Part 7
Safety Systems, Hazardous Areas and Fire
June 2013
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# Safety and Communication Systems

## Part 7, Chapter 1

### Section 1

#### General requirements

1. **General requirements**

2. **Fire and gas alarm indication and control systems**

3. **Systems for broadcasting safety information**

4. **Emergency lighting**

5. **Protection against gas ingress into safe areas**

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7. **Emergency shut-down (ESD) systems**

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### Section 1

#### General requirements

1.1 **General requirements**

1.1.1 This Chapter applies to all units defined in Pt 1, Ch 2 on board which drilling, production and processing of hydrocarbons and/or storage of crude oil in bulk is undertaken. It is also applicable to Accommodation Units and Support Units as detailed in Pt 3, Ch 4. However, Accommodation Units and Support Units not engaged in activities with drilling, production and processing of hydrocarbons and/or storage of crude oil in bulk units need not comply with all the requirements of Section 2, in relation to gas detection, or the requirements of Sections 5, 6, 7 or 8 of this Chapter. This Chapter also states the fire detection requirements for units to be assigned the UMS and CCS notations, see Pt 6, Ch 1, Sections 4 and 5. Attention is to be given to the relevant Statutory Regulations of the National Administrations in the country of registration and area of operation, as applicable.

1.1.2 While Chapter 2 prescribes the boundaries of hazardous areas where special precautions are to be applied, the safeguards called for in this Chapter include provision for actions applicable where gas is present beyond hazardous area boundaries. Such circumstances may arise, for example, as the consequence of an uncontrolled well blow out or catastrophic failure of pipes or vessels.

1.1.3 These requirements apply to manned units. Special consideration will be given to unmanned units which are controlled from the shore or from another unit. When accommodation and support units are to operate for prolonged periods adjacent to live offshore hydrocarbon exploration or production units, it is the responsibility of the Owner/Operator to comply with the requirements of the appropriate National Administrations and special consideration will be given to the safety requirements for classification purposes, as appropriate.

1.1.4 Section 2 states general requirements for fire and gas detection systems. This Section also includes the additional fire detection requirements applicable for unattended machinery spaces and machinery spaces under continuous supervision from a centralised control station, see Pt 6, Ch 1,4 and Ch 1,5, and incorporates requirements for accommodation and support units with spaces to house offshore personnel who are not members of the crew of the unit, see Pt 3, Ch 4.

1.1.5 Section 3 states requirements for personnel warning systems, general alarms and public address systems.

1.1.6 Section 4 states requirements for emergency lighting equipment.

1.1.7 Section 5 states the alarms and safeguards required for heating, ventilation and air conditioning systems to protect against ingress of gas into safe areas, as defined in Chapter 2.

1.1.8 Section 6 states requirements which apply where ventilation systems are installed in enclosed and semi-enclosed hazardous areas, as defined in Ch 2,1.2.

1.1.9 Section 7 states requirements which apply to reduce fire and gas hazards in an emergency by shutting down process plant and machinery.

1.1.10 Section 8 states requirements for control and alarms of riser systems for the assignment of the special features class notation PRS.

1.1.11 Section 9 states requirements for the alarm and control of watertight closing appliances as required by Pt 4, Ch 7 and the requirements for the warning of ingress of water.

### Section 2

#### Plans

1.2.1 The following plans and documentation, as far as applicable to the unit, are to be submitted for review/ approval:

(a) For fire and gas systems:

- Fire and gas system design philosophy document.
- Fire and gas system design specification.
- Loss control or hazard analysis charts.
- Block diagram showing interface and power supply arrangements.
- Fire and gas system ‘cause and effect’ diagrams, including actions on heating, ventilating and air conditioning systems.
- Layout drawing showing the positions of fire and gas detector heads, manually operated call points, control panels and repeaters, cable routes, and fire zones.
- Details of the make and type numbers of all detector heads, manual call points and associated panels.
- Fire pump control, alarm, starting and inhibiting arrangements.
- For programmable electronic systems and networked systems, see also Pt 6, Ch 1,2.5 and 2.9 to 2.12.
Safety and Communication Systems

(b) For public address and general alarms, unit status indicators and emergency lighting:
   - Communications philosophy document.
   - Block diagrams showing interfaces and power supply arrangements.
   - Single line diagrams.
   - Unit layout drawings showing location of fire zones, equipment and cable routes.
   - For programmable electronic systems and networked systems, see also Pt 6, Ch 1, 2.5 and 2.9 to 2.12.

(c) For protection against gas in safe and hazardous areas:
   - Layout drawing of drilling and/or process equipment and gas detectors.
   - Ventilation system flow diagrams and gas detectors.
   - Wellhead and riser valve hydraulic schematics and gas detectors.
   - Details of manual trips, resets and override facilities.
   - Automatic fire and gas detection alarm panels and sensors specific to the unit’s requirements.
   - For drilling units, specific reference should be made to the requirements of the 2009 IMO MODU Code Resolution A.1023(26) Ch 9 regarding fire and gas detection.

(d) For emergency lighting:
   - Single line diagram.
   - General arrangement plans showing the location of equipment and cable routes.

(e) For emergency shut-down systems (ESD) Systems:
   - ESD philosophy document.
   - Safety analysis tables based on results of HAZOP studies/reports.
   - ESD safety analysis function evaluation charts (cause and effect matrices).
   - Performance standards and criteria of the safety critical system.
   - Safety integrity level categorisation study for the instrument protective system.
   - Instrument protective system reliability and availability calculations report.
   - Alarm and trip schedules.
   - Block diagrams showing interfaces and power supply arrangements.
   - Physical arrangement of control panel.
   - Details of manual trips, resets and override facilities.
   - Layout drawings showing positions of the ESD system control panel, subpanels and manual trips.
   - Wellhead and riser valve hydraulic schematics and control panels.
   - ESD valve pneumatic and/or hydraulic schematics.
   - For programmable electronic systems and networked systems, see also Pt 6, Ch 1, 2.5 and 2.9 to 2.12.

(f) For watertight doors and other electrically operated closing appliances:
   - Single line diagram.
   - General arrangement plans showing the location of equipment and cable routes.

1.3.3 Equipment used in safety and communication systems should be suitable for its intended purpose, and accordingly, whenever practicable, should be selected from the List of Type Approved Products published by LR. A copy of the Procedure for LR Type Approval System will be supplied on application. For fire detection alarm systems, see 2.2.9. For networked and programmable electronic systems, see Pt 6, Ch 1, 2.9 to 2.12.

1.3.4 Where equipment requires a controlled environment, an alternative means is to be provided to maintain the required environment in the event of a failure of the normal air conditioning system, see Pt 6, Ch 1, 1.3.5 and 3.13.12.

1.3.5 Assessment of performance parameters, such as accuracy, repeatability, etc., are to be in accordance with an acceptable National or International Standard.

Section 2

Fire and gas alarm indication and control systems

2.1 General requirements

2.1.1 This Section states general requirements for fire and gas detection alarm indication and control systems. See also Sections 5, 6 and 7 for requirements concerning protection against gas leakage and shut-downs for process systems and associated equipment.

2.2 Fire and gas detection alarm panels and sensors

2.2.1 The requirements for fire detection alarm panels and sensors are given in Pt 6, Ch 1, 2.8 of the Rules for Ships. These Rules are also to be complied with, where applicable, for gas detection alarm panels and sensors and fire detection alarm panels and sensors specific to the unit’s requirements. For drilling units, specific reference should be made to the requirements of the 2009 IMO MODU Code Resolution A.1023(26) Ch 9 regarding fire and gas detection.

2.2.2 Automatic fire and gas detection alarm panels and sensors that satisfy the requirements of 2.2.3 to 2.2.14 are to be fitted. Additional requirements for accommodation spaces and machinery spaces are given in 2.5 and 2.6.

2.2.3 A fire and gas detection indicating panel is to be located at the main control station. A repeater panel is to be provided at a location which is readily accessible to responsible members of the crew at all times, at the fire-control station, if fitted, and at or adjacent to the workstation for navigation and manoeuvring or the workstation for safety, if fitted. The main panel and the fire-control station repeater are to indicate the source of the fire in accordance with arranged fire zones by means of a visual signal. Any other repeater panel(s) should indicate the general area of the fire zones affected.
2.2.4 An audible fire and gas alarm is to be provided having a characteristic tone(s), distinguishable from any other alarm. The audible alarm is to be immediately audible in all parts of the navigating bridge, if fitted, the workstations for navigation and manoeuvring, the fire control station, if fitted, all accommodation areas (with the exception, on accommodation units, of those for offshore personnel), and machinery spaces. The alarm need not be an integral part of the detection system.

2.2.5 Facilities are to be provided in the fire and gas detecting system to initiate manually the alarm in 2.2.4 from the following locations, in addition to the locations required by the Rules for Ships:
- Accommodation areas.
- The Unit Manager’s office.
- Control stations in machinery and process areas.
- The main control station or fire-control station, if fitted.

2.2.6 Fire and gas detection and alarm systems are to be provided with an emergency source of electrical power as required by Pt 6, Ch 2,3 and are also to be connected to the main source of emergency power, with automatic changeover facilities located in, or adjacent to, the main fire detection indicator panel, see also Pt 6, Ch 2,3,1.5(c)(iv). Reference should also be made to the guidance given in ISO 13702 to the supply capacity of UPS systems to defined emergency/critical facilities for the MOU. Failure of any supply system is to initiate an audible and visual alarm, see also Pt 6, Ch 1,2,8.6 of the Rules for Ships.

2.2.7 Fire and gas detectors are to be grouped as appropriate into zones conforming to passive fire protection boundaries and/or safe/hazardous area boundaries as defined in Chapter 2 of these Rules. Further zones subdividing the above boundaries may also be arranged where beneficial. Factors influencing zone boundaries include ventilation arrangements, bulkheads and the needs of the operating staff in locating and dealing with fire and gas incidents.

2.2.8 A zone/section of fire detectors which covers a control station, a service space or an accommodation space is not to include a machinery space or process area.

2.2.9 Fire and gas control and indicator panels, repeater panels, detector heads, manual call points and short-circuit isolation units are to be used for their intended purpose. Where practicable, these should be selected from LR’s List of Type Approved Products. The fire control system, as required by 2.5, is to be integrated with the main control panel.

2.2.10 When it is intended that a particular loop or detector is to be temporarily switched off, reactivation need not be automatic after a preset time.

2.2.11 Fire detector heads for the process and wellhead area, fusile plugs and linear electric elements for direct actuating of the deluge system may be used to supplement the automatic fire detection system.

2.2.12 Gas detectors are to be selected having regard to the flammable and/or toxic gases potentially present in each particular area or compartment and are to be sited having regard to the probable dispersal of the gas as governed by density, HVAC air flows and possible points of leakage, see also Sections 5 and 6.

2.2.13 Means are to be provided so that the sensitivity of gas detectors can be readily tested in their mounted positions by the injection of span gas or other equivalent method.

2.2.14 In addition to the fixed gas detection system, portable gas detectors of each of the following types, together with any necessary test facilities for checking their accuracy, are to be provided for all anticipated gas hazards including the following:
- Hydrocarbon gas detectors range 0 to 100 per cent of the lower explosive limit.
- Toxic gas detectors.
- Oxygen concentration meters.

2.3 Fire-extinguishing systems

2.3.1 The fire and gas detection system is to be arranged to initiate manually and automatically appropriate extinguishing system control actions by:
- Actuating fire-fighting media and pre-release warnings.
- Initiating fire and gas damper closures and stopping of ventilation fans to reduce the effect of fire and minimise ingress of gas.
- Starting fire pumps.

The arrangements are to comply with 2.3.2 to 2.3.10.

2.3.2 The operational state of fire-extinguishing facilities, including smothering gas, deluge, foam equipment and fire water systems, are to be displayed on the main control panel and the fire-control point repeater panel, if fitted, as follows:
- Charges of gas available for use, indication of zones into which gas has been released, and reserve capacity in hand.
- Indication of zones in which water deluge has been initiated.
- Liquid level in main installation (i.e., deck foam system, etc.), foam concentrate tank(s) and status of foam concentrate pumps and valves.
- Availability of fire pumps, indication of running and standby sets and positions of associated valves.
- Operational state of sprinkler systems.

2.3.3 The provision of manual and automatic release facilities for extinguishing media is to be designed to afford optimum protection to the installation while giving proper regard to the safety of personnel, as follows:
(a) Generally, the release of asphyxiating gases such as carbon dioxide should only be initiated locally by manual means since it is necessary to ensure that the space to be dealt with has been evacuated.
Safety and Communication Systems

(b) Deluge systems and extinguishing gases which can be released without introducing an unacceptable health risk should be capable of being released locally and remotely at the fire and gas indication and control panel and at the fire-control station, if fitted. Automatic release of media by the voting action of grouped fire detectors within a zone is recommended, especially for spaces carrying a high potential fire risk.

2.3.4 Fire pumps are to be provided with automatic and manual starting facilities on the fire and gas detection indication and control panel. Automatic starting is to be initiated by activation of fire detection heads, operation of any manual call points or reduction of pressure in the fire main. Controls which start the standby set in the event of starting or running failure of the duty set are to be provided. Safeguards required in the event of flammable gas being detected in the vicinity of the fire pump are detailed under 5.1.9. Manual starting facilities are to be provided adjacent to all fire pumps.

2.3.5 The design of the extinguishing systems is to be in accordance with SOLAS Ch II-2 Reg 10 and IMO Fire Fighting System (FSS) Code Resolution MSC.98(73). For drilling units, specific reference should be made to the requirements of the 2009 IMO MODU Code Resolution A.1023(26) Ch 9.

(a) When the emergency fire pump is electrically driven, the power is to be supplied by a source other than that supplying the main fire pumps. This source is to be located outside the machinery spaces containing the main fire pumps and their source of power and drive units, see also Pt 6, Ch 2.3.1.5(b)(iv).

(b) The cables to the emergency fire pump are not to pass through the machinery spaces containing the main fire pumps and their source of power and drive units. The cables are to be of a fire-resistant type where they pass through other high fire risk areas.

(c) Where there are electrically driven refrigeration units for carbon dioxide fire-extinguishing systems, one unit is to be supplied by the main source of electrical power and the other unit from the emergency source of electrical power. Exclusive circuits are to be used for the two units, see also Pt 6, Ch 2.3.1.5(b)(v).

(d) Each electrically driven carbon dioxide refrigeration unit is to be arranged for automatic operation in the event of loss of the alternative unit.

2.3.6 Fire and gas dampers and ventilation fans serving areas in which fire has been detected and confirmed by group voting are to be shut down automatically. Similar action is to be carried out prior to the release of extinguishing media. Manual shut-down from the main control panel and the fire-control position is also to be available and fire dampers should also be capable of being closed manually from both sides of the bulkhead or deck:

(a) The electrical power required for the control and indication circuits of fire dampers is to be supplied from the emergency source of electrical power.

(b) The control and indication systems for the fire dampers are to be designed on the fail-safe principle, with the release system having a manual reset.

2.3.7 The electrical power for the control, indication and alarm circuits of fire doors is to be supplied from the emergency source of electrical power. The control and indication systems for the fire doors are to be designed on the fail-safe principle, with the release system having a manual reset.

2.3.8 Automatic sprinkler systems are to be considered as part of the fire detection system.

2.3.9 Whenever any sprinkler comes into operation, an alarm and visual indication is to be initiated on the panels and repeaters required by 2.3.2.

2.3.10 The main fire and gas panel and the fire control point repeater, if fitted, are to indicate the location and zone/section of the sprinklers that have been initiated and the status of the system, as follows:

(a) Low level and pressure in the standing fresh water pressure tank.

(b) Start-up of the electrically driven pump which is brought into action automatically by the pressure drop in the system, before the standing fresh water charge in the pressure tank is completely exhausted.

(c) The status of the electrically driven or diesel driven seawater fire pumps that are required to start up when the fresh water system is exhausted.

2.3.11 The design of the sprinkler systems is to be in accordance with SOLAS Ch II-2 Reg 10 and IMO Fire Fighting System (FSS) Code Resolution MSC.98(73) Ch 8. The automatic alarm and detection system is to be fed by exclusive feeders from two sources of electrical power, one of which is to be an emergency source, with automatic changeover facilities located in, or adjacent to, the main alarm and detection panel.

2.4 Fire safety stops

2.4.1 Means of stopping all ventilating fans with manual reset are to be provided, outside the spaces being served, at positions which will not readily be cut off in the event of a fire. The provisions for machinery spaces are to be independent of those for other spaces.

2.4.2 Machines driving forced and induced draught fans, and independently driven oil pumps for fuel, lubricating, hydraulic or stored oil are to be fitted with remote controls, with manual reset, situated outside the space concerned so that they may be stopped in the event of fire arising in the space in which they are located.

2.4.3 Means of cutting off power to the galley, in the event of a fire, are to be provided outside the galley exits, at positions which will not readily be rendered inaccessible by such a fire.
2.4.4 Fire safety stop systems are to be designed on the fail-safe principle or, alternatively, the power supplies to, and the circuits of, the fire safety stop systems are to be continuously monitored and an alarm initiated in the event of a fault. Power supply circuits are to be duplicated and arranged in compliance with Pt 6, Ch 2,5.2.1 of the Rules for Ships. Cables are to be of a fire-resistant type, see Pt 6, Ch 2,11.5.3 of the Rules for Ships.

2.5 Additional requirements for accommodation fire detection systems

2.5.1 The requirements for accommodation fire detection systems are given in Pt 6, Ch 2,17 of the Rules for Ships, which are to be complied with where applicable.

2.5.2 Fire detection systems for crew accommodation spaces and accommodation spaces for offshore personnel as defined in Pt 1, Ch 2,2 of these Rules, and for accommodation and support units, are also to comply with the additional requirements given below.

2.5.3 Where the fire detection system does not include means of remotely identifying each detector individually, a minimum of two zones/sections of detectors are to serve cabin spaces and are to be arranged one on each side of the unit. Exceptionally, one zone/section of detectors may be permitted to serve both sides of the unit and more than one deck where it is satisfactorily shown that the protection of the unit against fire will not be reduced thereby.

2.5.4 Heat detectors used for the protection of accommodation spaces are to operate before the temperature exceeds 78°C but not until the temperature exceeds 54°C.

2.5.5 The permissible temperature of operation of heat detectors may be increased to 30°C above the maximum deckhead temperature in drying rooms and other accommodation spaces having a normally high ambient temperature.

2.5.6 The maximum spacing of detectors in the living quarters is to be in accordance with Table 1.2.1. Other spacing complying with appropriate National Standards will be permitted.

<table>
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<th>Type of detector</th>
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<th>Maximum distance apart between centres, in metres</th>
<th>Maximum distance away from bulkheads, in metres</th>
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<tr>
<td>Heat</td>
<td>37</td>
<td>9</td>
<td>4,5</td>
</tr>
<tr>
<td>Smoke</td>
<td>74</td>
<td>11</td>
<td>5,5</td>
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2.6 Machinery space fire detection systems

2.6.1 Where an automatic fire detection system is to be fitted in a machinery space, the requirements of 2.2 and the additional requirements of 2.6.2 to 2.6.5 are to be satisfied. These requirements are also to be applicable for units to be assigned the UMS and CCS notations, see Pt 6, Ch 1.

2.6.2 An audible fire alarm is to be provided, having a characteristic tone which distinguishes it from other audible warnings having lower priority. The audible fire alarm is to be immediately audible at the main control station and at all repeater stations. If the alarm is not accepted within two minutes, a general alarm is to be initiated throughout the unit.

2.6.3 Fire detection control units, indicating panels, detector heads, manual call points and short-circuit isolation units are to be Type Approved in accordance with Test Specification Number 1 given in LR’s Type Approval System. For addressable systems, which also require to be Type Approved, see Pt 6, Ch 1,2.9.

2.6.4 When it is intended that a particular loop be temporarily switched off locally, this state is to be clearly indicated at the main fire detection control panel. Such actions are to be controlled by a ‘permit-to-work’ procedure.

2.6.5 It is to be demonstrated to the Surveyor’s satisfaction that detector heads are so located that air currents will not render the system ineffective.

Section 3
Systems for broadcasting safety information

3.1 General requirements

3.1.1 This Section states requirements for safety systems which broadcast warning of existing and potential hazards present on the unit and advise personnel on board of necessary actions they need to take.

NOTE: The requirements for the sound pressure levels to be provided by the public address systems and audible alarms should be determined by reference to the International Life-Saving Appliances (LSA) Code and the Code on Alarms and Indicators.

3.1.2 In machinery spaces and other locations with high ambient noise levels, whether continuous or intermittent, audible alarms are to be supplemented by visual alarms.

3.2 Public address system

3.2.1 The requirements for public address systems are given in Pt 6, Ch 2,18.3 of the Rules for Ships, which are to be compiled with where applicable.
3.2.2 Additional requirements with respect to unit types as indicated in this Section should also be complied with as applicable.

3.2.3 A public address (PA) system is to be provided which is to be audible in all parts of the unit. The PA microphones are to be located at the main control station and at the fire control station and/or navigating bridge, if fitted. Additional microphones may be provided at other suitable locations, e.g., in the Unit Manager’s office.

3.3 General emergency alarm systems

3.3.1 The requirements for general emergency alarm systems are given in Pt 6, Ch 2,18.2 of the Rules for Ships, which are to be complied with where applicable.

3.4 Fire-extinguishing media release alarms

3.4.1 Where it is required that alarms be provided to warn of the release of a fire-extinguishing medium, and these are electrically operated, they are to be provided with an emergency source of electrical power, as required by Pt 6, Ch 2,3.1, and also connected to the main source of electrical power, with automatic changeover facilities located in, or adjacent to, the fire-extinguishing media release panel. Failure of any power supply is to initiate an audible and visual alarm, and the alarm is to be capable of being operated under fire conditions, see also Pt 6, Ch 2,1.13 and 1.14.

3.5 Escape route or low location lighting (LLL)

3.5.1 Escape route or low location lighting (LLL), either in the form of electric illumination or photoluminescent strip indicators, is to be provided in accordance with the requirements of SOLAS 1974 as amended, Pt D, Ch II-2, Reg. 13,3.2.5.1. Where satisfied by electric illumination, it is to comply with the requirements of this sub-Section.

3.5.2 The LLL system is to be provided with an emergency source of electrical power as required by Pt 6, Ch 2,3.1 and also connected to the main source of electrical power, with automatic changeover facilities located adjacent to the control panel. For Accommodation Units, the LLL system is to be provided with an emergency source of electrical power as required by Pt 3, Ch 4,4,2 and also connected to the main source of electrical power, with automatic changeover facilities located adjacent to the control panel. The system is to be capable of being operated under fire conditions, see also Pt 6, Ch 2,1.14.

3.5.3 The power supply arrangements to the LLL are to be arranged so that a single fault or a fire in any one fire zone or deck does not result in loss of the lighting in any other zone or deck. This requirement may be satisfied by the power supply circuit configuration, use of fire-resistant cables complying with the requirements of Pt 6, Ch 2,11.5.3 of the Rules for Ships, and/or the provision of suitably located power supply units having integral batteries adequately rated to supply the connected LLL for a minimum period of 60 minutes. If the accommodation or part of the accommodation is classified as the Temporary Refuge, the LLL integral batteries are to have a minimum supply capacity of 60 minutes or a period in excess of 60 minutes if the Temporary Refuge is to be rated to maintain integrity for a period in excess of 60 minutes. Where these units are installed within cabins for crew or offshore personnel, or within associated corridors, the batteries are to be of the sealed type, see Pt 6, Ch 2,11.2.

3.5.4 The performance and installation of lights and lighting assemblies are to comply with ISO Standard 15370: Ships and marine technology – Low location lighting on passenger ships.

4.1 General requirements

5.1 General

5.1.1 Heating, ventilation and air conditioning systems serving safe areas are to be provided with alarms and safeguards required by 5.1.2 to 5.1.9 to protect against hazards created by the ingress of gas.

5.1.2 Gas detectors are to be provided in or close to all air intakes serving safe areas. They are to be capable of initiating early warning of the presence of flammable and toxic gases likely to be present on the unit as appropriate to its purpose or service. The detectors are also to be capable of initiating relevant shut-down actions should the concentration of gas increase above the early warning level. To minimise nuisance shut-downs, the provision of duplicated or triple redundant detector heads in each inlet operating in a voting configuration is recommended.

5.1.3 In addition to the detectors required by 5.1.2, exhaust outlets of accommodation modules adjacent to gas hazardous areas may also need to be provided with gas detectors to give warning of ingress of gas when the ventilation system is shut down.
5.1.4 Automatically closed dampers are to be provided in all intakes and exhausts. When the gas detectors required by 5.1.2 and, if fitted, those to which 5.1.3 refers, have detected gas demanding shut-down action, all HVAC inlet and exhaust fans and dampers associated with the point where ingress of gas has been detected are to be shut down and closed in addition to the damper of the duct in which gas has been detected. No reliance is to be placed on solely shutting dampers without also shutting down the associated fan motors. Dampers utilised to mitigate against the ingress of gas are to be suitably rated for this service.

5.1.5 A five-second retention time between air inlet gas detectors and downstream dampers is to be considered in the ducting design for machinery space ventilation.

5.1.6 Where a machinery space is not served by redundant air intake ducts, consideration should be given to the provision of gas detection within the space. Consideration should also be given to the isolation of electrical equipment, other than that suitable for installation within a Zone 1 location, see Ch 2,8.1.6, when flammable gas is detected within the space.

5.1.7 The alarms for loss of ventilation, and loss of over pressure required by Ch 2,4 may be incorporated into the fire and gas central panel.

5.1.8 Consideration is to be given to the provision of gas detection within emergency generator spaces and their switchboard spaces as well as in the ventilation system intakes. In the event of gas being detected in the air intakes, the ventilation system intake and exhaust fan dampers are to be shut down and associated fan motors are to be stopped. The emergency generator may continue to run, provided that aspiration air is drawn separately from outside the space and the engine induction and exhaust arrangements comply with the relevant requirements of Ch 2,7. However, if gas is detected within the spaces, the generator is to be shut down.

5.1.9 Diesel driven fire pumps will not be required to be shut down if gas is detected in the area or space in which they are sited, provided that no electrical equipment, other than that suitable for installation in a Zone 1 location, see Ch 2,8.1.8, is required to remain in operation. Many firewater pump drives (i.e., diesel drive units, etc.) are not certified and are therefore not rated to operate in a hazardous atmosphere. Therefore they are to be suitably protected by other means, as follows:

- housed in a safe area, within a suitably rated enclosure with fire rated and gastight barriers, designed to run with the firewater pump drive enclosure shut down (i.e., enclosure fire and gas dampers closed, etc.);
- diesel drives are to be provided with engine overspeed protection, etc.

This is to mitigate against gas ingress and enable such drives to continue to operate. However, they should not be started up with gas present, and any electrical starting circuits, and control and alarm circuits, not suitable for operation in a Zone 1 location are also to be isolated.

5.1.10 Gas detectors are to be capable of initiating early warning of the presence of gas and are also to be capable of initiating relevant shut-down actions via the emergency shut-down system called for in Section 7 when higher gas concentrations are detected. To minimise nuisance shut-downs, it is recommended that trips be initiated by confirmed response by more than one detector within the space concerned or the provision of similar voting arrangements.

5.1.11 Detectors are to be provided with flammable gas detectors at the following locations:

- Turbine air intakes.
- Ventilation system air intakes.
- Ventilation system exhausts.

The presence of gas in the turbine air intake and/or ventilation system air intake is to initiate shut-down of the turbine and the ventilation system. If gas is sensed only in the ventilation exhaust, the ventilation system is to continue running and the turbine is to be shut down. Proposals involving shutting down and inerting the turbine machinery enclosure for the conditions described will be given special consideration.

6.1 General

6.1.1 Enclosed and semi-enclosed hazardous areas as defined in Ch 2,1.2 are to be provided with alarms and safe guards required by 6.1.2 to 6.1.4 to give protection against accidental release of hydrocarbon and toxic gases.

6.1.2 Gas detectors are to be provided to give warning of gas release in the following locations:

- Drill floor.
- Mudrooms.
- Shale shaker space.
- Wellhead and riser areas.
- Adjacent to process equipment.
- Machinery rooms with gas-fuelled equipment.
- Any other location where there is a significant risk of a leakage of gas or of liquid liable to release flammable vapour.

6.1.3 Detectors are to be capable of initiating early warning of the presence of gas and are also to be capable of initiating relevant shut-down actions via the emergency shut-down system called for in Section 7 when higher gas concentrations are detected. To minimise nuisance shut-downs, it is recommended that trips be initiated by confirmed response by more than one detector within the space concerned or the provision of similar voting arrangements.

6.1.4 Gas turbines and their enclosures shall be fitted with flammable gas detectors at the following locations:

- Turbine air intakes.
- Ventilation system air intakes.
- Ventilation system exhausts.

The presence of gas in the turbine air intake and/or ventilation system air intake is to initiate shut-down of the turbine and the ventilation system. If gas is sensed only in the ventilation exhaust, the ventilation system is to continue running and the turbine is to be shut down. Proposals involving shutting down and inerting the turbine machinery enclosure for the conditions described will be given special consideration.

6.1.5 If an enclosed hazardous area is supplied with a ventilation system, the presence of gas in the enclosed hazardous area and/or the ventilation system air extracts from this area is not to initiate the shut-down of the area’s ventilation system as this will result in the build-up of hazardous gas in this area. However, other suitable shut-down functionality (i.e., tripping of electrical equipment within the area, process plant shut-down and emergency depressurisation, etc.), is to be initiated, dependent upon the degree of hazard.
**Section 7**

**Emergency shut-down (ESD) systems**

### 7.1 General

#### 7.1.1 An ESD system is to be provided when any process presents a hazard which could affect the safety of personnel, the overall safety of the unit or the pollution of the environment. The system is to satisfy the requirements of 7.1.2 to 7.1.17.

#### 7.1.2 The ESD system is to operate in association with those items of plant defined in Pt 6, Ch 1.1.2.3 as applicable, and is to incorporate levels of shut-down appropriate to the degree of hazard to personnel, the unit and the environment. The arrangements are to be derived using hazard analysis techniques.

#### 7.1.3 The operation of the ESD system is to be initiated manually. In addition, operation is also to be initiated automatically by signals derived from the fire and gas detection system and signals derived from process and other equipment sensors. The shut-down of drilling equipment, required to make the installation safe, is only to be initiated manually.

#### 7.1.4 Manual ESD actuation points for complete shut-down of the installation are to be provided at the main control station and other suitable locations, e.g., at the helicopter deck, and the emergency evacuation stations.

#### 7.1.5 Each manual ESD actuation point on the installation is to be clearly identifiable, at field location, as well as with identifiable Tag and Location on Operator Control Screen.

#### 7.1.6 The ESD system is to be arranged with automatic changeover to a standby power supply, ensuring uninterrupted operation of the system in the event of failure of the normal power supply.

#### 7.1.7 Failure of any power supply to the ESD system is to initiate an audible and visual alarm.

#### 7.1.8 The characteristics of the failure to safety operation for plant and equipment is the automatic reversion to the least hazardous condition upon failure of protective system, logic, sensors, actuators or power source.

**Note**

This requirement is normally realised by employing a de-energise to trip design. Special consideration is given to subsea christmas tree solenoid valves which are not normally energised.

#### 7.1.9 Hydrocarbon related components are to be equipped with at least two independent levels of safety protection to prevent or minimise the effects of an equipment failure within the process. Where provision of two diverse means of protection cannot be achieved, special consideration must be given to the design of the alternative means.

#### 7.1.10 High level ESD (as defined in accordance with 7.1.2, e.g., platform shut-down, production shut-down) is to be provided with local reset of each final element. Elements affected by low level ESD (as defined in accordance with 7.1.2, e.g., unit shut-down) may be reset by means of a remote manual group reset operation from the central control room.

#### 7.1.11 Software input inhibits and output overrides may be used for maintenance purposes. However, this method of applying inhibits and overrides must be restricted to some of the fire and gas systems and low level of shut-down functions only. Physical key switches are to be used for applying inhibits and overrides for high level, safety critical shut-down system.

#### 7.1.12 Start-up overrides may be applicable to low level and similar trips during plant start-up. These overrides are to be cancelled automatically once the normal process condition has been reached or when a fixed period of time has expired.

#### 7.1.13 Where arrangements are provided for overriding parts of an ESD system, they should be such that inadvertent operation is prevented. Visual indication is to be given at the main control point when an override is operated.

#### 7.1.14 Accumulators for pneumatic and hydraulic systems are to have sufficient capacity to allow the performance of one complete shut-down followed by reset and a further shut-down, without the need for recharging the accumulator.

#### 7.1.15 Where ESD applications are to be implemented by programmable electronic instruments, a qualitative risk-based approach to the specification and design of these systems is to be adopted. The ESD system is to comply with the requirements of IEC 61508 – Functional safety of electrical/electronic safety-related systems and, as far as applicable, those of IEC 61511 – Functional safety – safety instrumented systems for the process industry sector. Each measure to control or mitigate hazards is to be assigned an appropriate degree of risk reduction which contributes to the overall risk reduction. The risk reduction figure is to be translated into performance standards for each measure which will be specified in terms of functionality, safety integrity and survivability, see also Pt 6, Ch 1, 2.9 to 2.11.

**Note**

The implementation of a programmable electronic system (P.E.S.) to perform high safety integrity level functions is not recommended unless the P.E.S. has been certified by the supplier or external body to meet the requirements of IEC 61508 2010 in terms of the safety integrity level (SIL) PFD_{AVG} requirements.

#### 7.1.16 Status, diagnostic and alarm information exchange executed by read-only soft links to remote digital systems for display purposes may be provided, as applicable, in addition to a matrix panel, see Pt 6, Ch 1.2.13.9 of the Rules for Ships.

#### 7.1.17 Consideration is to be given to the segregation of cabling and wiring associated with high level ESD functions from that associated with other functions.
7.2 Electrical equipment

7.2.1 Equipment which is located in spaces other than enclosed spaces and which is capable of operation after emergency shut-down should be suitable for installation in zone 1 locations. Such equipment which is located in enclosed spaces should be suitable for its intended application, see also Ch 2,8.1.6 and 8.1.8. At least the following facilities are to be operable after an emergency shut-down:

- emergency lighting detailed in Pt 6, Ch 2.3.1.5 for half an hour;
- blow out preventer control system;
- general alarm system;
- public address system; and
- battery-supplied radiocommunication installations.

It is noted that guidance from the IMO MODU Code and IEC 61892-7 for MODUs details the suitability of zone 2 certified equipment for facilities that are required to function following an emergency shut-down and provide continued operation during an ongoing emergency. However, LR recommends the utilisation of zone 1 certified equipment for facilities that are required to function following an emergency shut-down and provide continued operation during an ongoing emergency. This will ensure consistency with IEC 61892-7 for offshore production units and other guidance regarding offshore hydrocarbon production installations.

Section 8

Riser systems

8.1 General

8.1.1 The provisions laid down in Pt 3, Ch 12 for the assignment of the special features class notation PRS are to be complied with.

8.1.2 The location where the riser(s) is situated, inboard of the unit, is to be safeguarded by an appropriate fire and gas detection system complying with the requirements of Section 2. In the event that a fire or confirmed gas leakage is detected, effective automatic means of closing down the riser(s) are to be provided.

8.1.3 The riser system is to be equipped with an emergency shut-down valve, fitted as close to the waterline as possible. The valve is to be of the self-actuating type with its own localised control medium and interfaces with the installation ESD, as specified in Section 7.

8.1.4 Automatic testing facilities which periodically actuate the inboard riser valves are to be provided.

8.1.5 The riser system is to be provided with means of leakage monitoring and means to ensure integrity of the riser system. The leak detection system is to take the following parameters into consideration:

- Continuous monitoring of rate of change of pressure.
- Low pressure alarms.
- Low flow alarms.
- Reverse flow alarm.

8.1.6 Control of the riser system is to be effected from a clearly defined control centre, provided with sufficient instrumentation to indicate the conditions at each end of the riser system and to ensure effective control, shut-down and disconnection.

8.1.7 Where more than one control centre is provided, the arrangements are to be such that only one control centre can start up the riser system at a given time. Clear indication is to be provided to show which centre is in control.

8.1.8 Independent means of voice communication are to be provided between the single point mooring end of the riser system and the control centre(s).

8.1.9 Alarms displayed in a control centre are to be audible and visual. An alarm event recorder is to be provided.

8.1.10 The riser system is required to be safely disconnected when the design limits are exceeded. Self-closing devices positioned as close to the rapid disconnecting point as possible are to be fitted so as to ensure accidental spillage at the junction is minimised. A suitable alarm is to be provided, warning that the design limits have been reached.

Section 9

Protection against flooding

9.1 General requirements

9.1.1 The requirements for watertight and weathertight integrity and the general requirements regarding the control and closure of watertight and weathertight doors and hatch covers in order to satisfy the intact and damaged stability criteria are given in Pt 4, Ch 7, to which reference should be made.

9.1.2 A system of alarm displays and controls is to be provided which will ensure satisfactory supervision and control of watertight doors and hatch covers, and also in the case of column-stabilised units to give warning of ingress of water.

9.1.3 For column-stabilised units, the alarm displays and controls are to be provided at a centralised panel at the ballast control station. See Pt 4, Ch 7.3, Pt 5, Ch 13,8.6 and Pt 6, Ch 1,2.8.

9.1.4 For surface type and self-elevating units, the alarm displays and controls are to be provided at a centralised panel either at the ballast control station, the main control station, the bridge, or at the conning position, as applicable, see Pt 4, Ch 7.3.
9.1.5 Doors and hatch covers needed to ensure watertight integrity of internal openings and which are used during operation of the unit while afloat are to be remotely controlled. Detailed alarm, indication, and control requirements are given in 9.2 for electrically operated watertight doors and hatch covers, and in 9.3 for hydraulically operated watertight doors and hatch covers.

9.1.6 Doors and hatch covers needed to ensure watertight integrity of internal openings which are normally kept closed when the unit is afloat are to be provided with alarm indicators in accordance with 9.4.

9.1.7 Doors and hatch covers needed to ensure watertight and weathertight integrity of external openings are to comply with 9.1.4 and 9.1.6, as appropriate, in accordance with the requirements of Pt 4, Ch 7.

9.1.8 When other types of closing appliances (e.g., on ventilators) are required to be remotely controlled or alarmed in accordance with the requirements of Pt 4, Ch 7, the general requirements of this Section are to be complied with, as applicable.

9.1.9 Bilge level sensors and water level indication required for column-stabilised units are to be in accordance with 9.5.

9.2 Electrically operated watertight doors and hatches

9.2.1 The requirements for electrically operated watertight doors and hatches are given in Pt 6, Ch 2,19.1 of the Rules for Ships, which are to be complied with where applicable.

9.2.2 Where watertight doors and hatch covers are to be operated electrically, the term ‘door’ is to be understood to include hatch covers.

9.2.3 Where the Rules for Ships refer to ‘bulkhead deck’ this should be substituted for ‘final water plane after damage’.

9.2.4 The ‘master-mode’ switch is to be Type Approved in accordance with Test Specification Number 1 given in LR’s Type Approval Scheme.

9.3 Hydraulically operated watertight doors and hatch covers

9.3.1 Where watertight doors and hatch covers are operated hydraulically, the arrangements are to be equivalent to 9.2.1 and 9.2.5 for electrically operated doors and hatch covers.

9.3.2 Electrical indication arrangements for hydraulically operated doors and hatch covers are to meet the requirements of 9.2.1 and 9.2.5.

9.3.3 Where four or more doors or hatch covers are powered from a single hydraulic power unit, duplicated hydraulic pump units are to be provided.

9.4 Indicators for doors, hatch covers and other closing appliances

9.4.1 The indicator system(s) of 9.1.5 and 9.1.6 is to be designed on the fail-safe principle, such that, in the event of a fault, the system cannot incorrectly indicate that a door, hatch cover, or other closing appliance is fully closed. A green light is to indicate when a door, hatch cover or closing appliance is closed and a red light is to indicate that it is not fully closed or secured.

9.4.2 The electrical power supply for the indicator system(s) is to be independent of any electrical power supply for operating and securing the doors and hatch covers.

9.5 Bilge level and flood water level alarm and indication

9.5.1 Column-stabilised units are to be provided with arrangements to warn of high bilge level and ingress of water due to flooding, in accordance with 9.5.2 to 9.5.4, see also Pt 5, Ch 13,8.6.

9.5.2 Bilge high level alarms and water high level alarms are to be provided on a centralised control panel situated in the ballast control room required by Pt 6, Ch 1,2.8.

9.5.3 Bilge high level or water high level alarm sensors are to be installed in all compartments which are large enough to affect stability and which are required to remain watertight to comply with the intact and damaged stability criteria. Tanks fitted with remote tank level indicators with displays other than in the ballast control room are exempt from this requirement. The requirements for chain lockers are to comply with Pt 5, Ch 13,8.6.3.

9.5.4 Pump-rooms and propulsion rooms in lower hulls and columns are to be provided with two level sensors in each compartment, one for detection of high bilge water level, and a second detector to warn of flooding.
1.1.1 Application

Units for oil and gas exploration, units with production and process plant, drilling plant and other units where explosive gas-air mixtures are likely to be present are to be classified into ‘hazardous areas’ and ‘non-hazardous areas’ in accordance with the requirements of this Chapter, or alternatively, with an acceptable Code or Standard giving equivalent safety.

1.1.2 These requirements do not apply to the release of explosive gas-air mixtures as a consequence of an uncontrolled well blow out or catastrophic failure of pipes or vessels.

1.1.3 For special requirements relating to drilling, workover and wirelining operations, see Section 3.

1.1.4 For special requirements relating to the storage of oil in bulk, liquefied gases or other hazardous liquids, see Sections 9 to 11.

1.1.5 The hazardous areas applicable to well testing will be specially considered.

1.2 Definitions and categories

1.2.1 A hazardous area is an area on the unit where flammable gas-air mixtures are, or are likely to be, present in sufficient quantities and for sufficient periods of time such as to require special precautions to be taken in the selection, installation and use of machinery and electrical equipment.

1.2.2 Hazardous areas may be divided into Zones 0, 1 and 2, defined as follows:

**Zone 0**: An area in which an explosive gas-air mixture is continuously present or present for long periods.

**Zone 1**: An area in which an explosive gas-air mixture is likely to occur under normal operating conditions.

**Zone 2**: An area in which an explosive gas-air mixture is unlikely to occur, and if it does occur, it will only persist for short period.

Non-hazardous areas are those which are not classified as hazardous according to the above definitions.

1.2.3 An enclosed space is considered to be any building, room or enclosure, e.g., cabinet, within which, in the absence of artificial ventilation, the air movement will be limited and any flammable atmosphere will not be dispersed naturally.

1.2.4 A semi-enclosed space is considered to be a space which is adjoining an open area, where the natural ventilation conditions within the space are restricted by structures such as decks, bulkheads or windbreaks in such a manner that they are significantly different from those appertaining to the open deck, and where dispersion of gas may be impeded.

1.2.5 When an enclosed or semi-enclosed space is provided with a mechanical ventilation system which ensures at least 12 air changes per hour and no pockets of stagnant air within the space, such a space may be regarded as an open space.

1.2.6 An open-air area is one without stagnant regions where vapours are rapidly dispersed by wind and natural convection. Typically, air velocities will rarely be less than 0.5 metres per second and will frequently be above 2 metres per second.

1.2.7 Under normal operating conditions, a hazardous zone or space may arise from the presence of any of the following:

(a) Spaces or tanks containing any of the following:

(i) Flammable liquid having a flash point not exceeding 60°C closed-cup test;

(ii) Flammable liquid having a flash point above 60°C closed-cup test, heated or raised by ambient conditions to a temperature within 15°C of its flash point;

(iii) Flammable gas.

(b) Piping systems or equipment containing fluid defined by (a) and having flanged joints, glands or other fittings through which leakage of fluid may occur.

(c) Piping systems or equipment containing flammable liquid not defined by (a), and having flanged joints, glands or other fittings through which leakage of fluid in the form of a fine spray or mist could occur.
1.3.2 It is expected that the data sheets, referred to in 1.3.1, include, but are not limited to, the following information:

- Equipment identification.
- Operating conditions.
- Media and media properties.
- Fluid category.
- Sources of potential release.
- Grades of release.
- Venting rates.
- Hazardous zones determined.
- Dimension of each hazardous zone.
- Code or Standard used for reference.

1.3.3 Single copies, unless otherwise stated, of the following plans and particulars on ‘ventilation’ are to be submitted for consideration:

- Ventilation design philosophy.
- Ventilation design specifications.
- Ventilation layout plans.
- Ducting and instrumentation plans (D & ID’s).

### Section 2

#### Classification of hazardous areas

2.1 General

2.1.1 The hazardous areas as specified may be extended or restricted depending on conditions such as fluid system pressure and composition, or by the use of structural arrangements such as fire walls, windshields, special ventilation arrangements, etc. Special requirements may be applicable to units intended for the storage in bulk of flammable liquids or gases, see Sections 9 to 11.

2.1.2 Relatively small non-hazardous areas surrounded by or confined by hazardous areas, or Zone 2 areas within Zone 1 areas, are to be classified as the adjacent surrounding hazardous area.

2.1.3 For gas disposal systems other than permanently ignited flares, and for vents for large quantities of hydrocarbon gas from production facilities, the classification and extent of the surrounding hazardous areas should be based on dispersion calculations.

2.1.4 For permanently ignited flares, consideration is to be given to possible ‘flame out’ condition or intentional periods of cold venting and the hazardous area created by such are to be determined.

2.1.5 Within these Rules, all reference to the extent of the hazardous zones given as a radius refers to the horizontal extent of the zone, except where specifically stated as being a spherical zone; for vertical extent of zones, see 2.5.
### 2.2 Zone 0

**2.2.1 Areas to be classified as Zone 0 include:**

(a) the internal space of a closed tank or pipe containing a flammable liquid or gas, crude oil or active mud, or a space where an oil-gas-air mixture is continuously present, or present for long periods;

(b) unventilated spaces, containing a source of release (i.e., flange, valve, etc.), separated by a single gastight bulkhead, or deck, from a tank containing flammable liquid or gas;

(c) a region within 3 m radius from non-pressurised tank vents or other sources, or within 15 m radius from cold vents where discharge rates exceed 10 m³/h, which releases flammable gases or vapours frequently, continuously or for long periods.

### 2.3 Zone 1

**2.3.1 Areas to be classified as Zone 1 include:**

(a) adequately ventilated closed or semi-enclosed spaces containing primary grades of release, see 1.2.8(b);

(b) mechanically ventilated closed spaces, containing a source of release (i.e., flange, valve, etc.) separated by a single gastight bulkhead or deck from a tank containing flammable liquid or gas. Or unventilated closed spaces, not containing any sources of release, separated by a single gastight bulkhead, or deck, from a tank containing flammable liquid or gas;

(c) in open spaces, the area surrounding a primary grade of release. The extent of the Zone 1 hazardous area will be based upon the primary grade source of release;

(d) in open spaces, the area within 3 m from pig launcher and receiver doors. This may be reduced to 1.5 m if the equipment is purged with nitrogen or water washed before opening;

(e) in open spaces, the area local to any opening associated with an enclosed Zone 1 area, any ventilation outlet from a Zone 1 space, or any access, such as a doorway or non-bolted hatch to an enclosed Zone 1 hazardous area, is to be classified as a Zone 1 space. The extent of the external Zone 1 hazardous area will be based upon the largest source of release with the enclosed Zone 1 area;

(f) semi-enclosed spaces, such as inadequately ventilated pits, ducts or similar structures situated in locations which would otherwise be a Zone 2, but where their arrangement is such that gas dispersion cannot easily occur;

(g) for drilling units, specific reference is to be made to the requirements, given in the 2009 IMO MODU Code Resolution A.1023(26) Ch 6, regarding the extent of Zone 1 hazardous areas on MODUs, as well as the following Section 3; and

(h) air-locks between a Zone 1 and a non-hazardous area, see 4.1.3(c).

### 2.4 Zone 2

**2.4.1 Areas to be classified as Zone 2 include:**

(a) adequately ventilated closed or semi-enclosed spaces containing secondary grades of release, see 1.2.8(c);

(b) in open spaces, the area beyond the Zone 1 specified in 2.3.1(c) and (d), and beyond the semi-enclosed space specified in 2.3.1(f). The extent of the Zone 2 hazardous area will be based upon the primary grade source of release;

(c) in open spaces, the area surrounding secondary grades of release, any ventilation outlet from a Zone 2 space or any access to a Zone 2 space. The extent of the Zone 2 hazardous area will be based upon the source of release;

(d) mechanically ventilated closed spaces not containing a source of release separated by a single gastight bulkhead or deck from a tank containing flammable liquid or gas;

(e) for drilling units, specific reference is to be made to the requirements, given in the 2009 IMO MODU Code Resolution A.1023(26) Ch 6, regarding the extent of Zone 2 hazardous areas on MODUs as well as the following Section 3;

(f) For tanker storage facilities containing flammable liquids or flammable liquefied gases, specific reference is to be made to the requirements given in IEC 60092-502 regarding the extent of Zone 2 hazardous areas on the MOU;

(g) the area within a 3 m radius from bunds or barriers intended to contain spillage of liquids defined by 1.2.7(a); and

(h) air-locks between a Zone 1 and a non-hazardous area, see 4.1.3(c).

### 2.5 Vertical extent of hazardous zones

**2.5.1** The relationship between the hazard radius and the full 3-dimensional envelope of the hazardous area is dependent upon the height and orientation of the release, and the hazard radius. If the release height and the generated hazardous radius zone are greater than 1 m above the deck, then the developed hazardous area is independent of potential hazardous accumulations of flammable releases at deck level. If the release height and the generated hazard radius are less than 1 m above the deck, then the developed hazardous area is dependent on potential hazardous accumulations of flammable releases at deck level and the subsequent hazardous area needs to take into account the generated hazardous area at deck level.

**2.5.2** For tanker storage facilities containing flammable liquids or flammable liquefied gases, specific reference is to be made to the requirements given in IEC 60092-502 regarding the extent of Zone 1 and Zone 2 hazardous areas on the MOU.
Hazardous Areas and Ventilation

Section 3
Hazardous areas – Drilling, workover and wirelining operations

3.1 General

3.1.1 This hazardous area classification applies to any part of the drilling derrick or equipment which could potentially release oil or gas from the well, including equipment that is required to operate under controlled emergency conditions such as during a blow out.

3.1.2 The requirements of Section 2 are also to be complied with, where applicable.

3.2 Classification

3.2.1 For MOU drilling units, specific reference is to be made to the requirements given in the 2009 IMO MODU Code Resolution A.1023(26) Ch 6 regarding the extent of hazardous areas on MODUs. However, it must be recognised that other recognised Standards (i.e., IP15, etc.) give additional and potentially different hazardous area guidance associated with drill rigs and facilities. As such, the guidance given in these alternative Standards may be more applicable to the drilling facilities associated with the MOU to be classified.

Section 4
Enclosed and semi-enclosed spaces with access to a hazardous area

4.1 General

4.1.1 As far as practicable, access doors or other openings should not be provided between a non-hazardous space and a hazardous area or space, or between a Zone 2 space and a Zone 1 space.

4.1.2 Where such openings are necessary, an enclosed or semi-enclosed space with a direct access door or opening leading to an area or space which is of a greater hazard classification is to be regarded as the same hazard classification as the area or space into which this door or opening leads, except where suitable arrangements as permitted by 4.1.3 are provided.

4.1.3 An enclosed space with direct access to a:
(a) Zone 1 hazardous area may be classified as Zone 2 provided that:
(i) the access is fitted with a self-closing, gastight door that opens into the Zone 2 space; and
(ii) ventilation is such that the air flow with the door open is from the enclosed space to the Zone 1 hazardous area; and
(iii) loss of ventilation is alarmed at a manned control station.
(b) Zone 2 hazardous area may be classified as non-hazardous provided that:
(i) the access is fitted with a self-closing, gastight door that opens into the non-hazardous space; and
(ii) ventilation is such that the air flow with the door open is from the non-hazardous space to the Zone 2 hazardous area; and
(iii) loss of ventilation is alarmed at a manned control station; and
(iv) the enclosed space is maintained at an overpressure of at least 50 Pa relative to the external hazardous area.
(c) Zone 1 hazardous area may be classified as non-hazardous provided that:
(i) the access is via an air-lock consisting of two self-closing, gastight doors without any hold-back arrangement, and spaced at least 1.5 m but not more than 2.5 m apart; and
(ii) the enclosed space is maintained at an over-pressure of at least 50 Pa relative to the external hazardous area; and
(iii) the relative air pressure within the space is continuously monitored and so arranged that, in the event of loss of overpressure, an alarm is given at a manned control station.

4.1.4 Where one of the doors specified in 4.1.3(c)(i) is required to be weathertight or watertight and the provision of a self-closing mechanism would be impracticable, consideration will be given to waiving the requirement for this door to be self-closing, provided the door is normally kept closed and is provided with a notice to this effect.

Section 5
Machinery in hazardous areas

5.1 General

5.1.1 Installation of mechanical equipment within hazardous areas should be limited to that considered to be necessary for operational purposes within that area. Wherever possible, the installation of fired equipment or internal combustion machinery in hazardous areas should be avoided.

5.1.2 Where it is considered necessary for mechanical equipment or machinery to be installed in a hazardous area, it is to be constructed and installed so as to reduce the risk of sparking due to friction between moving parts or the formation of static electricity, or to ignition due to exposed high-temperature exhausts, etc., see also Pt 5, Ch 14.3.13.
5.1.3 Air compressors are not, in general, to be installed in hazardous areas. However, where this is not practicable, such an installation may be accepted provided that the air inlet is from a non-hazardous area in accordance with 6.4, and that the inlet ducting is fitted with suitable gas detectors arranged to give an audible and visual alarm and to shut down the compressor in the event of flammable and/or toxic gases entering the air inlet.

5.1.4 Fans located in hazardous areas are to be of the non-sparking type.

5.1.5 For the requirements appertaining to the installation of suitably protected oil engines in a Zone 2 hazardous area, see Section 7.

5.1.6 Wherever possible, piping system arrangements are to preclude direct communication between hazardous and non-hazardous areas, and between hazardous areas of different classifications. Where pipes, ducts or cables pass through decks or bulkheads, the penetration shall be designed to prevent the passage of hazardous gases.

5.1.7 Maintenance hatches and removable panels are to be provided with suitable seals to prevent the passage of hazardous gases when closed.

5.1.8 When oil storage pumps and ballast pumps in dangerous or hazardous spaces are fitted with automatic or remote controls so that under normal operating conditions they do not require any manual intervention by the operators, they are to be provided with the alarms and safety arrangements required by Table 2.5.1 as appropriate. Alternative arrangements which provide equivalent safeguards will be considered. The design of the alarm, control and safety systems is to comply with the requirements of Pt 6, Ch 1,2. Where machinery is arranged to start automatically or from a remote control station, interlocks are to be provided to prevent start-up under conditions which could cause hazard.

### Table 2.5.1 Alarm and safety arrangements

<table>
<thead>
<tr>
<th>Item</th>
<th>Alarm</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead gland temperature</td>
<td>High</td>
<td>Any machinery item</td>
</tr>
<tr>
<td>Bearing temperature</td>
<td>High</td>
<td>Any machinery item</td>
</tr>
<tr>
<td>Pump casing temperature</td>
<td>High</td>
<td>‘Oil storage’ pumps only</td>
</tr>
<tr>
<td>Bilge level</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Hydrocarbon concentration</td>
<td>High</td>
<td>&gt;10% LEL</td>
</tr>
</tbody>
</table>

5.1.9 Ducting materials, including associating fittings, are to be of a non-combustible material, to be of all welded construction adequate to withstand likely damage and corrosion and to be suitable for a marine saline atmosphere. Ventilation fans are to have non-overloading, non-stall characteristics and are to be fitted with anti-sparking tracks.

5.1.10 For aspects of ventilation systems relating to fire integrity, see Chapter 3, and for gas detection requirements, see Ch 1,5.
6.2 Ventilation of hazardous spaces

6.2.1 Ventilation systems and ducting for spaces designated as hazardous areas are to be entirely separate from ventilation systems and ducting for spaces designated as non-hazardous areas.

6.2.2 All enclosed hazardous spaces are to be adequately ventilated by a mechanical ventilation system providing at least 12 air changes per hour. Air change calculations are to be based upon empty volume of space. The mechanical ventilation is to be such that hazardous enclosed spaces are maintained with an underpressure of at least 50 Pa in relation to any adjacent less hazardous areas or spaces.

6.2.3 To ensure that the required relative underpressure is maintained in any hazardous enclosed space, the supply and exhaust fans are to be interlocked so that the supply fan cannot be run unless the exhaust fan is running.

6.2.4 Ventilation arrangements should ensure that the entire space is adequately ventilated, giving an even air distribution, with special consideration to locations where there is equipment which may release gas, and to locations within the space where stagnant pockets of gas could accumulate.

6.2.5 Electric heating elements are to be fitted with automatic temperature control, a high temperature alarm and an independent sensor and cut-out with manual reset. The surface temperature is to be restricted to a maximum of 200°C, or below the ignition temperature of any flammable gas likely to be present in the area.

6.2.6 The presence of gas within the enclosed hazardous area, and/or the ventilation system air extracts from this area, is not to initiate the shut-down of the area’s ventilation system as this will result in the build-up of hazardous gas in this area.

6.3 Ventilation of other spaces containing sources of hazard

6.3.1 Ventilation systems and ducting for any space containing a source of release of a flammable substance, but not designated as a hazardous space in its entirety (e.g., by virtue of compliance with 1.2.5), are to be entirely separate from ventilation systems and ducting for other non-hazardous areas or spaces.

6.3.2 The mechanical ventilation is to be such that the space and ducting serving it is maintained at an underpressure of at least 50 Pa in relation to adjacent non-hazardous areas or spaces.

6.3.3 Where the ventilation airflow rate, within the space in relation to the maximum release rate of flammable substances reasonably to be expected under normal operating conditions, is sufficient to prevent any concentration of flammable substances approaching their lower explosive limit, consideration will be given to regarding the entire space, including the zone around equipment contained within it, its ventilation systems and other openings into it, as non-hazardous. Ventilation airflow shall be monitored and appropriate measures taken in the event of failure. For requirements particular to gas turbine rooms and hoods, see 6.5.

6.3.4 The presence of gas within the enclosed hazardous area, and/or the ventilation system air extracts from this area, is not to initiate the shut-down of the area’s ventilation system as this will result in the build-up of hazardous gas in this area.

6.4 Location of air intakes and exhausts

6.4.1 Supply air intakes are to be located in external non-hazardous areas, at least 3 m from the boundary of any hazardous area.

6.4.2 The siting of supply air intakes should be such as to avoid the possibility of drawing in combustion products from equipment exhausts or hazardous/toxic gases from process equipment.

6.4.3 Ventilation intake and outlet ducts should not pass through spaces of different classification. Where this is unavoidable, ducts may pass through a more hazardous space than the ventilated space, provided such ducts have an overpressure in relation to the space through which they pass. Where necessary, ducts should be of welded, gastight construction. The internal space of such ducts is to have the same zone classification as the ventilated space.

6.4.4 Ventilation outlets are, as far as is practicable, to be located in external areas of the same or lesser zone classification as the ventilated space. Where this is not practicable, appropriate measures are to be taken to prevent backflow into the ventilated space, in the event of ventilation failure.

6.4.5 The separation between air intakes and outlets should be at least 4,5 m. The siting of inlets and outlets should be such as to avoid the possibility of cross-contamination.

6.4.6 Ventilation intakes and outlets are to be located and arranged to avoid ingress of rain, snow and sea-water, even under predicted worst storm conditions.

6.4.7 Gas turbine intakes and exhausts are to be positioned well clear of the unit's structure. Turbine exhausts are to be safely located so as not to endanger personnel or interfere with helicopter operations.

6.5 Gas turbine ventilation

6.5.1 The turbine room is to be designed as a non-hazardous space, mechanically ventilated with at least 12 air changes per hour and arranged so that an overpressure of at least 50 Pa is maintained in relation to the turbine hood.
Section 7
Oil engines in hazardous areas

7.1 Application

7.1.1 Oil engines are not permitted in Zone 0 and Zone 1 hazardous areas on offshore installations. Oil engines which are required to operate in Zone 2 hazardous areas are to comply with the requirements of 7.1.2 to 7.1.23. National Standards and National Administration Regulations or Codes of Practice which differ from these requirements may also be accepted, provided an equivalent standard of protection is achieved.

7.1.2 The air induction system is to be provided with a shut-off valve located between the engine air inlet filter and the flame arrester. The valve is to be capable of being closed manually. The valve is also to be capable of being automatically closed by the engine overspeed device and it is recommended that the induction air valve and engine fuel supply should automatically close by a signal from a local gas sensor.

7.1.3 An approved corrosion resistant flame arrester constructed and tested to a recognised Standard is to be provided in the induction system. The flame arrester is to be as close to the engine as possible with good access for inspection and overhaul.

7.1.4 Joints used in the induction and exhaust systems are to be designated either as ‘open joints’ or ‘closed joints’.

7.1.5 Where the surface temperature of the turbine or equipment inside the hood could exceed 80 per cent of the auto-ignition temperature of any flammable gas which may be present, the space inside the hood is to be ventilated with at least 90 air changes per hour. Under these conditions, the turbine hood need not be classified as a hazardous area when the turbine is in operation.

6.5.2 The turbine hood is to be mechanically ventilated by means of one duty and one 100 per cent standby extraction fan with a ventilation rate adequate to remove heat from the turbine and equipment, and to dilute any flammable gas. Potential leakage from under the turbine hood is to be considered. The ventilation rate is to be at least 12 air changes per hour and arranged so that an underpressure of at least 50 Pa is maintained in relation to the turbine room. On failure of the duty fan an alarm is to be given in the control room and the standby fan automatically activated.

6.5.3 Provided it can be shown that no exposed surface of the turbine or equipment inside the hood will have a surface temperature exceeding 200°C, or that the surface temperature will not exceed 80 per cent of the auto-ignition temperature, expressed in °C, of any flammable gas which may be present, the ventilation rate may be as per 6.5.2 where the turbine is in operation. Under these conditions, the space inside the hood will be classified as a Zone 2 hazardous area.

6.5.4 Where the surface temperature of the turbine or equipment inside the hood could exceed 80 per cent of the auto-ignition temperature of any flammable gas which may be present, the space inside the hood is to be ventilated with at least 90 air changes per hour. Under these conditions, the turbine hood need not be classified as a hazardous area when the turbine is in operation.

6.5.5 The turbine hood ventilation fans referred to in 6.5.2 are to be interlocked with the turbine starting sequence to provide at least five air changes in the turbine hood before start-up of the turbine or the energising of any associated electrical equipment, other than that suitable for installation in a Zone 1 location. On shut-down, the duty fan is to purge the turbine hood until the turbine has stopped. At least one of the fans is to be supplied from an emergency power source.

6.5.6 Equipment which is required to remain activated after shut-down or hood ventilation failure is to be suitable for use in a Zone 1 hazardous area.

6.5.7 Gas detectors are to be installed inside the turbine hood to shut down the turbine on detection of gas.

6.5.8 For gas turbines utilising gas fuel from the production and process facility, the arrangement and capacities of the ventilation system and fuel gas piping are to comply, where applicable, with the requirements of Pt 5, Ch 16, taking into account any additional requirements which may be necessary during start-up or shut-down of the plant.

7.1.6 A closed joint will not allow the passage of either gas or flame under normal or test conditions.

Fig. 2.7.1
Relationship between length and gap for flamepaths
7.1.7 An approved corrosion resistant flame arrester is to be provided in the exhaust system. The flame arrester is to be constructed and tested to a recognised Standard. The flame arrester is to be fitted as close to the engine as possible with good access for inspection and replacement. The flame arrester can be omitted if the exhaust terminates in a safe area.

7.1.8 A spark arrester is to be fitted in the exhaust system downstream of the flame arrester. The spark arrester is to be constructed and tested to a recognised Standard.

7.1.9 It is recommended that a back pressure indicator is fitted to the exhaust manifold to provide prior warning of exhaust flame arrester fouling.

7.1.10 The engine crankcase breather pipe is to be fitted with a flame arrester. For engines in enclosed Zone 2 areas the breather pipe is to be led to the open atmosphere. The breather pipe is not to be led to the engine induction system.

7.1.11 The engine crankcase is to operate at a small positive pressure.

7.1.12 With the engine at maximum continuous rating and temperatures stabilised, no surface temperature on the engine or exhaust system is to exceed 200°C.

7.1.13 Ventilation fan blades and belts are to be of the anti-static type. The combination of materials for fan impellers and the housing are to be non-sparking under both normal and fault conditions.

7.1.14 Engine starting systems are not to introduce a source of ignition external to the engine. The system is to have appropriate safe type certification, or to be capable of being demonstrated as being of a safe type by appropriate testing.

7.1.15 The engine is not to be capable of running in reverse.

7.1.16 Fuel supply is to be capable of being shut off manually and automatically in the event of:
- overspeeding;
- high exhaust temperature, see 7.1.17;
- high cooling water temperature;
- low lubricating oil pressure.

7.1.17 The high exhaust temperature sensor is to be located upstream of the exhaust flame arrester. The high exhaust temperature sensor and engine shut-down on high exhaust temperature can be omitted if the exhaust pipe terminates in a safe area.

7.1.18 Basic operating instructions should be permanently attached to the unit giving details of stop, start and emergency procedures.

7.1.19 Where an engine is fitted inside any enclosure, the following requirements are to be complied with as applicable:
(a) Where an engine is located inside an enclosed Zone 2 hazardous area, the space is to be independently ventilated at a recommended minimum rate of 20 air changes per hour whilst the engine is running and 12 air changes per hour when stopped.
(b) For engines placed inside enclosures of any type it is recommended that fire and gas sensors be provided inside the enclosure, suitably alarmed to a continuously manned control room.

7.1.20 A hydraulic proof test at a gauge pressure of 5 bar or 1.5 times the maximum pressure obtained in explosion tests in accordance with 7.1.21 is to be witnessed on the induction and exhaust system components without showing signs of leakage.

7.1.21 For engines of 370 kW (500 shp) and above, the induction and exhaust systems are to be explosion tested to a recognised Standard without showing signs of damage or flame transmission to the atmosphere. The maximum explosion pressure is to be recorded and used in the hydraulic proof test in 7.1.20.

7.1.22 Complete engine units and driven components are to be examined and tested at the manufacturer’s works or other suitable works before being put into service. Thereafter, the complete unit is to be examined annually and the original certificate endorsed or as otherwise agreed to ensure a permanent written record of survey. It is recommended that time clocks of the non-resetting type be fitted to the engine.

7.1.23 Where an engine manufacturer carries out satisfactory type tests on an engine or series of engines and subsequently provides conversion kits for similar engines, proof tests can be waived. However, each converted engine is to be shop-tested in accordance with 7.1.22.

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### Section 8

#### Electrical equipment for use in explosive gas atmospheres

8.1 General

8.1.1 The installation of electrical equipment in areas containing flammable gas or vapour and/or combustible dust is to be minimised as far as is consistent with operational necessity and the provision of lighting, monitoring, alarm or control facilities enhancing the overall safety of the unit.

8.1.2 Compliance with IEC 60092-502: Electrical Installations in Ships – Tankers – Special Features, where directly relevant, may be accepted as meeting the requirements of this Section.

8.1.3 The requirements for electrical equipment for use in explosive gas atmospheres are given in Pt 6, Ch 2,14.2 and 14.3 of the Rules for Ships, which are to be complied with where applicable.
8.1.4 Additions or amendments to these requirements are given in 8.1.5 to 8.1.15.

8.1.5 In locations classified as Zone 0, only intrinsically safe equipment of category ‘ia’, or simple apparatus as defined in Pt 6, Ch 2,14.2.4(b) of the Rules for Ships and complying in full with the relevant requirements of IEC 60079 for intrinsic safety, category ‘ia’, is permitted.

8.1.6 In locations classified as Zone 1, only the following equipment may be installed:

- Equipment having a type of protection listed under Pt 6, Ch 2,14.2.5 of the Rules for Ships.
- Equipment as described under Pt 6, Ch 2,14.2.6(c) of the Rules for Ships, arranged to be de-energised automatically on loss of pressurisation.

8.1.7 In locations classified as Zone 2, and on open deck in well-ventilated positions not within 3 m of any flammable gas or vapour outlet, equipment having the types of protection listed under Pt 6, Ch 2,14.2.5 of the Rules for Ships or as described under Pt 6, Ch 2,14.2.6 of the Rules for Ships may be installed.

8.1.8 Any electrical equipment which has to remain operational during catastrophic conditions (e.g., rupture of a process vessel or pipe), whether or not installed in a hazardous zone or location, is to be suitable for use in an explosive gas atmosphere. Such equipment is to be of a type permitted within Zone 1 locations, unless it is demonstrated that the equipment is appropriately protected against potentially coming into contact with a flammable atmosphere, by being located in an enclosed safe area with appropriate mitigating measures (i.e., enclosed safe area is equipped with gastight barriers, gastight doors, rated gas dampers, suitable gas detection within the enclosure and its ventilation air intakes, etc.).

8.1.9 Flame-proof enclosures and intrinsically safe electrical apparatus, and apparatus incorporating flame-proof or intrinsically safe components or otherwise tested or certified for particular groups, shall, with reference to the group(s) of gas(es) that may be present, be selected with reference to IEC/TR 60079-20, Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus.

8.1.10 The electrical apparatus shall be so selected that its maximum surface temperature as indicated by its temperature class, or otherwise documented, will not reach the auto-ignition temperature of any gas or vapour, or mixture of gases or vapour, which can be present. The ambient temperature range for which the apparatus is suitable is to be taken to be minus 20°C to 40°C, unless otherwise stated, and account is to be taken of this when assessing the suitability of the equipment for the auto-ignition temperature of the gases encountered.

8.1.11 Cables are not permitted to pass through locations classified as Zone 0, and are permitted to enter such locations only where required for the operation of any electrical equipment located therein.

8.1.12 Cables are to be either:

(a) mineral insulated with copper sheath, or
(b) armoured or braided, except where:

(i) the cable is associated with an intrinsically safe circuit; or
(ii) the cable does not pass into or through any location classified as Zone 1, and is routed or protected so as to present only a low risk of mechanical damage; or
(iii) a cable of flexible construction is demanded by operational requirements, and its construction, routing, and means of support are such as to present only a low risk of mechanical damage; or
(iv) the cable is installed within a conduit system meeting the relevant requirements of IEC 60079-14.

8.1.13 Cables associated with intrinsically safe circuits are to be used only for such circuits. They are to be physically separated from cables associated with non-intrinsically safe circuits, e.g., neither installed in the same protective casing nor secured by the same fixing clip, except where alternative arrangements are permitted by IEC 60079-14.

8.1.14 No more than one intrinsically safe circuit should be run in any multicore cable unless:

(a) no circuit is required to be of category ‘ia’, and, either:

(i) the circuit is run or protected so as to present little risk of its suffering mechanical damage; or

(ii) each intrinsically safe circuit is contained within an earthed metallic screen; or

(b) it can be shown that no combination of faults between the intrinsically safe circuits within the cable can lead to an unsafe condition.

8.1.15 Cabling, wiring, and connections within enclosures containing more than one intrinsically safe circuit or containing both intrinsically safe and other circuits, are to be arranged in accordance with the relevant requirements of IEC 60079-11 and IEC 60079-14 so as to minimise the risk of inadvertent interconnections between different circuits.

8.1.16 Metal coverings of cables installed in hazardous zones or spaces are to be effectively earthed, at both ends at least, except where otherwise permitted by IEC 60079-14.
Hazardous Areas and Ventilation

9.1.2 Spaces or locations associated with or close to the oil storage arrangements are to be classified in accordance with the zonal concept by direct application of IEC 60092-502: Electrical Installations in Ships – Tankers – Special Features. Alternatively, classification may be carried out by application of the methods given in IEC Publication 60079-10-1 or EI (formerly IP) Part 15, taking into account the probable frequency, duration and rates of leakages of flammable material from all sources (including structural defects) and the degree and availability of ventilation at the location. Consideration will then be given to the installation of equipment other than that defined within this Section. Such equipment is to meet the requirements of Section 8 for the relevant zone.

9.1.3 Where the Rules for Ships refer to ‘cargo oil/cargo tanks’, this also applies to ‘integral oil/oil storage tanks’.

9.1.4 Electric cables are not to be installed in dangerous zones or spaces, except as permitted by Section 8.

9.1.5 In addition to the requirements of Section 8, cables, other than those of intrinsically safe circuits, in hazardous zones or spaces, or which may be exposed to stored oil, oil vapour or gas, are to be either:
(a) mineral insulated with copper sheath; or
(b) armoured or braided (for mechanical protection and earth detection) with non-metallic impervious sheath.

9.1.6 Where electrical equipment is not suitable for a hazardous area into which the space has an opening, the electrical supply to the equipment is to be disconnected, provided shutting down the equipment will not introduce a hazard. In this case, an alarm may be given, in lieu of shut-down, upon loss of overpressure or ventilation, and a means of disconnection of the electrical equipment, capable of being controlled from a manned station, provided in conjunction with an agreed operational procedure. Where the means of disconnection (whether controlled automatically or manually) is located within the space, it is to be equipment of a type suitable for use in a Zone 1 location.

9.1.7 Within any space classified as safe by virtue of pressurisation, any electrical equipment required to operate upon loss of overpressure and lighting fittings and equipment within the air-lock is to be of a type suitable for a Zone 1 location. Means are to be provided to prevent electrical equipment, other than that suitable for a Zone 1 location, being energised until the atmosphere within the space is made safe, by air renewal of at least 10 times the internal volume of the space.
SECTION 1

GENERAL

1.1 Application

1.1.1 The requirements for fire and gas detection systems and other safety systems are to be in accordance with Chapter 1. The requirements for hazardous areas and ventilation are to comply with Chapter 2.

1.1.2 Compliance with the requirements for fire safety of the National Administrations in the country in which the unit is registered and in the area of operation, where applicable, is to be demonstrated by the issue of appropriate certification in accordance with Pt 1, Ch 2.1.

1.1.3 In addition to the requirements of 1.1.1 and 1.1.2, units with production and process plant are to comply with the additional requirements given in Section 3.

1.1.4 Units with crude oil storage tanks are, in general, to comply with the relevant requirements for tankers detailed in SOLAS Ch II-2 and IMO Fire Fighting System (FSS) Code Resolution MSC.98(73). Where this is not practicable owing to the general construction of the unit, special consideration will be given to other arrangements which provide equivalent protection, see also Pt 3, Ch 3.1.4.

1.1.5 The definitions given in Section 2 are, in general, in accordance with the IMO Code for the Construction and Equipment of Mobile Drilling Units, 2009 (hereinafter referred to as 2009 MODU Code) and are included for reference purposes only. Where applicable, reference to these definitions may be used in other Parts of these Rules.

1.1.6 For drilling units, specific reference should be made to the requirements of the 2009 IMO MODU Code Resolution A.1023(26) Ch 9 for fire safety.

1.2 Submission of plans and data

1.2.1 The requirements for submissions of plans and data are given in 1.2.7 to 1.2.10, which are to be complied with where applicable.

1.2.2 Additional requirements with respect to unit types as indicated in this Section should also be complied with, where applicable, as in 1.2.3 to 1.2.10.

1.2.3 In addition to the requirements of Chapter 1 of these Rules, when LR is authorised to carry out approvals of fire protection, detection and extinguishment arrangements on behalf of a National Administration or the requirements of Pt 1, Ch 2.1.1.13 of these Rules are applicable, the plans and documents detailed below and required by 1.2.7 to 1.2.10 are to be submitted for approval, together with all additional relevant information, such as the intended function of the unit, the gross tonnage and the power of machinery.

1.2.4 The requirements for active and passive type fire protection systems are to be clearly defined within the unit’s ‘Fire and Explosion Evaluation’ (FEE) report, see 2.4, which is to be submitted for information with the plans required below.

1.2.5 In the case of units with production and process plant, the FEE Report required by 1.2.4, 1.2.8, 1.2.9 and 1.2.10 is to be submitted for approval with full details of the water deluge system and/or water monitor system as required by 3.4.

1.2.6 For units with production and process plant, plans of escape routes with details of their protection are to be submitted for approval as required by 3.6.

1.2.7 For fire protection, the following plans and documents are to be submitted:

- A general arrangement plan showing escape stairways and fire compartment bulkheads and decks, including machinery spaces, control stations, accommodation and service spaces, corridor bulkheads and stairway enclosures.
- A ventilation plan showing the ducts and any dampers in them, and the position of the controls for stopping the system.
- A plan showing the automatic fire detection and fire alarm system.
- A plan showing the location and arrangement of the emergency stop for the oil fuel unit pumps and for closing the valves on the pipes from oil fuel tanks.
- A plan showing the details of the construction of the fire protection bulkheads, decks and deck heads and the particulars of any surface laminates incorporated in them.
- Copies of the Certificates of Approval by National Authorities in respect of all ‘A’ and ‘B’ Class fire divisions, non-combustible materials and materials having low flame spread characteristics, etc., which are intended to be used but have not been approved by LR.
- A general arrangement plan showing the purpose of each room or compartment and the fire classification of the bulkheads, decks, deck heads and doors of the accommodation and service spaces, control rooms and machinery compartments.
- A plan showing the construction of the fire doors.
- A plan showing any proposed remote control system for closing doors.
- A plan showing any proposed water sprinkler system.
- A plan showing the location and arrangement of the emergency stop for the oil fuel unit pumps and for closing valves on the pipes from oil fuel tanks.
- A plan of any proposed gas detection and alarm system.
For fire-extinguishing, the following plans and particulars are to be submitted:

- A plan showing the layout and construction of the fire main, including the main and emergency fire pumps, isolating valves, pipe sizes and materials and the cross connections to any other system.
- A plan showing details of each fixed fire-fighting system, including calculations for the quantities of the media used and the proposed rates of application.
- A general arrangement plan showing the disposition of all the fire-fighting equipment including the water fire main, all fixed fire-extinguishing systems, the disposition of all portable and non-portable extinguishers and the types used and the position and details of the fireman’s outfits.
- A plan showing the layout and construction of hydrants, hoses and nozzles including their material and type and the international shore connections.

For fire control, general arrangement plans are to be submitted:

(a) showing clearly for each deck:
   - the control stations;
   - the various fire sections enclosed by ‘H’ Class divisions, see 2.6.2;
   - the various fire sections enclosed by ‘A’ Class divisions, see 2.6.1; and
   - the fire sections enclosed by ‘B’ Class divisions, see 2.6.3;

(b) together with particulars of the:
   - fire alarms;
   - detecting systems;
   - sprinkler/deluge systems (if any);
   - fire-extinguishing appliances;
   - means of access to different compartments, decks, etc.; and
   - ventilating system, including particulars of the fan control positions, the position of dampers and identification numbers of the ventilating fans serving each fire section.

There is to be permanently exhibited in all units, for the guidance of those on board, the general arrangement plans as required by 1.2.9.

(a) Alternatively, the aforementioned details may be set out in a booklet, a copy of which is to be supplied to each responsible person, and one copy at all times is to be kept up to date, any alterations being recorded thereon as soon as practicable.

(b) All descriptions in such plans and booklets are to be in the official language of the Flag State. If the language is neither English nor French, a translation into one of those languages is to be included.

(c) In addition, instructions concerning the maintenance and operation of all the equipment and installations on board for the fighting and containment of fire are to be kept under one cover, readily available in an accessible position.

For fire-extinguishing, the following plans and particulars are to be submitted:

(a) showing clearly for each deck:
   - the control stations;
   - the various fire sections enclosed by ‘H’ Class divisions, see 2.6.2;
   - the various fire sections enclosed by ‘A’ Class divisions, see 2.6.1; and
   - the fire sections enclosed by ‘B’ Class divisions, see 2.6.3;

(b) together with particulars of the:
   - fire alarms;
   - detecting systems;
   - sprinkler/deluge systems (if any);
   - fire-extinguishing appliances;
   - means of access to different compartments, decks, etc.; and
   - ventilating system, including particulars of the fan control positions, the position of dampers and identification numbers of the ventilating fans serving each fire section.

There is to be permanently exhibited in all units, for the guidance of those on board, the general arrangement plans as required by 1.2.9.

(a) Alternatively, the aforementioned details may be set out in a booklet, a copy of which is to be supplied to each responsible person, and one copy at all times is to be kept up to date, any alterations being recorded thereon as soon as practicable.

(b) All descriptions in such plans and booklets are to be in the official language of the Flag State. If the language is neither English nor French, a translation into one of those languages is to be included.

(c) In addition, instructions concerning the maintenance and operation of all the equipment and installations on board for the fighting and containment of fire are to be kept under one cover, readily available in an accessible position.

For fire-extinguishing, the following plans and particulars are to be submitted:

(a) showing clearly for each deck:
   - the control stations;
   - the various fire sections enclosed by ‘H’ Class divisions, see 2.6.2;
   - the various fire sections enclosed by ‘A’ Class divisions, see 2.6.1; and
   - the fire sections enclosed by ‘B’ Class divisions, see 2.6.3;

(b) together with particulars of the:
   - fire alarms;
   - detecting systems;
   - sprinkler/deluge systems (if any);
   - fire-extinguishing appliances;
   - means of access to different compartments, decks, etc.; and
   - ventilating system, including particulars of the fan control positions, the position of dampers and identification numbers of the ventilating fans serving each fire section.

There is to be permanently exhibited in all units, for the guidance of those on board, the general arrangement plans as required by 1.2.9.

(a) Alternatively, the aforementioned details may be set out in a booklet, a copy of which is to be supplied to each responsible person, and one copy at all times is to be kept up to date, any alterations being recorded thereon as soon as practicable.

(b) All descriptions in such plans and booklets are to be in the official language of the Flag State. If the language is neither English nor French, a translation into one of those languages is to be included.

(c) In addition, instructions concerning the maintenance and operation of all the equipment and installations on board for the fighting and containment of fire are to be kept under one cover, readily available in an accessible position.
2.3 Flame spread

2.3.1 Low flame spread means that the surface thus described will adequately restrict the spread of flame in accordance with the Fire Test Procedures Code, this being determined by an acceptable test procedure.

2.4 Fire and Explosion Evaluation (FEE)

2.4.1 The FEE is an assessment of the potential fire loads and blast pressures, based on the specific hazards associated with the general layout of the unit, production and process activities and operational constraints.

2.4.2 These Rules allow for the dimensioning of explosion loads to be based on probabilistic risk assessment techniques. A methodology to establish risk based explosion loads based on such a probabilistic approach is given in LR's Guidelines for the Calculation of Probabilistic Explosion Loads.

2.5 Temporary refuge

2.5.1 This is a designated area that is to provide adequate facilities to protect the personnel from fire, explosion and associated hazards during the period for which they may need to remain on a unit following an uncontrolled incident, and for enabling their evacuation, escape and rescue. It is also to provide adequate facilities for monitoring and control of any major incident.

2.6 Fire divisions, spaces and equipment

2.6.1 ‘A’ Class divisions are those divisions formed by bulkheads and decks which comply with the following criteria:

(a) They are to be constructed of steel or other equivalent material.

(b) They are to be suitably stiffened.

(c) They are to be so constructed as to be capable of preventing the passage of smoke and flame up to the end of the one-hour standard fire test.

(d) They are to be insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 180°C above the original temperature at any one point, including any joint, rise more than 225°C above the original temperature, within the time listed below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘A-0’</td>
<td>0 minutes</td>
</tr>
<tr>
<td>‘A-15’</td>
<td>15 minutes</td>
</tr>
<tr>
<td>‘A-30’</td>
<td>30 minutes</td>
</tr>
<tr>
<td>‘A-60’</td>
<td>60 minutes</td>
</tr>
</tbody>
</table>

(e) In accordance with the Fire Test Procedures Code, a test of a prototype bulkhead or deck may be required to ensure that it meets the above requirements for integrity and temperature rise.

2.6.2 ‘H’ Class divisions are those divisions formed by fire walls and decks which comply with the construction and integrity requirements for ‘A’ Class divisions, 2.6.1(a) and (b) and with the following:

(a) They are to be so constructed as to be capable of preventing the passage of smoke and flame up to the end of the one hour hydrocarbon fire test. (Note that some administrations may require the ‘H’ Class division integrity to be maintained for 120 minutes).

(b) They are to be insulated with approved non-combustible materials such that the average temperature, on the unexposed side, when exposed to a hydrocarbon fire test, will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 180°C above the original temperature within the time listed below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘H-0’</td>
<td>0 minutes</td>
</tr>
<tr>
<td>‘H-60’</td>
<td>60 minutes</td>
</tr>
<tr>
<td>‘H-120’</td>
<td>120 minutes</td>
</tr>
</tbody>
</table>

(c) A test of a prototype fire wall or deck may be required to ensure that it meets the above requirements for integrity and temperature rise.

2.6.3 ‘B’ Class divisions are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

(a) They are to be so constructed as to be capable of preventing the passage of flame to the end of the first half hour of the standard fire test.

(b) They are to have an insulation value such that the average temperature of the unexposed side will not rise more than 140°C above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225°C above the original temperature, within the time listed below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘B-0’</td>
<td>0 minutes</td>
</tr>
<tr>
<td>‘B-15’</td>
<td>15 minutes</td>
</tr>
</tbody>
</table>

(c) They are to be constructed of approved non-combustible materials and all materials used in the construction and erection of ‘B’ Class divisions are to be non-combustible, with the exception that combustible veneers may be permitted, provided they meet other appropriate requirements of this Chapter.

(d) In accordance with the Fire Test Procedures Code, a test of a prototype division may be required to ensure that it meets the above requirements for integrity and temperature rise.

2.6.4 ‘C’ Class divisions are divisions to be constructed of approved non-combustible materials. They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise. Combustible veneers are permitted provided they meet the requirements of this Chapter.

2.6.5 Continuous ‘B’ Class ceilings or linings are those ‘B’ Class ceilings or linings which terminate only at an ‘A’ or ‘B’ Class division.
2.6.6 **Machinery spaces** of category A are all spaces which contain internal combustion-type machinery used either:

(a) for main propulsion; or

(b) for other purposes where such machinery has in the aggregate a total power of not less than 375 kW; or which contain any oil-fired boiler or oil fuel unit; and trunks to such spaces.

2.6.7 **Machinery spaces** are all machinery spaces of Category ‘A’ and all other spaces containing propelling machinery, boilers and other fired processes, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilising, ventilation and air conditioning machinery, and similar spaces, and trunks to such spaces.

2.6.8 **Control stations** are those spaces in which the unit’s radio or main navigating equipment or the emergency source of power is located or where the fire recording or fire control equipment or the dynamic positioning control system is centralised or where a fire-extinguishing system serving various locations is situated. In the case of column-stabilised units, a centralised ballast control station is a ‘control station’. However, for purposes of the application of Chapter 3, the space where the emergency source of power is located is not considered as being a control station.

2.6.9** For definitions and categories of hazardous areas including ‘enclosed’ and ‘semi-enclosed’ spaces, see Ch 2,1.2.

2.6.10 **Drilling, process plant and industrial machinery and components** are the machinery and components which are used in connection with the operation of drilling, production and process systems.

2.6.11 **Working spaces** are those open or enclosed spaces containing equipment and processes, associated with drilling operations, which are not included in hazardous areas and machinery spaces.

2.6.12 **Accommodation spaces** are those used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobbies rooms, pantries containing no cooking appliances and similar spaces. ‘Public spaces’ are those portions of the accommodation which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

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

2.6.14 **Oil fuel unit** is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 N/mm². Oil transfer pumps are not considered oil fuel units.

2.6.15 **Crude oil** is any oil occurring naturally in the earth, whether or not treated to render it suitable for transportation, and includes:

(a) crude oil from which certain distillate fractions may have been removed; and

(b) crude oil to which certain distillate fractions may have been added.

2.6.16 **Storage spaces** are spaces used for bulk storage and trunks to such spaces, e.g., crude oil storage tanks on oil storage units.

### Section 3
**Additional requirements for units with production and process plant**

#### 3.1 General requirements for fire-water mains and pumps

3.1.1 Each unit is to be provided with a pressurised wet pipe fire main so equipped and arranged such that water for fire-fighting purposes can be supplied to any part of the unit. The fire main is to be:

(a) Connected to at least two independent fire pumping units, adequately segregated such that a single incident will not compromise the required fire-water supply, as defined in the unit’s FEE Report. Each pumping unit is to be capable of providing sufficient fire-water to satisfy the maximum credible fire water demand.

(b) Designed to deliver the pressure and flow requirements for the simultaneous operation of water-based active fire protection systems (deluge waterspray, monitors, hoses, etc.) sufficient to meet the requirements of these systems as defined in the FEE Report. This is typically to be the single largest credible fire area (where deluge/waterspray systems are installed), plus any anticipated manual fire fighting demand (monitors/hose streams).

(c) Where required in the FEE Report, the total fire pumping capability is also to cater for fire escalating to adjacent areas, i.e., typically where suitable fire divisional barriers do not exist.

(d) Capable of delivering at least one jet simultaneously from each of any two fire hydrants, hoses and 19 mm nozzles, while maintaining a minimum pressure of 3.5 bar (3.5 kgf/cm²) at any hydrant. In addition, where a foam system is provided for protection of the helicopter deck and is served by the fire main, a pressure of 7 bar (7 kgf/cm²) at the foam installation is to be capable of being simultaneously maintained.

3.1.2 The arrangements of the pumps, sea suction and sources of power are to be such as to ensure that a fire in any one space would not put more than one required pumping unit out of action.
3.1.3 Suitable provision is to be made for the automatic start-up of the fire pumps when any fire-fighting appliance supplied with water from the fire main is operated. Provision is also to be made for the start-up of the pumps locally and remotely from a continuously manned space or fire-control station. Once activated, the pumps are to be capable of continuous unattended operation for at least 18 hours.

3.2 Fire mains

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

3.2.2 With the required pumps operating simultaneously, the pressure maintained in the fire main is to be adequate for the safe and efficient operation of all equipment supplied therefrom. The arrangements are to be such that the hand-held fire-fighting equipment supplied from the main may be safely used by one person.

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

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

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

3.2.6 All practicable precautions consistent with having water readily available are to be taken to protect the fire main against freezing.

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

3.3 Fire pumps

3.3.1 Any diesel-driven power source is to be capable of being readily started in its cold condition down to a temperature of 0°C, except where agreed otherwise with LR. If this is impracticable, or if lower temperatures are likely to be encountered, consideration will be given to the provision and maintenance of heating arrangements, so that ready starting will be assured. The engine is to be equipped with an approved starting device (e.g., starting battery), independent hydraulic system, or independent starting air system, having a capacity sufficient for at least six starts of the emergency fire pump within a 30 minute period with at least two starts within the first 10 minutes.

3.3.2 Any service fuel tank is to contain sufficient fuel to enable the pump to run on full load for at least 18 hours.

3.3.3 Under both normal and emergency conditions, any compartment in which a pump unit is located is to be accessible, properly illuminated and efficiently ventilated.

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

3.3.5 Relief valves are to be provided in conjunction with all pumps connected to the fire main if the pumps are capable of developing a pressure exceeding the design pressure of the fire main, hydrants and hoses. Such valves are to be so placed and adjusted as to prevent excessive pressure in the fire main system.

3.3.6 Means are to be provided for testing the output capacity of each fire pumping unit, in accordance with NFPA 20 or an equivalent Standard.

3.3.7 The provision of surge relief devices is also to be considered at the fire pumps, to prevent over-pressurisation of the mains on fire pump start-up. Such devices are to reset automatically once the excess pressure has been relieved.

3.3.8 The fire-water pump stop should be local only. Except during testing, any alarms from pump monitoring systems should not automatically stop a running fire pump with the exception of engine overspeed for fire-water pump engine drive units. Fire detection at the fire-water pump should not stop the pump or inhibit the start of the fire-water pump driver. Confirmed hydrocarbon detection in the air inlet of the driver should inhibit the pump start but should not trip a running fire-water pump.

3.3.9 With reference to Section 3.3.8, the design of the fire-water pump drive system shall ensure, so far as practical, that the fire-water pump drive set does not constitute an ignition source for potential hydrocarbon gas, which may migrate to the pump drive enclosure on a hydrocarbon release incident. As such, the fire-water pump drive units should be located in a non-hazardous area of the MOU and housed in a non-hazardous enclosure with ventilation designed to be maintained an over-pressure of at least 50 Pa in relation to adjacent external spaces. The fire-water pump drive enclosure is to be constructed with suitable fire rated and gastight barriers, suitable fire rated and gastight doors, suitable fire rated and gas rated dampers. The design of the fire-water pump drive shall be such that on gas detection on the enclosure ventilation air intakes, the drive is capable of continued operation with the enclosure ventilation shut-down, ventilation fire and gas dampers closed and all entrances to the enclosure closed.
3.4 Water deluge systems and water monitors

3.4.1 The topside area of each unit is to be provided with a water deluge system and/or water monitor system by means of which any part of the unit containing equipment used for storing, conveying or processing hydrocarbon resources (other than fuels for use on the unit) can be protected in the event of fire. Areas containing equipment requiring water protection include the following:

- Areas containing equipment (including piping) through which hydrocarbons will flow during well test operations.
- Crude oil and gas manifolds/piping (not fuel gas), including piping routed over bridges between platforms.
- Crude oil pumps.
- Crude oil storage vessels.
- De-aeration/filtration equipment (if using gas).
- Emergency shut-down valves.
- Flare knock-out drums.
- Gas compressors.
- Gas liquids/concentrate storage vessels.
- Glycol regeneration plant.
- Liquefaction plant.
- Pig launchers/receivers.
- Process pressure vessels.
- Process separation equipment.
- Riser connections.
- Swivel stack areas.
- Turret areas.

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

3.4.3 The quantity of water supplied to any part of the production and process plant facility is to be at least sufficient to provide exposure protection to the relevant equipment within that part, and where appropriate, local principal load-bearing structural members. ‘Exposure protection’ means the application of water spray to equipment or structural members to limit absorption of heat to a level which will reduce the possibility of failure.

3.4.4 Generally, the minimum water application rate is to be not less than 10 litres/minute over each square metre of exposed surface area requiring protection within the appropriate reference area. Other water application rates in accordance with a recognised Standard or Code which meets the requirements of 3.2.1 will be considered. A reference area is a horizontal area bounded completely by:

- vertical ‘A’ or ‘H’ Class divisions; or
- the outboard extremities of the unit; or
- a combination of (a) and (b).

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

- a fixed system of piping fitted with suitable spray nozzles; or
- water monitors; or
- a combination of (a) and (b).

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

3.4.6 The layout of piping and nozzles within each reference area is to be such that all parts requiring protection are exposed to the direct impingement of water spray. The piping system may be subdivided within each reference area in accordance with the disposition of equipment and structure.

- Spray nozzles are to be of the open type and fitted with deflector plates or equivalent devices capable of reducing the water discharge to a suitable droplet size. The relative location and orientation of individual nozzles is to be in keeping with their established discharge characteristics.
- The water pressure available at the inlet to a system or an individual section is to be sufficient to ensure efficient operation of all nozzles in the system or section.

3.4.7 Water monitors may be operated either remotely or locally. Each monitor arranged solely for local operation is to be:

- Provided with an access route which is remote from the part requiring protection; and
- Sited so as to afford maximum protection to the Operator from the effects of radiant heat.

Each monitor is to have sufficient movement in the horizontal and vertical planes to permit the monitor to be brought to bear on any part protected by it. Means are to be provided to lock the monitor in any position. Each monitor is to be capable of discharging under jet and spray conditions.

3.4.8 With reference to the above requirements for water deluge and water monitor coverage, it may be possible to utilise passive fire protection in place of fire-water cover over certain facilities dependent upon the finding of the FEE. Refer to Section 3.6.

3.5 Hydrants, hoses and nozzles

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

3.5.2 A cock or valve is to be fitted to serve each fire hose so that any fire hose may be removed while the fire pumps are operating.
3.5.3 Fire hoses are to be of type approved material and be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their maximum length, in general, is not to exceed 18 m. Every fire hose is to be provided with a dual-purpose nozzle and the necessary couplings. Fire hoses, together with any necessary fittings and tools, are to be ready for use at any time and should be kept in conspicuous positions near the water service hydrants or connections.

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

3.5.5 For machinery spaces and exterior locations, the nozzle size is to be such as to obtain the maximum discharge possible from two jets at the pressure specified in 3.1.1(d) from the smallest pump, provided that a nozzle size greater than 19 mm need not be used. For accommodation and service spaces, a nozzle size greater than 12 mm need not be used.

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

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

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

3.6 Passive fire protection

3.6.1 As outlined in 1.2.1, 1.2.2 and 3.4.8, the additional requirements for passive type fire protection systems to the topsides process modules, and associated plant, are to be evaluated within the unit’s FEE Report. The specific requirements for passive fire protection (PFP) systems are to be designed to provide adequate hydrocarbon containment to prevent escalation and enable safe evacuation of personnel to the ‘Temporary Refuge’.

3.6.2 With regard to the performance requirements for PFP systems, particular attention is to be given to the potential thermal and erosive effects of hydrocarbon jet-fires in the initial phase of a topsides incident. Consideration is also to be given to the ongoing thermal effects from pool fires. The duration of these events is to be examined in the project FEE in conjunction with the process systems.

3.7 Fixed pressure water spraying and water-mist systems

3.7.1 Additional consideration may be given to the installation of Fixed Pressure Water Spraying and Water-Mist fire extinguishing systems within internal machinery spaces, cabins and low risk areas. Specific functionality requirements for these systems should be evaluated and clearly defined within the unit’s FEE Report.
**Section 5**

**Deckhouses and superstructures**

### 5.1 Boundary bulkheads

5.1.1 Particular consideration is to be given to the potential effects of fire and blast impinging on exposed boundary bulkheads of accommodation spaces and/or temporary refuge. Where boundary bulkheads can be subjected to blast loading, the scantlings are to comply with Pt 4, Ch 3,4.16 and Ch 6,9.1.6.

### 5.2 Enclosed spaces

5.2.1 In addition to the requirements of Ch 2,4, enclosed spaces of deckhouses and superstructures used for accommodation and/or ‘temporary refuge’ are to be maintained at an over-pressure relative to the external area to prevent the potential ingress of smoke and hazardous gases, in the event of a major topsides incident.

5.2.2 With reference to 5.2.1, the design of the accommodation and/or ‘temporary refuge’ is to be such that the accommodation and/or ‘temporary refuge’ enclosure is to be supplied with a ventilation system designed to maintain an overpressure of at least 50 Pa in relation to adjacent external spaces. The ventilation air intakes to the accommodation and/or ‘temporary refuge’ are to be equipped with suitable hydrocarbon gas, smoke and/or toxic gas detection dependent upon the credible risks associated with the MOU. The accommodation and/or ‘temporary refuge’ enclosure is to be constructed with suitable fire rated and gastight barriers, suitable fire rated and gastight doors, suitable fire rated and gas rated dampers. The design of the accommodation and/or ‘temporary refuge’ enclosure shall be such that on hydrocarbon gas, smoke and/or toxic gas detection at the enclosure ventilation air intakes, dependent upon the credible risks associated with the MOU, the enclosure ventilation system will shut down and all ventilation fire and gas dampers will close in order to mitigate against potential hydrocarbon gas, smoke and/or toxic gas entering the accommodation and/or ‘temporary refuge’.

5.2.3 With reference to 5.2.2, the design of the accommodation and/or ‘temporary refuge’ enclosure is to be designed with a suitable air leakage rate to mitigate against any potential hydrocarbon gas, smoke and/or toxic gas impairment on isolation of the accommodation and/or ‘temporary refuge’ enclosure ventilation. The air leakage rate for the accommodation and/or ‘temporary refuge’ enclosure should be based on the required endurance period of the accommodation and/or ‘temporary refuge’ enclosure in any potential credible hydrocarbon gas, smoke and/or toxic gas incident associated with the MOU.

### 5.3 Access doors

5.3.1 Access doors to spaces referred to in 5.2.1 are to be fitted with self-closing gastight doors that open outwards from the enclosed space. Special consideration will be given to spaces which are protected by mechanically ventilated air locks, see also Ch 2,4.