Stations		
Wheelhouse	A-II or C-II	2 near the exit; 1 only if less than 50 m ² (538 ft ²). (See Note 1)
Control rooms (other than Wheelhouse)	A-II or C-II	1 required
Radio room	C-II	1 outside the space in vicinity of exit. (See Note 2)
Machinery Spaces		
Central control station for propulsion machinery	A-II and/or C-II	1 required; when main switchboards are arranged in central control station, 1 additional suitable for electrical fires
Machinery spaces of Category A	B-II	2 required in each space, in addition to the required for the machinery contained.
Spaces containing oil-fired boilers, either main or auxiliary, or their fuel units	B-V	1 required in each space.
Internal combustion engines or gas turbines with total power output not less than 750 kW (1000 hp).	B-II	1 for each 750 kW (1000 hp) but not less than 2 nor more than 6 in each space.
	B-III	1 required in each space.
Internal combustion engines or gas turbines with total power output less than 750 kW (1000 hp).	B-II	1 outside the space containing engines or turbines in vicinity of exit. (See Note 2)
Electric generators, propulsion motors, thrusters that do not have enclosed ventilating system.	C-II	1 for each motor or generator.
Electric generators, propulsion motors, thrusters that have enclosed ventilating systems.	—	None required.
Main switchboards	C-II	2 required in the vicinity of the switchboards. (See Note 2)
Electric emergency motors or generators	C-II	1 outside the space containing motors or generators in vicinity of exit. (See Note 2)

TABLE 2 (continued)
Hand Portable Fire Extinguishers and Semi-portable Fire-Extinguishing Systems (2012)

<i>Space</i>	<i>Classification*</i>	<i>Quantity and Location</i>
Machinery Spaces (cont'd)		
Steam driven auxiliary machinery	—	None required.
Enclosed space with oil-fired inert gas generators, incinerators and waste disposal units	B-II	2 required in each space.
Separately enclosed room with fuel oil purifiers	—	None required.
Workshops forming part of propulsion machinery spaces and other machinery spaces	B-II or C-II	1 required in each space.
Trunks to machinery spaces	—	None required.
Fuel tanks	—	None required.
Miscellaneous Areas		
Open decks	—	None required.
Lifeboat embarkation and lowering stations and external escape routes	—	None required.
Drill floor	C-II	2 required, one at each exit.
Mud pump room	C-II	1 required.
Mud pits and mud processing areas	B-II	1 for each enclosed space (travel distance to an extinguisher not to exceed 10 m (33 ft) for open space)
Cranes with electric motors/hydraulics	—	None required.
Cranes with internal combustion engines	B-II	2 required, one in cab and one at exterior of engine compartment in vicinity of exit. (See Note 2)
Helicopter landing decks	(See 5-2-3/9.3)	
Helicopter fueling facilities	(See 5-2-3/9.3)	

Notes:

- 1 One of which must be placed inside. If chartroom is adjacent to wheelhouse and with direct access from it, no additional fire extinguisher will be required for the chartroom.
- 2 Vicinity is intended to mean within 1 m (3 ft)
- * See 5-2-4/Table 1.

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CHAPTER 2 Active Fire Protection Systems and Equipment

SECTION 5 Fire and Gas Detection

1 Other Fire Protection Requirements

1.1 Fire Detection and Alarm Systems (2013)

1.1.1 General

1.1.1(a) Application. Spaces having a fire risk, are to be provided with an automatic fire detection and alarm system.

1.1.1(b) Selection of Detectors. In selecting the type of detectors, the following features are to be taken into account:

- i) Capability to detect fire at the incipient stage
- ii) Ability to avoid spurious alarm and trips, and
- iii) Suitability to the located environment

1.1.1(c) Fire Detection Indicating Board Location. The fire detection main indicator board is to be at a manned control station and is to be clearly to indicate where fire has been detected.

1.1.2 Machinery Spaces

Fire detectors are to be fitted in normally unattended machinery spaces. Detection systems using only thermal detectors, in general, are not to be permitted.

1.1.3 Accommodation and Service Spaces

An automatic fire detection and alarm system is to be provided in all accommodation and service spaces.

Accommodation space is to be fitted with smoke detectors. Thermal detectors are to be fitted in galleys.

1.1.4 Electrical Rooms and Control Stations

Smoke detectors are to be provided in all electrical rooms and control stations.

1.1.5 Drilling and Mud Processing Areas

Flame or thermal detectors are to be installed in open drilling and/or mud processing areas.

Smoke detectors may be used in enclosed mud processing areas.

1.1.6 Manually Operated Alarm System

Sufficient manual fire alarm stations are to be installed throughout the accommodation spaces, service spaces, and control stations. One manually operated call point is to be located at each exit. Manually operated call points are to be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m (66 ft) from a manually operated call point.

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

1.3 General Alarm

1.3.1 Overview

A general alarm system is to be provided and so installed as to be clearly perceptible in all parts of the unit. Alarm signal devices are to be provided which will produce a distinctive and strong note.

The signals used should be limited to: general emergency, toxic gas (hydrogen sulfide), combustible gas, fire alarm, and abandon unit signals.

The signals given over the general alarm system should be supplemented by instructions over the public address system.

1.3.2 Locations

At least in the following spaces, the general alarm is to be capable of being operated:

- i)* Main control station
- ii)* Drilling console
- iii)* Navigating bridge (if any), and
- iv)* Fire control station (if any)

1.5 Public Address (2013)

See 4-3-2/15.9.

1.7 Mud Tank Level Alarm

A suitable audible and visual alarm to indicate significant increase or decrease in the level of the contents of the active mud tanks is to be provided, both at the control station for drilling operations and at the mud tank.

1.9 Ventilation System Alarms

See 4-3-6/7 and 4-3-3/9.3.3.

3 Gas Detection and Alarm Systems (2013)

Fixed automatic combustible gas detection and alarm systems are to be provided for the following areas:

- i)* Cellar deck
- ii)* Drill floor
- iii)* Mud pit area
- iv)* Shale shaker area
- v)* Enclosed spaces containing open components of the mud circulation system from the bell nipple to the mud pits.
- vi)* Ventilation intakes of enclosed machinery spaces contiguous to hazardous areas and containing internal combustion engines and boilers, and
- vii)* Ventilation intakes and near other openings of accommodation spaces

The gas detectors are to be connected to an audible and visual alarm system with indicators on the drill floor and at the required emergency control stations (See 5-3-1/7). The alarm system is to clearly indicate the location and concentration of the gas hazard. The combustible gas detectors are to alarm at not more than 25% and at 60% of the lower explosive limit (LEL).

In addition to the fixed automatic gas detection system, two portable combustible gas detectors are to be provided on the unit.

5 Hydrogen Sulfide Detection and Alarm (2013)

5.1 Areas for Protection

A fixed automatic hydrogen sulfide gas detection and alarm system are to be provided for the following areas:

- i) Drill area
- ii) Mud processing area, and
- iii) Well test area

5.3 Alarms

The detectors are to be connected to an audible and visual alarm system with indicators in main control room. The system is clearly to indicate where gas has been detected.

Low level alarm set at 10 ppm and high level alarm set not higher than 300 ppm are to be provided. The high level alarm is to activate an evacuation alarm.

If the alarm at the main control point is unanswered within 2 minutes, the toxic gas (hydrogen sulfide) alarm and the helideck status light is to be automatically activated.

5.5 Portable Hydrogen Sulfide Gas Detectors

At least two portable hydrogen sulfide gas monitoring devices should be provided on the unit.

7 Respiratory Protection Equipment for Hydrogen Sulfide (2013)

7.1 Self-contained Breathing Apparatus (SCBA)

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

7.3 Air Line Breathing Equipment

7.3.1 Details

Positive-pressure/pressure-demand air line breathing equipment coupled with a SCBA-equipped low pressure warning alarm and rated for a minimum of 15 minutes is to be provided for each person on board the unit.

7.3.2 Locations

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

- i) Living quarters
- ii) Muster/evacuation area
- iii) Drilling areas
- iv) Mud processing areas, and
- v) Other working areas

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SECTION 1 General

1 Means of Escape (1993)

1.1

The following requirements are to apply to accommodation spaces, service spaces and control stations:

1.1.1

In every general area that is likely to be regularly manned or in which personnel are accommodated, at least two separate escape routes are to be provided, situated as far apart as practicable, to allow ready means of escape to the open decks and/or embarkation stations. Exceptionally, one means of escape may be considered, taking into account the nature and location of spaces and the number of persons who might normally be accommodated or employed there.

1.1.2

Stairways are to normally be used for means of vertical escape. However, a vertical ladder may be used for one of the means of escape from machinery spaces when the installation of a stairway is shown to be impracticable.

1.1.3

Every escape route should be readily accessible and unobstructed and all exit doors along the route are to be readily operable from both sides. Dead-end corridors exceeding 7 m (23 ft) in length are not permitted.

1.1.4 (2012)

In addition to the emergency lighting, the means of escape in accommodation areas, including stairways and exits, are to be marked by lighting or photoluminescent strip indicators placed not more than 300 mm above the deck at all points of the escape route, including angles and intersections. The marking is to enable personnel to identify the routes of escape and readily identify the escape exits. If electric illumination is used, it is to be supplied by the emergency source of power and it is to be so arranged that the failure of any single light or cut in a lighting strip will not result in the marking being ineffective. Additionally, escape route signs and fire equipment location markings are to be of photoluminescent material or marked by lighting. The lighting or photoluminescent equipment are to be evaluated, tested and applied in accordance with the *International Code for Fire Safety Systems (Resolution MSC.98(73)) (FSS Code)*.

1.3 (2014)

Two means of escape are to be provided from every machinery space of Category A by either of the following:

1.3.1

Two sets of steel ladders as widely separated as practicable leading to doors in the upper part of the space similarly separated and from which access is provided to the open deck. One of these ladders is to be located within a protected enclosure that satisfies 5-1-1/Tables 1 and 2, category (4), from the lower part of the space it serves to a safe position outside the space. Self-closing fire doors of the same fire integrity standards are to be fitted in the enclosure. The ladder is to be fixed in such a way that heat is not transferred into the enclosure through non-insulated fixing points. The enclosure is to have minimum internal dimensions of at least 800 mm by 800 mm, and is to be provided with emergency lighting.

1.3.2

One steel ladder leading to a door in the upper part of the space from which access is provided to the open deck. Additionally, in the lower part of the space and in a position well separated from the ladder referred to, a steel door capable of being operated from each side is to be provided with access to a safe escape route from the lower part of the space to the open deck.

The minimum width between stringers of the above mentioned ladders, or of any other vertical or inclined ladder fitted to provide means of escape within and from machinery spaces, is not be less than 600 mm.

1.5

From machinery spaces other than those of Category A, escape routes are to be provided having regard to the nature and location of the space and whether persons are normally employed in that space.

1.7

Elevators are not to be considered as forming one of the required means of escape.

1.9

At least one escape route from the superstructure and deckhouses to the survival craft embarkation area is to be protected against radiation effects of a drill floor area fire as far as practicable

1.11 (2012)

Stairways and corridors used as a means of escape are to be not less than 700 mm (27.6 in.) in clear width and are to have a handrail on one side. Stairways and corridors with a clear width of 1800 mm (70.9 in.) and over are to have handrails on both sides. Clear width is considered the distance between the handrail and the bulkhead on the other side or between the handrails. The angle of inclination of stairways is to be, in general, 45°, but not greater than 50°, and in machinery spaces and small spaces not more than 60°. Doorways which give access to a stairway are to be of the same size as the stairway.

1.13 (2012)

All materials that comprise the escape routes and muster stations are to be of steel or equivalent material which would not be rendered ineffective by heat. Fiber Reinforced Plastic (FRP) gratings may be considered, provided all conditions listed in Appendix 5-3-A1 are fully met and are accepted by the Flag Administration.

3 Means of Access and Egress (2012)

At least two means of escape from the unit are to be provided. They are to consist of fixed stairways or fixed ladders constructed of steel and extending from the unit to the surface of the water. In the case of self-elevating drilling units, the means of escape will be specially considered. Sufficient personnel landings are to be provided on each unit to assure safe access and egress. When, due to special construction, personnel landings are not feasible, suitable transfer facilities to provide safe access and egress are to be installed.

5 Guards and Rails

5.1 Floor Deck Areas and Openings (2003)

Except for helicopter landing decks, which are provided for in 5-3-1/5.3, and areas not normally occupied, the unprotected perimeter of all floor or deck areas and openings is to be protected with efficient guard rails or bulwarks. The height of the bulwarks or guard rails is to be at least 1 m (39.5 in.) from the deck, except that where this height would interfere with the normal operation of the unit, a lesser height may be considered if adequate protection is provided. Where approval of a lesser height is requested, justifying information is to be submitted, such as arrangements provided to prevent personnel going over the guard rails or bulwarks. The opening below the lowest course of the guard rails is not to exceed 230 mm (9 in.). The other courses are not to have more than 380 mm (15 in.) clear opening. In the case of units with rounded gunwales, the guard rail supports are to be placed on the flat of the deck.

5.3 Helicopter Landing Deck

The unprotected perimeter of the helicopter landing deck is to be provided with safety netting or equivalent.

7 Emergency Control Stations (2017)

At least two emergency control stations are to be provided. One of the stations is to be located near the drilling console and the other station is to be at a suitable manned location outside of the hazardous areas. The control stations are to be provided with the following.

- Manually operated contact makers for actuating the general alarm system.
- An efficient means of communication between these stations and all locations vital to the safety of the unit.
- Emergency shut-down facilities. (See 4-3-5/7.1.1)
- **Gas Detection and Alarm Panel (5-2-5/3)**

9 Arrangements in Machinery Space

9.1 Ventilating Fans and Openings (2011)

9.1.1 General

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

9.1.2 Release of Smoke from Machinery Space

Suitable arrangements are to be made to permit the release of smoke, in the event of fire, from the machinery space of Category A. The normal ventilation may be acceptable for this purpose. The means of control is to be provided for permitting the release of smoke and such control is to be located outside the space concerned so that they will not be rendered inaccessible in the event of fire in the space they serve. See also 4-3-2/5.3.12 and 4-3-3/5.17.1

9.3 Other Auxiliaries (2009)

Machinery driving forced and induced draft fans, electric motor pressurization fans, oil fuel transfer pumps, oil fuel unit pumps and other similar fuel pumps are to be fitted with remote controls situated outside of the space concerned so that they may be manually stopped in the event of a fire arising in the space in which they are located. See 4-3-2/19.1.2.

In addition to the remote shutdowns required above, a means to shut down the equipment is to be provided within the space itself.

9.5 Oil Tank Suction Pipes

Every fuel oil suction pipe from a storage, settling or daily service tank which emanates at such a level that it will be subjected to a static head of oil from the tank is to be fitted with a positive shutoff valve capable of being closed manually from a readily accessible location outside of the space in which the valve is located.

9.7 Oil Fuel Unit (1995)

Oil fuel unit is any equipment, such as pumps, filters and heaters, used for the preparation and delivery of fuel oil to oil-fired boilers (including incinerators and inert gas generators), internal-combustion engines or gas turbines at a pressure of more than 1.8 bar (1.8 kgf/cm², 26 psi).

9.9 Floor Plating in Machinery Spaces of Category A (2014)

The floor plating of normal passageways in machinery spaces of category A shall be made of steel or other equivalent material, including Fiber Reinforced Plastic (FRP) gratings complying with Appendix 5-3-A1.

11 Segregation of Fuel Oil Purifiers (1997)

Fuel oil purifiers for heated oil are to be placed in a separate room or rooms, enclosed by steel bulkheads extending from deck to deck and provided with self-closing doors. In addition, the room(s) is to be provided with the following: (See also 5-3-1/9.1 and 5-3-1/9.3)

- i) Independent mechanical ventilation or a ventilation arrangement which can be isolated from the machinery space ventilation
- ii) Fire detection system
- iii) Fixed fire extinguishing system capable of activation from outside the room. The extinguishing system is to be separate for the room but may be part of the main fire extinguishing system for the machinery space.
- iv) Means of closing ventilation openings from a position close to where the fire extinguishing system is activated

If it is impracticable to locate the fuel oil purifiers in a separate room, special consideration will be given in regard to location, containment of possible leakage, shielding and ventilation. In such cases, a local fixed fire extinguishing system is to be provided and arranged to be activated automatically, where permitted, or manually from the machinery control position or from another suitable location. If automatic release is provided, additional manual release is also to be arranged.

13 Rotary Table Area

The area adjacent to the rotary table is to be free of openings through which gases or water can enter the hull structure. Any such openings that are necessary are to be equipped with quick-acting closing devices.

15 Fire Precautions for Machinery Spaces (1996)

Installation in machinery spaces which contain fired boilers, internal combustion engines, oil purifiers and similar equipment are to comply with the following:

- i) The surfaces of all internal combustion engines, gas turbines, boilers, exhaust pipes and other exposed parts which may be heated to a temperature in excess of 220°C (428°F) and may be exposed to flammable liquids are to be insulated. Where insulation is oil absorbing and exposed to penetration of oil, this insulation is to be encased in sheet metal or an equivalent impervious sheet.
- ii) Drip trays for collecting oil, as required in 4-2-1/11.33, are to be fitted below pumps, burners, tanks, etc. They are to be of suitable height and provided with suitable drainage to a collecting tank incorporating a high level alarm.
- iii) Hydraulic pumps, actuators, motors and accessories are to be suitable for the intended duty, compatible with the working fluid and are to be designed to operate safely at full-power conditions. In general, the hydraulic fluid is to be nonflammable or have a flash point above 157°C (315°F).
- iv) For unmanned machinery spaces, fuel oil heaters, purifiers, pumps and filters are to be shielded or grouped in a special room or location ventilated by suction.

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CHAPTER **3** **Outfitting**

APPENDIX **1** **Fiber Reinforced Plastic (FRP) Gratings (2013)**

Based on U.S.C.G. Policy File Memorandum (PFM 2-98) dated 19 June 1998

1 **General**

1.1

FRP gratings are not specifically addressed in the individual vessel regulations. However, the resins typically used in the manufacture of these gratings are combustible and heat sensitive; therefore, FRP gratings use must be limited based on the requirements discussed below.

1.3

These requirements are not intended to eliminate any other design criteria or requirement pertaining to the material, construction, or performance of the FRP gratings in the non-fire condition.

3 **FRP Grating Material Systems**

3.1

All fire integrity, flame spread, smoke, and toxicity testing, where required, shall be conducted on each material system.

3.3

Changes in either the type, amount, and/or architecture, of either the reinforcement materials, resin matrix, coatings, or manufacturing processes shall require separate testing in accordance with the procedures below. Manufacturers should provide evidence, such as enrollment in a follow-up program, that the FRP gratings being installed are the same as those which were tested and approved.

5 **Fire Test Requirements**

5.1 **Structural Fire Integrity***

The structural fire integrity matrix in 5-3-A1/9 establishes the structural fire integrity characteristics that FRP gratings should possess, based on location and service. Where a specific application satisfies more than one block in the matrix, the highest level of fire integrity shall be required. The test procedures required to qualify FRP gratings to one of three levels are described in 5-3-A1/7. The ABS Surveyor shall determine the location and service of the FRP gratings, keeping in mind the following considerations for each of the three performance levels:

5.1.1 **Level 1 (L1)**

FRP gratings meeting the L1 performance criteria are intended to be satisfactory for use in escape routes or access for firefighting, emergency operation or rescue, after having been exposed to a significant hydrocarbon or cellulosic fire incident. In addition, they are also acceptable for the services and functions described for levels L2 and L3.

5.1.2 Level 2 (L2)

FRP gratings meeting the L2 performance criteria are intended to be satisfactory for use in open deck areas where groups of people are likely to assemble, such as temporary safe refuge or lifeboat embarkation areas. In addition, they are also acceptable for the services and functions described for level L3.

5.1.3 Level 3 (L3)

FRP gratings meeting the L3 performance criteria are intended to be satisfactory for use in egress routes and any areas that may require access for firefighting, rescue or emergency operations during exposure to or shortly after exposure to a transitory hydrocarbon or cellulosic fire.

* The structural fire integrity requirements are intended for self-supporting personnel platforms or walkways, and are not intended for grating overlaid on steel decking or used in other applications such as pipe guards, seachest screenings, safety guards, etc.

5.3 Fire Retardance

All FRP gratings should be fire retardant; this can be demonstrated by testing to ASTM E-84, Standard Test Method for the Surface Burning Characteristics of Building Materials with a flame spread rating not to exceed 25, or by meeting the requirements in 5-3-A1/5.5.1 or 5-3-A1/5.5.2 below.

5.5 Flame Spread

All FRP gratings, except those fitted on open decks and within tanks, cofferdams, void spaces, pipe tunnels and ducts, should have low flame spread characteristics as determined by one of the following test procedures:

5.5.1

Tested to ASTM E-84 with a flame spread rating not to exceed 20; or

5.5.2

Tested to IMO Resolution A.653(16), Recommendation on Improved Fire Test Procedures for Surface Flammability of Bulkhead, Ceiling and Deck Finish Materials and meeting the criteria for bulkheads, linings, or ceilings.

5.7 Smoke Generation

FRP gratings within accommodation, service and control spaces, should have low smoke characteristics as determined by one of the following test procedures:

5.7.1

Tested to ASTM E-84 with a smoke developed rating not to exceed 10; or

5.7.2

Tested in accordance with the IMO Fire Test Procedures Code (FTPC), Resolution MSC.61(67), Part 2 – Smoke and Toxicity Test, and meeting the criteria established for materials used as bulkheads, linings, or ceilings.

7 Structural Fire Integrity Test Procedures

7.1 Level 1

To be qualified as level 1 (L1), the FRP gratings shall meet the requirements for qualification as level 3 and level 2, and in addition shall be subjected to the following test procedures:

7.1.1

Three (3) FRP grating specimens, after being subjected to the level 2 testing, shall be unloaded and prepared for impact testing in the manner specified for horizontal specimens in ASTM E-695, Standard Method of Measuring Resistance of Wall, Floor, and Roof Construction to Impact Loading. The test specimens shall be secured as required in section 8.3 of ASTM E-695 except that the span shall be 200 mm less than the specimen length. A lead shot bag of 40 kg mass shall be dropped once from a height of 2 m such that the point of impact is in the center of the span. The specimens shall then be uniformly loaded as required by the level 2 test procedures.

7.1.2

The test will be considered successful if all three (3) specimens remain intact after being subjected to the impact test and the level 2 loading test. Failure will be indicated by collapse of one or more of the gratings.

7.3 Level 2

To be qualified as level 2 (L2), the FRP gratings shall meet the requirements for qualification as level 3, and in addition shall be subjected to the following test procedures:

7.3.1

On the FRP grating specimen and the steel grating specimen subjected to the level 3 post-loaded testing, the specimen shall be gradually loaded in increments not to exceed 20 kg, placed in such a manner as to represent a uniformly distributed load across the span.

7.3.2

The test will be considered successful if the FRP grating remains intact at a load greater than or equal to a uniform 4.5 kN/m² (94 lbf/ft²), or greater than or equal to the steel grating failure loading, whichever is less. Failure will be indicated by collapse of the grate.

7.5 Level 3

To be qualified as level 3 (L3), the FRP gratings should be subjected to the following fire test procedures for both the post-loaded and pre-loaded tests and conditions:

7.5.1

A fire test will be conducted in accordance with ASTM E-119, Standard Test Method for Tests of Building Construction and Materials. Two tests shall be conducted in the ASTM E-119 furnace for each FRP grating design. The first fire test shall be conducted with the specimens under the specified load (pre-loaded) and the second fire test will be conducted on unloaded specimens (post-loaded). The time-temperature curve shall be the standard for E-119 or the ISO equivalent. The duration of the tests shall be as specified below.

7.5.2

Each test specimen shall be 300-350 mm wide to allow for the differences in the spacing of longitudinal supporting members. The length of each test specimen shall be the length of the maximum span to be seen in service, plus 200 mm. Four test specimens shall be prepared as described above: two of the proposed FRP gratings and two of a similar steel grating that would be used in the same location constructed to the applicable regulations and standards (steel gratings rated at a minimum of 4.5 kN/m² (94 lbf/ft²) uniform loading with a 1.67 factor of safety are acceptable).

7.5.3

The pre-loaded test shall consist of the following:

- i) One steel grating specimen and one FRP grating specimen shall be placed adjacent to one another in the furnace, simply supported on two I-beams with a minimum flange width of 100 mm at an elevation of at least one half of the furnace height, or a minimum of 300 mm above the burners;
- ii) The specimens shall be placed on the I-beams such that 100 mm of each side of the specimen rests on each of the two I-beams;
- iii) A static load represented by a 40 kg mass shall be placed in the center span of the test specimens;
- iv) The 40 kg mass load shall consist of a steel container filled with sand, the base of which shall be square with an area of 0.9 m²;
- v) Arrangements shall be made to measure the deflection at the center of the span of each of the loaded specimens during the test, with a degree of accuracy of ±5 mm.
- vi) The two specimens shall be subjected to the time-temperature curve specified in the ASTM E-119;
- vii) Deflection of the two loaded test specimens shall be measured throughout the duration of the fire test, and the average furnace temperature shall be recorded when each of the two specimens has deflected a distance of L/10 (failure point) from the horizontal, where L is equal to the maximum unsupported span of the specimens; and
- viii) The test will be considered successful if the difference between the average furnace temperature at the time of failure of the steel grating and the average furnace temperature at the time of failure of the FRP grating is less than 100°C (180°F).

7.5.4

The post-loaded test shall consist of the following:

- i) One steel grating specimen and one FRP grating specimen shall be placed adjacent to one another in the furnace, simply supported on two I-beams with a minimum flange width of 100 mm at an elevation of at least one half of the furnace height;
- ii) The specimens shall be placed on the I-beams such that 100 mm of each side of the specimen rests on each of the two I-beams;
- iii) The two specimens shall be subjected to the time-temperature curve specified in the ASTM E-119 for a duration of 60 minutes;
- iv) At the end of the 60 minutes, the specimens will be allowed to cool and shall then be subjected to a static load represented by the 40 kg mass specified in the pre-loaded test above, placed in the center span of the test specimens; and
- v) The test will be considered successful if the FRP grating specimen is intact at the end of the test and does not collapse under the 40 kg mass load.

9 Structural Fire Integrity Matrix

<i>Location</i>	<i>Service</i>	<i>Fire Integrity</i>
Machinery Spaces	Walkways or areas which may be used for escape, or access for firefighting, emergency operation or rescue	L1 ⁽¹⁾
	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	L3
Cargo Pump Rooms	All personnel walkways, catwalks, ladders, platforms or access areas	L1
Cargo Holds	Walkways or areas which may be used for escape, or access for firefighting, emergency operation or rescue	L1
	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	None required
Cargo Tanks	All personnel walkways, catwalks, ladders, platforms or access areas	None required ⁽²⁾
Fuel Oil Tanks	All personnel walkways, catwalks, ladders, platforms or access areas	None required ⁽²⁾
Ballast Water Tanks	All personnel walkways, catwalks, ladders, platforms or access areas	None required ⁽³⁾
Cofferdams, void spaces, double bottoms, pipe tunnels, etc.	All personnel walkways, catwalks, ladders, platforms or access areas	None required ⁽³⁾
Accommodation, service, and control spaces	All personnel walkways, catwalks, ladders, platforms or access areas	L1
Lifeboat embarkation or temporary safe refuge stations in open deck areas	All personnel walkways, catwalks, ladders, platforms or access areas	L2
Open Decks or semi-enclosed areas	Walkways or areas which may be used for escape, or access for firefighting, emergency operation or rescue	L3 ⁽⁴⁾
	Personnel walkways, catwalks, ladders, platforms or access areas other than those described above	None required

Notes:

- 1 If the machinery space does not contain any internal combustion machinery, other oil-burning, oil-heating, or oil-pumping units, fuel oil filling stations, or other potential hydrocarbon fire sources, and has not more than 2.5 kg/m² of combustible storage, gratings of L3 integrity may be used in lieu of L1.
- 2 If these spaces are normally entered when underway, gratings of L1 integrity shall be required.
- 3 If these spaces are normally entered when underway, gratings of L3 integrity shall be required.
- 4 Vessels fitted with deck foam firefighting systems require gratings of L1 integrity for foam system operational areas and access routes.

11 Other Authorized Uses

11.1

The ABS Surveyor may authorize the use of FRP gratings without Main Office approval in applications where structural fire integrity of the FRP gratings is not a concern, provided they meet the applicable fire retardance, flame spread and smoke generation requirements set forth in 5-3-A1/5.3, 5-3-A1/5.5, and 5-3-A1/5.7. Applications where the use of FRP gratings have been authorized in the past, without any structural fire integrity requirements, include the following:

- i) Sea chest coverings;
- ii) Small sundeck awnings and supports;
- iii) Lifeboat bilge flooring;
- iv) Electrical control flooring;
- v) Pipe guards on deck, in cargo holds, and in engine rooms;

- vi)* Removable guards over hawse holes, anchor hawse pipes, and scuppers;
- vii)* Personnel barriers, such as protection for electrical panels; and
- viii)* Ship staging and work platforms (Occupational Safety and Health Administration (OSHA) requirements may also apply).

PART

5

CHAPTER 3 Outfitting

APPENDIX 2 Fiber Reinforced Plastic (FRP) Guard Railings (2016)

1 General

1.1

FRP guard railings are not specifically addressed in the individual vessel regulations. However, the resins typically used in the manufacture of these guard railings are combustible and heat sensitive; therefore, FRP guard railings use must be limited based on the requirements discussed below.

1.3

These requirements are not intended to eliminate any other design criteria or requirement pertaining to the material, construction, or performance of the FRP guard railings in the non-fire condition.

1.5

FRP guard railings are to comply with:

- i) Appendix 5-3-A2 of the *MODU Rules*
- ii) Flag Administration requirements
- iii) A published standard from an organization recognized by ABS as being acceptable

3 FRP Guard Railing Material Systems

3.1

All flame spread, smoke, and toxicity testing, where required, are to be conducted on each material system.

3.3

Changes in either the type, amount, and/or architecture, of either the reinforcement materials, resin matrix, coatings, or manufacturing processes shall require separate testing in accordance with the procedures below. Manufacturers should provide evidence, such as enrollment in a follow-up program, that the FRP guard railings being installed are the same as those which were tested and approved.

5 Fire Test Requirements

5.1 Fire Retardance

All FRP guard railings are to be fire retardant; this can be demonstrated by testing to ASTM E-84, Standard Test Method for the Surface Burning Characteristics of Building Materials with a flame spread rating not to exceed 25, or by meeting the requirements in 5-3-A2/5.3.1 or 5-3-A2/5.3.2 below.

5.3 Flame Spread

All FRP guard railings, except those fitted on open decks and within tanks, cofferdams, void spaces, pipe tunnels and ducts, should have low flame spread characteristics as determined by one of the following test procedures:

5.3.1

Tested to ASTM E-84 with a flame spread rating not to exceed 20; or

5.3.2

Tested to IMO Resolution A.653(16), Recommendation on Improved Fire Test Procedures for Surface Flammability of Bulkhead, Ceiling and Deck Finish Materials and meeting the criteria for bulkheads, linings, or ceilings.

5.5 Self Extinguishing

All FRP guard railings should meet the self extinguishing requirement of ASTM D-635.

7 Application of FRP Guard Railing

Suitable locations for FRP guard railings are given in 5-3-A2/Table 1.

TABLE 1
Application of FRP Guard Railing (2016)

<i>Location</i>	<i>Service</i>
Holds/Storages	Personnel walkways, catwalks, ladders, platforms or access areas, except where used for escape, or access for firefighting, emergency operation or rescue
Open Decks or semi-enclosed areas not protected by deck foam firefighting system	

9 Other Requirements

9.1

The FRP guard rails are to be fabricated in accordance with a recognized standard, such as ASTM E985, with adequate strength to withstand the anticipated loads.

9.3

The weathering characteristics of the FRP guard rails should be in compliance with a recognized standard (for example ASTM D4587, ASTM D4329) for testing resistance to ultraviolet degradation for those exposed to weather.