CHINA CLASSIFICATION SOCIETY

RULES FOR CLASSIFICATION OF MOBILE OFFSHORE UNITS

PART SEVEN FIRE AND EXPLOSION SAFETY

CONTENTS

CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.1 Scope of application

1.1.1.1 The provisions of 1.1.1.2 of this Part apply to the fire and explosion protection of non-oil and gas mobile offshore units as defined in 1.2.5.2 of this Part, and the remaining provisions of this Part below apply to the fire and explosion protection of oil and gas mobile offshore units as defined in 1.2.5.1 of this Part.

1.1.1.2 The fire and explosion protection requirements of non-oil and gas mobile offshore units shall meet the following requirements:

(1) The mobile offshore engineering unit defined in 1.2.5.3 of this Part shall meet the fire and explosion protection requirements of special purpose vessels in CCS Rules for Classification of Steel Seagoing Vessels;

(2) The mobile offshore unit of which the main function is to carry passengers shall meet the fire and explosion protection requirements of passenger vessels in CCS Rules for Classification of Steel Seagoing Vessels;

(3) The mobile offshore fishery culture unit shall meet the fire and explosion protection requirements of CCS Guidelines for Inspection of Offshore Fishery and Aquaculture Facilities;

(4) The fire protection of self-elevating non-oil and gas mobile offshore units shall also meet the additional requirements for self-elevating units in 6.2.7.3 of this Part;

(5) Non-oil and natural gas mobile offshore units of which the fire pumps cannot absorb water from the sea around the clock due to tidal restrictions shall also comply with the requirements of 6.2.7.4 of this Part.

1.1.2 Objectives

The safety objectives specified in this part are:

(1) To prevent fires and explosions;

(2) To minimize the effects of fires and explosions.

1.1.3 Functional requirements

To achieve the objectives specified in this part, the unit is to have the following functions:

(1) Control of flammable and explosive fluids in a closed system for preventing overflow and leakage and for collection in a safe position in the event of overflow or leakage;

(2) Leading flammable gas to be discharged to a safe position for combustion or discharge into open air;

(3) Restricted use of combustible materials;

(4) Detection of possible leakage and accumulation of flammable gases;

(5) Satisfactory ventilation of hazardous spaces for preventing accumulation of flammable gases;

(6) Means for eliminating any ignition source in fire risk spaces;

(7) Means for eliminating any explosion source in hazardous areas;

(8) Inerting the crude oil tanks which contribute to the overall structural strength of the unit;

(9) Detection of any fire within fire risk spaces;

(10) Layout and protection of access for fire fighting;

(11) Ready availability of fire-extinguishing appliances;

(12) Fire divisions for restricting fire spread;

(13) Cutoff of fuel and air supply to fire and explosion and in the event of large leakage of flammable gas, shutdown of non-explosion-proof equipment;

(14) Reasonable arrangement of functional zones and essential equipment of the unit;

(15) Arrangement and protection of escape way and life-saving appliances.

1.1.4 Plans and information

The following plans and information are to be submitted to CCS for approval:

(1) General arrangement and classification of hazardous areas;

(2) Fire divisions;

(3) Details of construction of fire walls, decks and doors;

(4) Remote control system for fire doors;

(5) Arrangement of ventilation system showing the ducts and dampers and the position of controls for stopping the system;

(6) Piping and instrumentation diagram of fixed fire-extinguishing systems;

(7) Design calculations of fixed fire-extinguishing systems (e.g. required quantity of extinguishing medium);

(8) Arrangement of fixed fire detection and alarm system;

(9) Fire control plan;

(10) Arrangement of flammable gas detection and alarm system;

(11) Arrangement of inert gas system;

(12) Arrangement of oxygen and acetylene gas bottle including pipes;

(13) Arrangement of liquefied petroleum gas cooking ranges;

(14) Arrangement of escape route;

(15) Explosion-proof design report;

(16) Other documents as deemed necessary by CCS.

1.1.5 Approval

1.1.4.1 The principal materials, equipment, installations and systems used for fire and explosion safety are to be approved by CCS.

1.1.4.2 Any exemption from and any alternative or equivalent means for fire safety equipment are to be approved by CCS.

1.1.6 Miscellaneous

1.1.5.1 Aluminum coating is prohibited in all spaces where hydrocarbon gas will easily accumulate.

1.1.5.2 Deck coverings, if applied within accommodation and service spaces and control stations, are to be made of approved materials which will not readily ignite, and to be determined in accordance with the International Code for Application of Fire Test Procedures as adopted by IMO resolution MSC.61 (67) (hereinafter referred to as the Fire Test Procedures Code).

1.1.5.3 Hydrogen sulfide protective equipment include hydrogen sulfide detection and alarm system and hydrogen sulfide protective breathing apparatus. Hydrogen sulfide detection and alarm system is to comply with the relevant requirements in Chapter 9 of this part. Hydrogen sulfide protective breathing apparatus is to comply with the requirements in Section7, Chapter 12 of this part.

Section 2 DEFINITIONS

1.2.1 Materials

1.2.1.1 *Non-combustible material* is a material which neither burns nor gives off flammable vapors in sufficient quantity for self-ignition when heated to approximately 750℃, this being determined in accordance with the Fire Test Procedures Code. Any material other than a non-combustible material is combustible material.

1.2.1.2 *Steel or other equivalent material* means any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g., aluminium alloy with appropriate insulation).

1.2.2 Low flame-spread

Low flame-spread means that the surface thus described will adequately restrict the spread of flame, this being determined in accordance with the Fire Test Procedures Code.

1.2.3 Standard fire test

1.2.3.1 *H class standard fire test* means the H class test specified in ISO 834: Fire-resistance tests.

1.2.3.2 *A* or *B class standard fire test* means the A or B class test specified in the Fire Test Procedures Code.

1.2.4 Fire-resisting divisions

1.2.4.1 *"H" class divisions* are those divisions formed by bulkheads and decks which comply with the following criteria:

(1) They are made of steel or other equivalent material;

(2) They are suitably stiffened;

(3) They are so constructed as to be capable of preventing the passage of smoke and flame to the end of the two-hour standard fire test;

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

class "H – 120" 120 min

class "H – 60" 60 min

class "H – 0" 0 min

1.2.4.2 *" A" class divisions* are those divisions formed by bulkheads and decks which comply with the following criteria:

(1) They are made of steel or other equivalent material;

(2) They are suitably stiffened;

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

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

class "A – 60" 60 min

class "A – 30" 30 min

class "A – 15" 15 min

class "A – 0" 0 min

(5) The Administration or the organization duly authorized by it required a test of a prototype bulkhead or deck in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity and temperature rise.

1.2.4.3 *" B" class divisions* are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

(1) They are 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;

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

class "B – 15" 15 min

class "B – 0" 0 min

(3) They are made of approved non-combustible materials and all materials used in the construction and erection of "B" class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet other appropriate requirements of this Chapter;

(4) The Administration or the organization duly authorized by it required a test of a prototype division in accordance with the Fire Test Procedures Code to ensure that it meets the above requirements for integrity and temperature rise.

1.2.4.4 *" C" class divisions* are divisions made of approved non-combustible materials. They need meet neither requirements relative to the passage of smoke and flame nor limitations relative to the temperature rise. Combustible veneers are permitted provided they meet other requirements of this chapter.

1.2.4.5 *Continuous " B" class ceilings or linings* are those "B" class ceilings or linings which terminate at an "A" or "B" class division.

1.2.5 Areas

1.2.5.1 *Wellhead area* means an area where drill floor or Christmas tree and distributing manifold are located.

1.2.5.2 *Oil, gas and water processing areas* are areas where oil, gas and water processing installations including test separators are located.

1.2.5.3 *Crude oil storage areas* are areas where crude oil storage means are located.

1.2.5.4 *Utility machinery areas* are areas where machinery installations serving exploration, production of oil and gas, and safety (e.g. generators and boilers) are located.

1.2.5.5 *Drilling fluid (mud) processing areas* are areas where drilling fluids are processed, transferred and stored.

1.2.5.6 *Living quarter areas* are those used for living, rest and recreation.

1.2.5.7 *Hazardous areas* are all those areas where, due to the possible presence of a flammable atmosphere, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion.

1.2.6 Spaces

1.2.6.1 *Public spaces* are those portions of the accommodation which are used for halls, dining

rooms, lounges and similar permanently enclosed spaces.

1.2.6.2 *Accommodation spaces* are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, game and hobby rooms, barber shops, pantries containing no cooking appliances and similar spaces.

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

1.2.6.4 *Machinery spaces of category A* are those spaces and trunks to such spaces which contain either:

(1) Internal combustion engine used for main propulsion;

(2) Internal combustion engine used for purposes other than main propulsion where such machinery has in the aggregate a total power output of not less than 375 kW; or

(3) Any oil-fired boiler or oil fuel unit, or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc.

1.2.6.5 *Machinery spaces* are all machinery spaces of category A and 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, stabilizing, ventilation and air conditioning machinery and similar spaces; and trunks to such spaces.

1.2.6.6 Control stations refer to those spaces in which the radio equipment, main navigating equipment and emergency power supply are located, fire control stations, spaces with centralized fire alarms, spaces for centralized control of dynamic positioning and ballast system, propulsion control room located outside the propulsion machinery space or the spaces for centralized control of oil and gas process system.

1.2.6.7 *Enclosed spaces* are spaces delineated by floors, bulkheads and/or decks which may have doors and/or windows.

1.2.6.8 *Semi-enclosed spaces* are locations where natural conditions of ventilation are notably different from those on open decks due to the presence of structures such as roofs, windbreaks and bulkheads and which are so arranged that dispersion of gas may not occur.

1.2.6.9 Open spaces are spaces other than enclosed spaces and semi-enclosed spaces.

1.2.6.10 Work places: refer to open or enclosed places that are not included in hazardous areas and machinery places and contain equipment and installations related to oilfield engineering operations (e.g., oil and gas drilling, production and maintenance, support, etc.).

1.2.6.11 Places for important machinery and equipment: refer to places containing important machinery and equipment as defined in 1.2.8.2 of this Section, but do not include places located on the drill floor, such as driller room.

1.2.7 Plant, machinery and equipment

1.2.7.1 Oil-fired plant: refers to equipment intended to deliver oil fuel to an oil-fired boiler or to deliver heated oil fuel to an internal combustion engine, and includes any pressure oil pumps, filters and heaters for handling oil at pressures exceeding 0.18MPa.

1.2.7.2 Important machinery and equipment: refers to machinery and equipment essential to the safety of the mobile offshore drilling unit and all personnel on the unit, including but not limited to fire pumps, emergency power supplies, dynamic positioning systems, remote BOP start-up controls, and other operational or safety systems of which the sudden failure may cause dangerous conditions.

1.2.8 Deck

Weather deck is a deck which is completely exposed to the weather from above and from at least

two sides.

1.2.9 Inert gas system

1.2.9.1 *Inert state* means a state of an inerted tank, in any part of which the oxygen content of the atmosphere is reduced to 8% or less by volume.

1.2.9.2 *Inerting* means sending inert gas into a tank to bring it into an inert state as specified in 1.2.9.1 of this Section.

1.2.9.3 *Purging* means sending inert gas into an inerted tank to:

(1) further reduce oxygen content;

(2) to reduce hydrocarbon gas content such that the entry of air will not create a flammable gas mixture.

1.2.9.4 *Gas-freeing* means sending fresh air into a tank to remove toxic, flammable or inert gas so as to increase the oxygen content to 21% by volume.

1.2.10 Fluids

Explosive fluids mean flammable gas, flammable liquid having a flashpoint not above 60ºC, or the mixture of the two and flammable liquid operating above the flashpoint due to heating.

1.2.11 Source of release

1.2.11.1 *Source of continuous release* means a source of continuous or nearly continuous release.

1.2.11.2 *Source of category 1 release* means a source of release available under normal conditions.

1.2.11.3 *Source of category 2 release* means a source of release unlikely available under normal conditions and if available, only for a short time.

1.2.12 Ventilation

Adequate ventilation means a ventilation giving at least 12 air changes per hour. Open spaces in mobile offshore units are considered to be satisfactorily ventilated.

1.2.13 Gastight door

Gastight door means a solid, close-fitting door designed to resist the passage of gas under normal atmospheric conditions.

1.2.14 Unit

1.2.14.1 Oil and gas mobile offshore units: refer to the mobile offshore units used for drilling, production, storage, transportation, support and maintenance of oil and gas (including natural gas hydrate), including mobile offshore drilling unit, mobile offshore workover unit, mobile offshore production unit, mobile offshore oil storage unit and natural gas hydrate drilling and production unit, etc.

1.2.14.2 Non-oil and gas mobile offshore units: refer to mobile offshore units other than oil and gas mobile offshore units as defined in 1.2.14.1 of this Section.

1.2.14.3 Mobile offshore engineering unit: refers to the unit used for offshore construction operations in non-oil and gas mobile offshore units defined in 1.2.14.2 of this Section, mainly including: mobile offshore wind turbine operation unit, mobile offshore riprap unit, mobile offshore lifting unit, offshore mining unit, etc.

Section 3 PREVENTION OF FIRES AND EXPLOSIONS

1.3.1 Objective

The objective specified in this Section is to reduce the probability of fires and explosions.

1.3.2 Functional requirements

1.3.2.1 The fundamental measure to reduce the probability of fires and explosions is to control the combustible and explosive materials, ignition source, and oxidant source, the purpose of which is to isolate combustible and explosive materials from the ignition source or oxidant source.

1.3.2.2 Control of combustible and explosive materials

(1) The use of combustible materials is to be restricted in accommodation spaces, service spaces, control stations, temporary refuge, muster station and embarkation station. Use of combustible materials is to meet the following requirements:

① The calorific value of facings and linings is not to exceed 45 MJ/m^2 of the area for the thickness used;

② The total volume of facings, mouldings and decorations is not to exceed a volume equivalent to a 2.5 mm thickness on the combined area of the walls and ceilings.

③ Combustible materials used, including surface coatings, are not to release excessive smoke or toxic substances in case of fires.

(2) All waste receptacles are to be made of non-combustible materials with no openings in the sides or bottom.

(3) Flammable and explosive fluids are processed, delivered and stored in an enclosed system, with the following measures adopted to prevent spill or out-leakage:

① Designed strength of materials used for the system is compliant with requirements;

② Tightness of connecting parts is compliant with requirements;

③ Corrosion and erosion is controlled;

④ System pressure, temperature and liquid levels are monitored.

The detailed requirements for achieving this function refer to PART FOUR of the Rules.

(4) In flammable and explosive fluid system, proper non-return devices are to be provided to prevent leakage of back flows in case of the system failure. For details, refer to requirements of PART FOUR of the Rules.

(5) In flammable and explosive fluid system, shutdown arrangements are to be provided as specified in Chapter 11 of this part to prevent the spread of leaking.

(6) An open drain system is to be provided on the unit as required in Chapter 3, PART FOUR of the Rules. In case of leakage, flammable and explosive fluids will be collected to the safety location.

(7) Spaces where flammable gases may leak out are to be adequately ventilated.

1.3.2.3 Control of ignition source

(1) In spaces where a fire is likely to occur, the following measures are to be adopted to eliminate the ignition sources:

① No smoking unless in specified spaces;

② Hot work in specified spaces;

③ Flare and vent is to be provided with fire flash-back means;

④ Combustion equipment (boilers, heaters, etc.) is to operate in the enclosed space. The surface temperature and smoke cannot be the source of ignition.

⑤ Prevention of ignition caused by cooking;

⑥ Prevention of lightning disasters;

⑦ Prevention of ignition caused by mechanical frictions;

⑧ Prevention of ignition caused by hot equipment and system surface ;

⑨ Measures to be taken against self-ignitions, e.g., those caused by oily parts of insulation bandaging ;

⑩ Electric radiators, if used, are to be fixed in position and so constructed as to reduce fire risks to a minimum. No such radiators are to be fitted with an element so exposed that clothing or other similar materials can be scorched or set on fire by heat from the element.

(2) For measures to control the explosion source in hazardous areas, refer to requirements specified in PART FIVE of the Rules.

1.3.2.4 Control of oxidant source

The crude oil tank contributing to the overall structural strength of the unit is to be kept in an inert state.

Section 4 ARRANGEMENT AND STORAGE OF OXYGEN AND ACETYLENE CYLINDERS

1.4.1 General requirements

1.4.1.1 Permanent piping systems for oxyacetylene systems are to be designed and tested in accordance with applicable standards and regulations acceptable to CCS.

1.4.1.2 Where two or more cylinders of each gas are intended to be carried in enclosed spaces, separate dedicated storage rooms are to be provided for each gas. Storage rooms are to be made of steel and not situated below the weather deck. They are to be well ventilated and accessible from the open deck. The ventilation is to be arranged to be separate from other ventilation systems.

1.4.1.3 Permanent piping and fittings, joints, and valves are to meet the requirements for Class I piping system. Copper or copper alloys containing more than 65% of copper are not to be used in the permanent piping for acetylene. High pressure pipes between acetylene cylinders and regulators are to be made of steel. Oxygen permanent piping is to be made of steel or copper. All components of oxygen and acetylene system are to be resistant to corrosions, and all pipes in the permanent piping are to be of seamless steels.

1.4.1.4 Where the oxygen acetylene gas welding space and cylinder storage room is separated at a distance exceeding one deck or passing through the bulkhead, permanent piping is to be provided between the cylinders and gas welding space. Suitable protection is to be provided where piping passes through bulkheads or decks. Closing valves are to be fitted on the outlets.

1.4.1.5 No ignition source is allowed in storage rooms of acetylene cylinders and any electrical equipment, if needed, is to be explosion-proof.

1.4.1.6 The securing arrangements of gas cylinders are to be capable of being easily and quickly released, for the expeditious removal of cylinders in the event of fire.

1.4.1.7 "NO SMOKING" signs are to be permanently and markedly displayed at the gas cylinder storage rooms.

1.4.1.8 Where cylinders are stowed in open locations, means are to be provided to:

(1) protect cylinders and associated piping from physical damage;

(2) Exposure to hydrocarbon gas environment as few as possible; and

(3) ensure suitable drainage.

1.4.2 Fire extinguishing

Fire-extinguishing appliances in the acetylene storage areas are to be provided in compliance with

6.12.19 of this part.

Section 5 USE OF GALLEY RANGES

1.5.1 General requirements

1.5.1.1 Electrical ranges are to be used in galleys. Where liquefied-gas-fired ranges are used, 1.5.2 of this Section is to be complied with and where fuel-oil-fired ranges are used, 1.5.3 of this Section is to be complied with.

1.5.1.2 Fire-extinguishing appliances of ranges are to be provided in compliance with 6.12.18 of this PART.

1.5.2 Liquefied-gas-fired ranges

If liquefied-gas-fired ranges are fitted in a galley, the following requirements are to be met:

(1) Ranges, gas cylinders, angle valves and pressure reduction valves, etc. are to comply with the applicable standards acceptable to CCS;

(2) The liquefied gas cylinders are to be placed on the open deck or within those well ventilated spaces accessible only from the open deck;

(3) Quantity of liquefied gas stored is to be calculated and approved by CCS and is not allowed to be exceeded;

(4) No opening or stairway is allowed to be arranged inside the galley to the underlying spaces;

(5) The doors and windows in the boundary of galley are to open outwards and to the open deck. Natural ventilation or power ventilation is to be provided to ensure the air flowing between upper and lower spaces inside the galley so that sufficient air is available for combustion;

(6) Liquefied gas ranges are to be fitted reliably at predetermined positions. Means are to be provided to prevent shifting of ranges;

(7) Liquefied gas cylinders are to be positioned vertically and fixed reliably. Fixed hoops are to be capable of being released easily and quickly. Cylinders are to be provided with wood blocks under the bottom to avoid impact;

(8) Steel liquefied gas pipe lengths are to be connected by welding. Threaded joints may be used in the connections between ranges, valve fittings, instrumentation etc. and pipes and valves. The joints are to be fitted with oil-resistant sealing washers or coated with binder to ensure gas tightness.

The joints between rubber hose and pressure reduction valves, ranges or steel pipes are to be cramped by metal bands. The bands are to be connected reliably and capable of being easily fitted or removed in a manner to ensure gas tightness;

(9) The gas pipes are to be of steel or other equivalent materials and fitted with means of automatic closing upon extinction of fire in the range;

(10) Sufficient fire protection and heat insulation is to be provided above, below and around the range;

(11) For the pressures of strength and tightness tests of the liquefied gas piping system, the requirements in Table 1.5.2 are to be complied with.

Test of Liquefied Gas Piping System **Table 1.5.2**

Liquefied gas piping system	Test pressure	
	Strength test (in workshop) MPa	Tightness test (installed onboard) MPa
Piping system from cylinder to pressure reduction valve	2.4	2.0
Piping system from pressure reduction valve to range	0.2	0.1

1.5.3 Galley ranges

1.5.3.1 The fuel oil tank is to be provided outside the galley and filled and ventilated in a safe way.

1.5.3.2 Oil supply control location for burners is to be easily accessible in case of fires in galley.

1.5.3.3 Ventilation of the galley is to comply with the relevant requirements of Chapter 4, PART FOUR of the Rules.

Section 6 REQUIREMENTS FOR SAFE OPERATION

1.6.1 Maintenance

The unit is to be provided with a maintenance plan for fire and explosion safety facilities and repairs, examinations and tests are to be carried out according to the plan in time so as to ensure that they are readily available.

1.6.2 Training and drills

Training manuals are to be provided in the unit and training and practical drills are to be carried out for persons concerned so that they will have necessary knowledge and skills in fire and explosion safety.

1.6.3 Operating manuals (or procedures) for fire and explosion safety

1.6.3.1 Operating manuals or procedures for fire and explosion safety are to be provided in the unit.

1.6.3.2 Fire control plan is to be permanently exhibited in the unit for the guidance of operators, clearly indicating the followings:

(1) Location of fire control station and control room;

(2) Fire zones enclosed by various fire-resisting divisions;

(3) Arrangement of fire detectors;

(4) Arrangement of the manually operated call points for fire alarms;

(5) Arrangement of the flammable gas detectors;

(6) Arrangement of hydrogen sulfide gas detectors;

(7) Arrangement of hydrogen sulfide protective breathing apparatus;

(8)Location to initiate general alarms;

(9) Arrangement of fire-fighting equipment;

(10) Position to store fire-fighter’s outfits;

(11) Location of Helicopter Crash Kit;

(12) Arrangement of water spray nozzles;

(13) Operational location of emergency shutdown (such as oil fuel source shutdown, engine shutdown, etc);

(14) Arrangement of fire/watertight doors and their remote control position;

(15) The ventilating system including the fan control positions, the position of damper and identification numbers of ventilating fans serving each section;

(16) Position of fuel pump and quick-closing valve emergency shutdown on oil tanks;

(17) Position of emergency shutdown for oil/gas/water processing system;

(18) Position for control of blowout preventer;

(19) Plan for fire-fighting access, means of escape and escape routes;

(20) Emergency muster station and arrangement of life-saving appliances.

1.6.3.3 The details mentioned in 1.6.3.2 may be set out in a booklet, a copy of which is to be supplied to each officer, and one copy is to at all times be available on board in an accessible position. Contents of fire control plan or booklets are to be consistent with the actual conditions, and in case of any change, the fire control plans or booklets are to be modified correspondingly.

1.6.3.4 Instructions for the maintenance and operation of all equipment and devices for fire fighting and fire suppression on the unit are to be kept in an envelope and kept ready for use in an easily accessible location.

1.6.3.5 A set of duplicate fire control plans or a booklet containing such plans is to be permanently stored in a prominently marked weathertight enclosure outside the deckhouse on the unit for the assistance of shore-side fire-fighting personnel.

CHAPTER 2 FIRE AND EXPLOSION SAFETY REQUIREMENTS FOR UNIT'S ARRANGEMENT

Section 1 GENERAL PROVISIONS

2.1.1 Objectives

The objectives specified in this Section are:

(1) To separate the hazardous areas from non-hazardous areas, to arrange the living quarter area in the most safe area, and to arrange central control room and emergency equipment space in a well protected locations;

(2) To arrange the system and equipment in a such way that the possibility and consequence of fires and explosions will be minimized;

(3) To facilitate personnel to quickly response and evacuate in emergency cases.

2.1.2 Functional requirements

2.1.2.1 All areas classified as hazardous are to be located as far apart from those areas containing any ignition source as possible, at a minimum distance of 3 m.

2.1.2.2 The use of the prevailing wind direction is to be taken into account so far as possible in the general arrangement of areas so that:

(1) the possibility of flammable gas escaping from any hazardous area into any area containing any ignition source is minimized;

(2) the exhaust gas from flares and burners and the cool vent led into open air will be dispersed away from the unit;

(3) smoke will not be led into living quarter area , refuges, emergency muster stations and positions for abandoning the unit in case of fires or explosions.

Section 2 ARRANGEMENT OF AREAS

2.2.1 Living quarter area

2.2.1.1 Living quarter area is to be located windward so far as possible.

2.2.1.2 Living quarter area is to be located above non-hazardous areas and far away from the wellhead area, mud processing area, oil, gas and water processing areas, and crude oil storage area.

2.2.2 Control stations

Control stations attended by watch-keepers are to be located in non-hazardous areas and so far as possible in or arranged near living quarter area.

2.2.3 Wellhead area

2.2.3.1 The wellhead area is to be located so far as possible downwind from the prevailing wind direction and well ventilated. The wellhead area is to be completely separated from any areas where large quantities of fuels are stored or risers of subsea pipelines, and so far as possible away from the living quarter area.

2.2.3.2 The wellhead area is preferably to be adjacent to the mud processing area, and oil, gas and water processing areas.

2.2.4 Drilling liquid processing areas

2.2.4.1 The drilling fluid treatment area should be adjacent to the wellhead area.

2.2.4.2 Drilling liquid processing areas are to be so far as possible away from the living quarter area.

2.2.5 Well test area

Well test area is to be so far as possible away from the living quarter area.

2.2.6 Oil, gas and water processing areas

2.2.6.1 The high pressure oil gas processing equipment is not to be located at the bottom or in the supporting frame of the unit.

2.2.6.2 The oil, gas and water processing systems are to be located on the well ventilated open deck, preferably not within an enclosed or semi-enclosed space.

2.2.6.3 The oil, gas and water processing areas are to be so far as possible away from the living quarter area.

2.2.7 Crude oil storage area

2.2.7.1 The crude oil storage area is to be isolated from the wellhead area, risers of subsea pipelines and any area containing any ignition source.

2.2.7.2 Crude oil storage tanks are to be far away from living quarter area and not located directly below living quarter area and control stations.

2.2.8 Utility machinery areas

2.2.8.1 The utility machinery areas are preferably to be located to isolate living quarter area from oil, gas and water processing areas, crude oil storage area and drilling fluid processing area.

2.2.8.2 Internal combustion engines, burners, etc. are preferably to be installed within engine rooms or housings, however, the main portion of any equipment not forming an ignition source may be arranged in the open.

The emission of exhaust gas is not to influence the take off/landing of helicopters and personnel's health.

2.2.9 Helicopter deck

The helicopter deck is to be arranged in accordance with the requirements of Section 4, Chapter 10 of PART EIGHT.

2.2.10 Flare

2.2.10.1 The flare shall not be placed in a position to ignite natural gas released under normal or accidental conditions.

2.2.10.2 The flare system shall comply with the relevant provisions of American Petroleum Institute's Pressure-relieving and Depressuring Systems (API Std 521) and the amount of flare heat radiation shall comply with the requirements of 3.10.5 of Chapter 3 of CCS Guidelines for Inspection of Offshore Drilling Units.

Section 3 ARRANGEMENT OF ESSENTIAL EQUIPMENT

2.3.1 Risers and associated stop valves

2.3.1.1 Risers are not to be installed below living quarter area and so far as possible away from living quarter area.

2.3.1.2 Risers and their associated stop valves are to be fitted at protected positions so as to avoid

environmental loading and damages due to collision, fire, explosion, falling objects, etc.

2.3.1.3 Stop valves are to be fitted where risers approach or leave the unit and so arranged that they will not exposed to fire for a long time in case of a fire in the unit.

2.3.2 Pig launchers and receivers

2.3.2.1 Pig launchers and receivers are to be far away from any ignition sources, passageways with dense traffic and supply handling areas.

2.3.2.2 The doors of pig launchers and receivers are to be faced to external sides of the unit.

2.3.3 Flare towers and cold vent stacks

2.3.3.1 Flare towers and cold vent stacks are to be located downwind from the prevailing wind direction to minimize the effects of smoke, heat and abnormal liquid ejection on the unit.

2.3.3.2 Flare towers and cold vent stacks are to be so far as possible away from helicopter deck and living quarter area.

2.3.4 Vent outlets of diverter line

Vent **outlets** of diverter line are to be arranged in such a way that flammable gas will be emitted directly to the outside of the unit and be far away from accommodation units.

2.3.5 Lifting appliances

2.3.5.1 In the arrangement and operation of lifting appliances, it is to be considered of minimizing the possibility of a catastrophic accident (e.g. fire, explosion or oil spill) resulting from falling of the lifted object.

2.3.5.2 Means are to be provided to prevent the crane from colliding with any oil tank, accommodation house or other structure.

2.3.5.3 Lift platforms are to be located so far as practicable in non-hazardous areas. Such platforms are preferably to be of a heavy-duty construction.

2.3.6 Survival craft

2.3.6.1 Survival craft are to be located in non-hazardous areas.

2.3.6.2 Survival craft and their associated muster stations are to be located near living quarter area and far away from hazardous areas.

2.3.7 Safety and emergency equipment

Essential safety and emergency equipment is to be fitted at protected positions so that they will not be easily damaged and are readily accessible for use in the event of an accident.

2.3.8 Oxygen and acetylene cylinders

Arrangement of oxygen and acetylene cylinders is to comply with the relevant requirements of Section 4, Chapter 1 of this part.

CHAPTER 3 FIRE AND EXPLOSION SAFETY EQUIREMENTS FOR VENTILATION

Section 1 GENERAL PROVISIONS

3.1.1 Objectives

The objectives specified in this Chapter are:

(1) To prevent dangerous accumulation of flammable gas;

(2) To prevent the spread of fire and smoke through ventilation ducts;

(3) To prevent the supply of oxygen to enclosed spaces in case of fires;

(4) To prevent the leakage of released fire-extinguishing medium through ventilation ducts from the enclosed spaces.

3.1.2 Functional requirements

To achieve the objectives specified in this Chapter, the ventilation system is to have the functions for fire and explosion safety as follows:

(1) spaces classified as Hazardous Areas Zone 1 and Zone 2 (refer to definitions in Section 1, Chapter 7 of this part) are adequately ventilated;

(2) power ventilation in the hazardous area is separated from that in non-hazardous areas;

(3) to avoid the spread of flammable gas from hazardous areas to non-hazardous areas, or from hazardous areas of high level to hazardous areas of low level;

(4) fan emergency shutdown is provided for the ventilation system;

(5) The ventilation inlet and outlet are provided with air gates which can close the air duct during fire extinguishing;

(6) fires in the spaces where ducts are located could not be spread to other spaces through the ducts.

3.1.3 Relevant parts and chapters

In addition to the requirements of this Chapter, the ventilation system is to comply with the relevant requirements of Chapter 4, PART FOUR of the Rules and Chapter 11 of this part.

Section 2 VENTILATION DUCTS AND FIRE DAMPERS

3.2.1 Requirements for materials and fire resistance tests

3.2.1.1 Ventilation ducts shall be made of non-combustible material. However, for short ducts generally not exceeding 2m in length and not exceeding 0.02m2 in net cross-sectional area, unless they meet the following conditions:

(1) The duct is made of low burning material;

(2) The duct is only used at the end of the ventilation device;

(3) The ducts are not situated less than 600 mm, measured along the duct, from an opening in an "A" or "B" class division, including continuous "B" class ceiling.

3.2.1.2 Fire dampers including their relevant means of operation, and duct penetrations through "A" class divisions are to be subject to a fire test. However, the test is not required where steel sleeves are directly joined to ventilation ducts by means of riveted or screwed flanges or by welding.

3.2.2 Arrangement of ducts

3.2.2.1 Ducts passing through fire divisions are to be such that the integrity of the divisions are not impaired.

3.2.2.2 Ducts provided for the ventilation of machinery spaces of category A and galleys are not to pass through accommodation spaces, service spaces or control stations unless they comply with the conditions specified in (1) or (2) below:

(1) The ducts are insulated to "A – 60" class standard from the machinery spaces and galleys to a point at least 5 m beyond each fire damper, and:

① The ducts are made of steel having a thickness of at least 3 mm and 5 mm for ducts the widths or diameters of which are up to and including 300 mm and 760 mm and over respectively and, in the case of such ducts, the widths or diameters of which are between 300 mm and 760 mm, having a thickness obtained by interpolation;

② The ducts are suitably supported and stiffened;

③ The ducts are fitted with automatic fire dampers close to the boundaries penetrated; or

(2) The ducts are insulated to "A – 60" class standard throughout the accommodation spaces, service spaces or control stations and made of steel in compliance with (1)①and② above.

3.2.2.3 Ducts provided for ventilation to accommodation spaces, service spaces or control stations are not to pass through machinery spaces of category A and galleys unless they comply with the conditions specified in (1) or (2) below:

(1) The integrity of boundaries of machinery spaces of category A and galleys are maintained in way of penetrations and the steel ducts passing through machinery spaces of category A and galleys comply with 3.2.2.2(1)①, ② and ③ above; or

(2) The ducts are insulated to "A – 60" class standard throughout machinery spaces of category A and galleys and the steel ducts passing through machinery spaces of category A and galleys comply with 3.2.2.2(1)① and ②above.

3.2.2.4 Ducts served for hazardous spaces are not to pass through non-hazardous spaces and ducts served for non-hazardous spaces are also not to pass through hazardous spaces. 3.2.2.5 The ducts served for hazardous Zones 2 and Zone 1 are not to pass through hazardous Zone 0. (Refer to definitions specified in Section 1, Chapter 7 of this part).

3.2.2.6 Generally, ducts served for hazardous Zone 2 are not to pass through hazardous Zone 1 and ducts served for hazardous Zone 1 are also not to pass through hazardous Zone 2. if it is unavoidable, the following measures are to be taken:

(1) if the ducts served for Zone 2 pass through Zone 1, the pressure in the ducts is to be higher than that of Zone 1;

(2) if the ducts served for Zone 1 pass through Zone 2, the pressure in the ducts is to be lower than that of Zone 2.

3.2.2.7 The ducts subject to negative pressure are to be of rigid construction.

3.2.3 Details of duct penetrations

3.2.3.1 Where a thin plated duct with a free cross-sectional area equal to, or less than, 0.02 m^2 passes through "A" class bulkheads or decks, the opening is to be lined with a steel sheet sleeve having a thickness of at least 3 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of the bulkhead or, in the case of the deck, wholly laid on the lower side of the decks pierced.

3.2.3.2 Where ventilation ducts with a free cross-sectional area exceeding 0.02 m^2 pass through "A" class bulkheads or decks, the opening is to be lined with a steel sheet sleeve unless such ducts are of steel construction. In this case, the ducts and sleeves are to comply with the following:

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

(2) Ducts with a net cross-sectional area exceeding 0.075m2 shall be provided with fire dampers in addition to complying with the requirements of (1) of this paragraph. The fire dampers shall be self-operated but shall also be manually closed on either side of the bulkhead or deck. Fire dampers shall be fitted with indicators indicating their opening and closing status, except where ducts pass through places enclosed by Class A partitions and where they are not used, so long as those ducts have the same fire-resistant integrity as the partitions through which they pass.

3.2.3.3 Ventilation ducts with a free cross-sectional area exceeding 0.02 m^2 passing through "B" class bulkheads are to be lined with steel sheet sleeves of 900 mm in length, divided preferably into 450 mm on each side of the bulkheads unless the duct is of steel.

3.2.4 Exhaust ducts from galley ranges

Where exhaust ducts from galley ranges pass through accommodation spaces or spaces containing combustible materials, they are to be made of "A" class divisions. Each exhaust duct is to be fitted with:

(1) a grease trap readily removable for cleaning;

(2) a fire damper located in the galley end of the duct which is automatically and remotely operated and, in addition a remotely operated fire damper located in the exhaust end of the duct;

(3) arrangements, operable from within the galley, for shutting off the exhaust fans; and

(4) fire-extinguishing arrangements complying with 6.12.18 of this part.

Section 3 VENTILATION OF ENCLOSED SPACES

3.3.1 Ventilation control

In case of fires, requirements for ventilation shutdown control are given in Chapter 11 of this part.

3.3.2 Power ventilation of enclosed hazardous spaces

3.3.2.1 Enclosed spaces of hazardous Zones 1 and 2 are to be provided with adequate power ventilation sufficient to give at least 12 air changes per hour.

3.3.2.2 In the natural gas and crude oil system, the ventilation for combustion equipment enclosure, or the ventilation for combustion equipment rooms or the ventilation for fuel pipe ducts is to comply with the requirements of Section 9, Chapter 3 of PART FOUR.

3.3.2.3 Where an enclosed hazardous space is adjacent to an enclosed non-hazardous space, the atmospheric pressure in the enclosed hazardous space is to be 50Pa lower than that in the enclosed non-hazardous space.

3.3.2.4 The ventilation inlet and outlet are to be so arranged that the entire space is effectively ventilated, particular attention is to be given to provide suction outlet at position where gas may accumulate and leak.

3.3.2.5 The ventilation inlet of a non-hazardous space is to be located within the non-hazardous area and at least 3 m away from any hazardous area.

3.3.2.6 All air inlets in the enclosed hazardous space are to be located in the non-hazardous areas.

3.3.3 Ventilation conditions affecting the extent of hazardous areas

For ventilation conditions affecting the extent of hazardous areas, refer to the relevant requirements specified in Chapter 7 of this part.

CHAPTER 4 FIRE DETECTION

Section 1 GENERAL REQUIREMENTS

4.1.1 Objective

The objective specified in this Chapter is to automatically and manually monitor fires in spaces of fire risk, initiate alarms in case of fires to remind relevant personnel of taking subsequent measures, or automatically activate shut-down action and start fire-extinguishing system.

4.1.2 Functional requirements

To achieve the objectives specified in this Section, the fire detection system is to have the following functions:

(1) System is to be capable of automatically monitoring each fire place, and detecting initial stage of fires in so far as practicable. The detectors are to be selected adaptable to the environment, characteristics of the space and potential fire phenomena;

(2) In case a fire is detected, the system is to be capable of being operated immediately, displaying the fire places and giving audible and visual alarms;

(3) System is to be capable of automatically monitoring it's circuit failures;

(4) A reliable detection system is to be capable of automatically activating the shutdown process and automatically starting the fire-extinguishing system;

(5) The fire detection system is to be designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in units. All electrical and electronic equipment on the bridge (central control room) or in the vicinity of the bridge (centralized control room) are to be tested for electromagnetic compatibility;

(6) Manually operated call points are to be readily available.

4.1.3 Definitions

4.1.3.1 *Section* means a group of fire detectors and manually operated call points as reported in the indicating unit(s).

4.1.3.2 *Section identification capability* means a system with the capability of identifying the section in which a detector or manually operated call point has activated.

4.1.3.3 *Individually identifiable* means a system with the capability to identify the exact location and type of detector or manually activated call point which has activated, and which can differentiate the signal of that device from all others.

Section 2 TECHNICAL REQUIREMENTS

4.2.1 System design

The fire-detection system is to be designed to:

(1) control and monitor input signals from all connected fire and smoke detectors and manual call points;

(2) provide output signals to the navigation bridge, continuously manned central control station or onboard safety centre to notify the crew of fire and fault conditions;

(3) monitor power supplies and circuits necessary for the operation of the system for loss of power and fault conditions; and

(4) the system may be arranged with output signals to other fire safety systems including:

① paging systems, fire alarm or public address systems;

② fan stops;

③ fire doors;

④ fire dampers;

⑤ spray systems;

⑥ low-location lighting systems;

⑦ fixed local application fire-extinguishing systems;

⑧ closed circuit television (CCTV) systems; and

⑨ other fire safety systems.

4.2.2 Connection to unit's decision-management system

The fire detection system may be connected to the decision management system, provided that:

(1) the decision management system is proven to be compatible with the fire detection system;

(2) the decision management system can be disconnected without losing any of the functions required by this Chapter for the fire detection system; and

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

4.2.3 Zone address identification capability

Fire detection systems with a zone address identification capability are to be so arranged that:

(1) means are provided to ensure that any fault (e.g. power break, short circuit, earth) occurring in the loop will not render the whole loop ineffective;

(2) all arrangements are made to enable the initial configuration of the system to be restored in the event of failure (e.g. electrical, electronic, informatics);

(3) the initial fire alarm will not prevent any other detector from initiating further fire alarms; and

(4) no loop will pass through a space twice or more. When this is not practical (e.g. for large public spaces), the part of the loop which by necessity passes through the space for a second time is to be installed at the maximum possible distance from the other parts of the loop.

4.2.4 Sources of power supply

4.2.4.1 There are to be not less than two sources of power supply for the fire detection system, one of which is to be an emergency source of power. The supply is to be provided by separate feeders reserved solely for that purpose. Such feeders are to run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system.

4.2.4.2 There is to be sufficient power to permit the continued operation of the system with all detectors activated, but need not be more than 100.

4.2.5 Detectors

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

4.2.5.2 Smoke detectors required in all stairways, corridors and escape routes within accommodation spaces are to be certified to operate before the smoke concentration exceeds 12.5% obscuration per metre, but not until the smoke concentration exceeds 2% obscuration per metre, when tested according to standards EN 54:2001 and IEC 60092-505:2001. Smoke detectors to be installed in other spaces are to operate within proper sensitivity limits having regard to the

avoidance of detector insensitivity or oversensitivity.

4.2.5.3 Heat detectors are to be certified to operate before the temperature exceeds 78℃, but not until the temperature exceeds 54℃, when the temperature is raised to those limits at a rate less than 1℃ per minute, when tested according to standards EN 54:2001 and IEC 60092-505:2001. At higher rates of temperature rise, the heat detector is to operate within proper temperature limits.

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

4.2.5.5 Flame detectors are to be tested according to EN54:2001 and IEC60092-505:2001.

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

4.2.5.7 Detectors installed in hazardous areas are to be certified explosion-proof types.

4.2.6 Sections

4.2.6.1 Detectors and manually operated call points are to be grouped into sections.

4.2.6.2 A section of fire detectors which covers a control station, a service space or an accommodation space is not to include a machinery space of category A. For fixed fire detection systems with remotely and individually identifiable fire detectors, a section covering fire detectors in accommodation, service spaces and control stations is not to include fire detectors in machinery spaces of category A.

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

4.2.7 Positioning of detectors

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

4.2.7.2 The maximum spacing of detectors is to be in accordance with Table 4.2.7.2. Different spacing to that specified in the Table may be required or permitted, if based upon test data which demonstrate the characteristics of the detectors.

Spacing of Detectors **Table 4.2.7.2**

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

4.2.7.3 Detectors in stairways are to be located at least at the top level of the stair and at every second level beneath.

4.2.8 Arrangement of electric wiring

4.2.8.1 Electrical wiring for the loop is to be fire-retarding type specified in IEC60332-1.

4.2.8.2 Electrical wiring which forms part of the system is to be so arranged as to avoid galleys, machinery spaces of category A, and other enclosed spaces of high fire risk except where it is

necessary to provide for fire detection or fire alarm in such spaces or to connect to the appropriate power supply.

4.2.8.3 A loop of fire detection systems with a zone address identification capability is not to be damaged at more than one point by a fire.

4.2.9 Control and indication

4.2.9.1 The activation of any detector or manually operated call point is to initiate a visual and audible fire signal at the control panel and indicating units. If no particular attention is paid to the signals within 2 min, an audible alarm is to be automatically given throughout the crew accommodation and service spaces, control stations and machinery spaces of category A. This audible alarm system need not be an integral part of the detection system.

4.2.9.2 The control panel is to be located on the navigating bridge or in the continuously manned central control station. The control panel is to be tested as per EN54:2001 and IEC60092-505:2001.

4.2.9.3 Indicating units are, as a minimum, capable of denoting the section in which a detector has been activated or manually operated call point has been operated. At least one unit is to be so located that it is easily accessible to responsible members of the crew at all times. One set of indicating unit is to be located on the navigating bridge if the control panel is located in the central fire control station.

4.2.9.4 Clear information is to be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.

4.2.9.5 Power supplies and electric circuits necessary for the operation of the system are to be monitored for loss of power or fault conditions as appropriate. Occurrence of a fault condition is to initiate a visual and audible fault signal at the control panel which is to be distinct from a fire signal:

(1) a single open or power break fault caused by a broken wire;

(2) a single ground fault caused by the contact of a wiring conductor to a metal component; and

(3) a single wire to wire fault caused by the contact of two or more wiring conductors.

4.2.9.6 Means to manually acknowledge all alarm and fault signals is to be provided at the control panel. The audible alarm on the control panel and indicating units may be manually silenced. The control panel is to clearly distinguish normal, alarm, acknowledged alarm, fault and silenced conditions, respectively.

4.2.9.7 The system is to be arranged to automatically reset to the normal operating condition after alarm and fault conditions are cleared.

4.2.10 Testing

4.2.10.1 The function of fire detection systems is to be tested under various conditions of ventilation after installation.

4.2.10.2 The function of fire detection systems is to be periodically tested and in compliance with the test requirements by means of equipment producing hot air at the appropriate temperature, or smoke or aerosol particles having the appropriate range of concentration or particle size, or other phenomena associated with incipient fires to which the detector is designed to respond.

4.2.10.3 The unit is to be provided with suitable instructions and component spares for testing and maintenance.

Section 3 REQUIREMENTS FOR PROVISION OF DEVICES

4.3.1 General requirements

4.3.1.1 Detectors are to be selected according to the early and main phenomena associated with incipient fires to which the detector is designed to respond.

4.3.1.2 In selecting the type of detectors, their suitability to the environment in which they are to be located is to be taken into account.

4.3.1.3 Optical detectors are to be fitted in such a position and angle that they are not exposed to radiation effects of flares.

4.3.2 Provision of detectors in spaces

4.3.2.1 Service spaces and accommodation spaces are to be provided with automatic fire detection systems.

4.3.2.2 Smoke detectors are to be installed in all cabins, stairways, corridors and means of escape within accommodation spaces. Thermal detectors are preferably to be installed in galley and other spaces producing vapour and smoke.

4.3.2.3 Smoke detectors are to be provided in the electric room and control stations.

4.3.2.4 Utility machinery spaces not continuously attended by watch-keepers are to be provided with a fire detection system in compliance with the following:

(1) The system is to be so designed and the detectors are to be so positioned as to detect rapidly the onset of fire in any part of machinery spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures; Except in spaces of restricted height and where their use is specially appropriate, detection systems using only thermal detectors are not permitted.

(2) The detection system is to initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigation bridge and by a responsible engineer officer. When the navigation bridge is unmanned, the audible alarm is to be given in a place where a responsible member of the crew is on duty.

4.3.2.5 In the open wellhead area, or mud processing area, flame or thermal detectors are preferably to be provided.

4.3.2.6 Oil, gas and water processing areas are to be provided with a fusible-plug-loop type temperature detection system and a smoke detection system.

4.3.3 Manually operated call points

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

4.3.3.2 Manually operated call points are also to be installed in machinery spaces, wellhead area, oil and gas processing area and crude oil storage area as well as other places considered necessary.

4.3.3.3 Measures are to be taken against mis-operation of manual alarm system.

Section 4 SHUTDOWN AND RELEASE FUNCTIONS

4.4.1 Automatic shutdown

4.4.1.1 Fusible-plug fire detection loop installed in oil, gas and water processing areas may automatically shut down piping and equipment serving as a source of fuel for fire and give an alarm.

4.4.1.2 The fire detection system may be provided with means of automatically closing fire doors or similar closing features on the control panel.

4.4.2 Automatic release of fire-extinguishing medium

An automatic release of fire-extinguishing medium is not permitted for fire detection systems,

except in the following cases:

(1) highly reliable detection systems (e.g. fusible-plug loop) may automatically activate a fire-extinguishing medium system not harmful to human body (e.g. water spraying);

(2) in spaces not accessible to any person during navigation or operation (e.g. gas turbine housing).

CHAPTER 5 CONTAINMENT OF FIRE

Section 1 GENERAL PROVISIONS

5.1.1 Objective

The Objective specified in this Section is to contain the fires in the space of origin in order to minimize the consequences.

5.1.2 Functional requirements

To achieve the objectives specified in this Section, the fire-proof structure is to meet the following requirements:

(1) dividing the unit into several zones by fire-resisting divisions;

(2) properly setting different classes of fire-resisting divisions based on the characteristics of the space and significance to safety;

(3) all doors, windows and penetrations on fire-resisting divisions are not to impair the fire integrity.

Section 2 FIRE INTEGRITY OF BULKHEADS AND DECKS

5.2.1 Structural materials

The structural bulkheads and decks of the unit are to be made of steel or other equivalent material.

5.2.2 Fire-resisting divisions of bulkheads and decks

5.2.2.1 The minimum fire integrity of bulkheads and decks shall be in accordance with Tables 5.2.2 (1) and 5.2.2 (2), except as specified in this Section and in Section 3 for the fire integrity of bulkheads and decks. "H-60" shall be constructed for all parts of the superstructure of the enclosed living places and the outer clearance of the deckhouse (including the overhanging deck supporting the living compartment) facing the drilling turntable and within 30m of the center of the turntable. For units with movable derricks, this 30m shall be measured at the base of the derrick at the drilling location nearest to the living place.

5.2.2.2 The Tables are to be applied according to the following requirements:

Tables 5.2.2.1(1) and 5.2.2.1(2) apply respectively to the bulkheads and decks separating adjacent spaces.

For determining the appropriate fire integrity standards to be applied to divisions between adjacent spaces, such spaces are classified according to their fire risk as shown in categories (1) to (11). The title of each category is intended to be typical rather than restrictive. The number in circle preceding each category refers to the applicable column or row in the tables.

(1) Controls stations: The spaces as defined in section 2, Chapter 1 of this part.

(2) Corridors: Corridors and lobbies.

(3) Accommodation spaces: Spaces as defined in section 2, Chapter 1 of this part, excluding corridors, lavatories and pantries containing no cooking appliances.

(4) Stairways: Interior stairways, lifts and escalators (other than those wholly contained within the machinery spaces) and enclosures thereto. In this connection a stairway which is enclosed only at one level is to be regarded as part of the space from which it is not separated by a fire door.

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

(6) Machinery spaces of Category A are as defined in Section 2, Chapter 1 of this part.

(7) Other machinery spaces are as defined in Section 2, Chapter 1 of this part, other than

machinery spaces of Category A.

(8) Hazardous areas are areas defined in Section 2, Chapter 1 of this part.

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

(10) Open decks: open deck spaces, excluding hazardous areas.

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

Fire Integrity of Bulkheads Separating Adjacent Spaces **Table 5.2.2 (1)**

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

Refer to notes to Table 5.2.2 (2).

Fire Integrity of Decks Separating Adjacent Spaces **Table 5.2.2 (2)**

Space above / Space below	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Control stations (1)	A-0	A-0	A-0	A-0	A-0	A-60	A-0	A-0[e]	A-0	*	A-0
Corridors (2)	A-0	*	*	A-0	*	A-60	A-0	A-0[e]	A-0	*	*
Accommodation spaces (3)	A-60	A-0	*	A-0	*	A-60	A-0	A-0[e]	A-0	*	*
Stairways (4)	A-0	A-0	A-0	*	A-0	A-60	A-0	A-0[e]	A-0	*	A-0
Service spaces (low risks) (5)	A-15	A-0	A-0	A-0	*	A-60	A-0	A-0	A-0	*	A-0
Machinery spaces of Category A (6)	A-60	A-60	A-60	A-60	A-60	*[a]	A-60	A-60	A-60	*	A-0
Other machinery spaces (7)	A-15	A-0	A-0	A-0	A-0	A-0[a]	*[a]	A-0	A-0	*	A-0
Hazardous areas (8)	A-60[e]	A-0[e]	A-0[e]	A-0[e]	A-0	A-60	A-0	—	A-0	*	A-0
Service spaces (high risks) (9)	A-60	A-0	A-0	A-0	A-0	A-60	A-0	A-0	A-0[c]	*	A-0
Open decks (10)	*	*	*	*	*	*	*	—	*	—	*
Sanitary and similar spaces (11)	A-0	A-0	*	A-0	*	A-0	A-0	A-0	A-0	*	*

Notes: to be applied to Tables 5.2.2(1) and 5.2.2(2), as appropriate.

(a) Where the space contains an emergency power source or components of an emergency power source adjoining a space containing a service generator or the components of a service generator, the boundary bulkhead or deck between those spaces is to be an "A-60" class division.

(b) For clarification as to which note applies see paragraphs 5.3.1.3 and 5.3.1.5.

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

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

(e) The engineering evaluation shall be carried out in accordance with 5.3.1.1. In no case shall the grade of bulkhead and deck be lower than the values shown in the table. For oil production unit or oil storage unit, the main control station, corridor, living place and stairway shall not be adjacent to the dangerous area.

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

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

5.2.2.4 The insulation of a deck or bulkhead is to be carried past the penetration, intersection or terminal point for a distance of at least 450 mm in the case of steel and aluminium structures. If a space is divided with a deck or a bulkhead of "A" class standard having insulation of different values, the insulation with the higher value is to continue on the deck or bulkhead with the insulation of the lesser value for a distance of at least 450 mm.

5.2.2.5 Windows and sidescuttles, with the exception of navigating bridge windows, are to be of the non-opening type. Windows of navigating bridge may be of the opening type provided the design of such windows permits rapid closure. Windows and sidescuttles outside hazardous areas may be permitted to be of the opening type, subject to approval of CCS.

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

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

5.2.2.8 If a sauna room is provided on the unit, the structure and arrangement is to comply with the relevant requirements of SOLAS for sauna rooms on cargo ships.

5.2.2.9 Vibrating screen houses shall be designed in accordance with the International Standards Committee (ISO) Requirements and Guidelines for the Control and Mitigation of Fire and Explosion in Offshore Development and Installation (ISO 13702-2015) or other standards accepted by the Press to consider the effects of oil and gas explosions.

5.2.3 Penetration of divisions

5.2.3.1 Where "A" class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc, or for the fitting of girders, beams or other structural members, arrangements are be made to ensure that the fire resistance is not impaired.

5.2.3.2 Where "B" class divisions are penetrated for the passage of electric cables, pipes, trunks, ducts, etc, or for the fitting of ventilation terminals, lighting fixtures and similar devices, arrangements are to be made to ensure that the fire resistance is not impaired.

5.2.4 Helicopter decks

Where an air space of less than 1 m is left below the helicopter deck, the insulation is to be of at least "A－0" class standard.

5.2.5 H-class Divisions

Any boundary expected to be exposed to a hydrocarbon fire, where thermal loads are over 100 kW/m^2, class H divisions are recommended in lieu of appropriate class A divisions.

Section 3 PRPTECTION OF ACCOMMODATION SPACES, SERVICE SPACES AND CONTROL STAINS

5.3.1 General requirements

5.3.1.1 Living spaces, service places, control stations and places containing important machinery and equipment shall not normally be adjacent to hazardous areas. However, if this is not possible, an engineering evaluation shall be carried out in accordance with the ISO Requirements and Guidelines for the Control and Mitigation of Fire and Explosion in Offshore Development and Installation (ISO 13702-2015) or other standards approved by the Press to ensure that the bulkheads and decks separating these places from hazardous areas have sufficient fire and

explosion protection levels to cope with possible hazards. If it is shown that these places may be exposed to radiant heat flux exceeding 100 kw/m2, bulkheads or decks shall be constructed at least in accordance with "H-60" standard.

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

5.3.1.3 All bulkheads forming "B" class divisions are to extend from deck to deck and to the deckhouse side or other boundaries, unless continuous "B" class ceilings or linings are fitted on both sides of the bulkhead, in which case the bulkhead may terminate at the continuous ceiling or lining. In corridor bulkheads, ventilation openings may be permitted only in and under the doors of cabins, public spaces, offices and sanitary spaces. The openings are to be provided only in the lower half of the door. Where such an opening is in or under a door, the total net area of any such opening or openings is not to exceed 0.05 m^2. When such an opening is cut in a door it is to be fitted with a grille made of non-combustible material. Such openings are not to be provided in a door in a division forming a stairway enclosure.

5.3.1.4 Stairs are to be made of steel or equivalent material.

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

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

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

(1) constructed to an "A-60" standard; or

(2) protected by a water curtain; or

(3) fitted with shutters of steel or equivalent material.

5.3.2 Structural materials

5.3.2.1 Except for insulation in refrigerated compartments, insulation material, pipe and vent duct lagging, ceilings, linings and bulkheads are to be of non-combustible material. Insulation of pipe fittings for cold service systems and vapour barriers and adhesives used in conjunction with insulation need not be non-combustible but they are to be kept to a minimum and their exposed surfaces are to have low-flame spread characteristics.

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

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

5.3.2.4 Bulkheads, linings and ceilings may have combustible veneers provided that the thickness of such veneers is not to exceed 2.5 mm within any space other than corridors, stairway enclosures and control stations where the thickness is not to exceed 1.5 mm. Combustible materials used on these surfaces are to have a calorific value not exceeding 45 mJ/m^2 of the area for the thickness used.

5.3.2.5 Primary deck coverings, if applied within accommodation and service spaces and control stations, are to be of approved material which will not readily ignite.

5.3.2.6 Materials and testing of ventilation ducts and penetrations are to comply with the relevant provisions of Section 2, Chapter 3 of this part.

CHAPTER 6 FIRE CONTROL AND FIRE FIGHTING

Section 1 FIRE SAFETY APPLIANCE

6.1.1 Summary

6.1.1.1 Fire safety appliances are to include fire-fighter's outfits and fire extinguishers.

6.1.1.2 A fire-fighter's outfit is to consist of a set of personal equipment, a breathing apparatus and a lifeline. Personal equipment is to consist of protective clothing, gloves, boots, a helmet, an electric safety lamp (portable lamp) and an axe.

6.1.1.3 Fire extinguishers are classified into portable fire extinguishers, large movable fire extinguishers and portable foam applicators.

6.1.2 Objective

The objectives specified in this Section are to:

(1) provide firemen with proper outfits for fire fighting and personnel rescue;

(2) provide proper portable fire extinguishers in spaces of fire risk so that operators on site can quickly extinguish incipient fires;

(3) Provide oil fire risk spaces, in addition to portable fire extinguishers, with large movable fire extinguishers to extinguish oil fires that are spreading quickly and can hardly be extinguished by portable fire extinguishers.

6.1.3 Functional requirements

To achieve the objectives specified in this Section, the fire safety appliances are to meet the following functional requirements:

(1) The provision and quality of fire-fighter's outfits are to be such that operators will not be hurt when fighting fires or rescuing personnel.

(2) Portable fire extinguishers are to be readily available and easy to use.

(3) Large movable fire extinguishers are to be readily available and easy to use.

6.1.4 Technical requirements for fire-fighter's outfits

6.1.4.1 Personal protection equipment:

(1) The material of protective clothing is to protect the skin from the heat radiating from fire and from burns and scalding by steam. The outer surface is to be water-resistant;

(2) Boots and gloves are to be made of rubber or other electrically non-conducting material;

(3) The rigid helmet is to provide effective protection against impact;

(4) The electric safety lamp (portable lamp) is to be of an approved type with a minimum burning period of 3 h. Electric safety lamps intended to be used in hazardous areas are to be of an explosion-proof type;

(5) The handle of the axe is to be provided with high-voltage insulation.

6.1.4.2 Breathing apparatus

Breathing apparatus is to be a self-contained compressed-air-operated breathing apparatus for which the volume of air contained in the cylinders are to be at least 1200 *l* in standard atmosphere, or other self-contained breathing apparatus which is to be capable of functioning for at least 30 min. All air cylinders for breathing apparatus are to be interchangeable.

6.1.4.3 Lifeline

Each fire-proof lifeline is to be of at least 30 m in length. The lifeline is to successfully pass an

approval test by static load of 3.5 kN for 5 min without failure. The lifeline is to be capable of being attached by means of a snap hook to the harness of the breathing apparatus or to a separate belt in order to prevent the breathing apparatus becoming detached when the lifeline is operated.

6.1.5 Storage of fire-fighter's outfits

The fire-fighter's outfits are to be kept ready for use in an easily accessible location that is permanently and clearly marked and, where more than one fire-fighter's outfit is carried, they are to be stored in widely separated positions and at least one of which is to be stored near the helicopter deck.

6.1.6 Provision of fire-fighter's outfits

6.1.6.1 A unit is to carry at least two fire-fighter's outfits. It is recommended that two additional fire-fighter's outfits be provided for production and oil storage units or units having helicopter decks. Each outfit is to be provided with portable instruments for measurement of oxygen and flammable gas concentration.

On the passages to helicopter decks, two fire-fighters' outfits are provided in the neighborhood.

6.1.6.2 Two spare charges are to be provided for each required breathing apparatus. Units that are equipped with suitably located means for fully recharging the air cylinders free from contamination need carry only one spare charge for each required apparatus.

6.1.7 Recharging of air cylinders of fire-fighter's outfits

6.1.7.1 The apparatus for recharging air cylinders, if provided, is to have its power supplied from the main and emergency supply or be independently diesel-powered, or be so constructed or equipped that the air cylinders may be used immediately after recharging, with a minimum capacity of 60 *l*/min per required breathing apparatus, but not to exceed 420 *l*/min.

6.1.7.2 The apparatus for recharging air cylinders is to be suitably located in a sheltered space above main deck level on the unit.

6.1.7.3 Intakes for air compressors are to draw from a source of clean air.

6.1.7.4 The air is to be filtered after compression to eliminate compressor oil contamination.

6.1.7.5 The recharging capacity is to meet one of the following requirements:

(1) for breathing air compressors, a minimum capacity of 60 *l*/min per required breathing apparatus, not to exceed 420 *l*/min;

(2) for self-contained high-pressure storage systems, a capacity of at least 1,200 *l* per required breathing apparatus, not to exceed 50,000 *l* of free air.

6.1.7.6 Where the fixed hydrogen sulfide protective breathing air system mentioned in 12.7.1.3 of this part complies with the requirements for recharging capacity in 6.1.7.5 of this Section, it may be used for recharging of air cylinders of fire-fighter's outfits.

6.1.8 Technical requirements for fire extinguishers

6.1.8.1 Portable extinguishers

Each powder or carbon dioxide portable extinguisher is to have a capacity of at least 5 kg and each foam extinguisher is to have a capacity of at least 9 *l*. The mass of all portable fire extinguishers is not to exceed 23 kg and they are to have a fire-extinguishing capability at least equivalent to that of a 9 *l* fluid extinguisher.

6.1.8.2 Large movable extinguishers

Foam extinguishers having a capacity of 45 *l* and 135 *l* and used for extinguishing oil fires are to be fitted with rollers and a hose of sufficient length to protect the spill fire risk areas covered by them.

6.1.8.3 Portable foam applicators

A portable foam applicator unit is to consist of a foam nozzle of an inductor type capable of being connected to the fire main by a fire hose, together with a portable tank containing at least 20 *l* of foam-making liquid and one spare tank of foam making liquid. The nozzle is to be capable of producing effective foam suitable for extinguishing an oil fire, at the rate of at least 1.5 m^3/min.

6.1.9 Arrangement of fire extinguishers

6.1.9.1 Fire extinguishers are to be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of a fire.

6.1.9.2 One of the portable fire extinguishers intended for use in any space is to be stowed near the entrance to that space.

6.1.10 Spare charges

6.1.10.1 Spare charges for each type of portable extinguishers are to be provided for 100% of the first ten extinguishers and 50% of the remaining fire extinguishers. Not more than sixty total spare charges are required.

6.1.10.2 For each type of portable extinguishers capable of being recharged on board, the number of spare charges is to be equal to the quantity used by spare extinguishers specified in 6.1.10.1 of this Section.

6.1.11 Provision of fire extinguishers

The requirements for provision of fire extinguishers are given in Section 12 of this Chapter.

Section 2 FIRE MAIN SYSTEM

6.2.1 Objective

The objective of this Section is to provide the unit with water for fire fighting in time, so that in case of fires, the fires may be controlled and extinguished quickly and cooling protections be provided promptly.

6.2.2 Functional requirements

To achieve the objective specified in this Section, the fire main system is to have the following functions:

(1) The system is to be so designed that each space of fire risk is effectively protected;

(2) The system is to be so designed that each protected space is to be supplied with water immediately;

(3) The system is to be so arranged that the major functions will not be damaged in case of fires or explosions;

(4) The system is to be so designed that it is suitable for the intended purpose of fire control, fire extinguishing and cooling protections;

(5) Means for quick connection for fire mains are to be provided between units and piers or between units.

6.2.3 Piping

6.2.3.1 Water service pipes are to be designed according to the maximum water flow and pressure required for fire fighting.

6.2.3.2 The fire main piping is to be preferably designed as a ring main system and arranged in protected locations not liable to damage. Where the pipes are laid closely adjacent to oil and gas processing equipment, consideration is to be given to fire-retarding insulation.

6.2.3.3 Discharge pipes of main pumps and stand-by pumps are to be connected to the fire mains respectively, the connecting points being far away from each other.

6.2.3.4 For units with a lower hull, each lower hull is to be separately supplied with water by the fire pump inside the hull for fire extinguishing. In addition, it is to be supplied with water by the water ring mains.

6.2.3.5 Units operating in low-temperature environment are to be provided with means for preventing freezing of water service pipes, such as insulation for pipes and drain valves at low point of system.

6.2.3.6 Water service pipes are not to be of any material readily rendered ineffective by heat.

6.2.3.7 In selecting piping materials, resistance against fire and corrosion is to be taken into account. Carbon steel pipes are to be protected against corrosion. Fiberglass-reinforced plastic pipes are to comply with the relevant provisions in Appendix I, Chapeter 2, PART FOUR of the Rules.

6.2.3.8 Fire hose, lines, fittings and associated components in the wellhead area shall be designed to withstand exposure to temperatures up to 925℃.

6.2.4 Isolating valves

Isolating valves to separate damaged pipe lengths are to be fitted in piping as follows:

(1) The ring mains are to be fitted with an appropriate number of isolating valves.

(2) Where water supply is divided into sections, each branch is to be fitted with an isolating valve.

6.2.5 Number of fire pumps

Each unit is to be provided with at least two fire pumps, one of which is the main pump and the other is standby, complying with 6.2.6 to 6.2.9 of this Section.

6.2.6 Capacity of fire pumps

6.2.6.1 As required in Section 12 of this Chapter, areas and spaces with fire risks are to be protected with hydrants, fire monitors, spray system and foams.

6.2.6.2 The discharge of each fire pump shall be calculated in accordance with the provision of the fire extinguishing system as required in 6.2.6.1 and shall not be less than the greater of the following plus 40m3/h:

(1) 230m3/h for two fire water monitors (if fitted);

(2) Flow rate required for spraying water on the largest place;

(3) Flow rate required for foam fire extinguishing system the largest place;

(4) If there is foam protection and spray protection in the same place, the flow rate shall be the sum of the two.

6.2.7 Arrangement of fire pumps, power source and sea connections

6.2.7.1 The arrangement of fire pumps, their sources of power and sea connections is to ensure that in the event of a fire in any one space, the two fire pumps will not be put out of action simultaneously.

6.2.7.2 The suction of each fire pump is to be fitted with a corrosion-proof filter. The pipe length from each pump to the fire main is to be fitted with a stop valve and for centrifugal pumps, a non-return valve is to be additionally fitted.

6.2.7.3 Each unit is to be provided with at least two water supply sources (sea chest, valves, strainer and pipes). Failure of one supply source will not put all supply sources out of action. For self-elevating units, the following additional requirements are to be complied with:

(1) When the unit is elevated, each fire pump is to be capable of drawing water from at least two independent submersible pump systems that are installed far away from each other (if it is impracticable, a temporary submersible pump system is to be additionally provided). The failure

of one submersible pump system is not to result in the failure of the other submersible pump system(s).

(2) While unit lifting or lowering, the drill water system is to supply water to the fire pumps. Before the lifting and lowering of unit, drill water tank is expected to hold at least water of $40m^3$ for the fire extinguishing purpose. As an alternative, buffering water tank of $40m^3$ may be provided to supply water for fire extinguishing purpose.

6.2.7.4 Where the fire pumps are not able to draw water from seas 24 h a day due to restriction by tides, a tank supplying water for fire extinguishing is to be provided, whose capacity is at least to meet the fire pump's needs for water for 2 hours. When the water in the tank is depleted, proper means are to be provided to use ballast water for fire extinguishing.

6.2.8 Pressure of fire pumps

6.2.8.1 Each pump is to be capable of delivering jets simultaneously from any two fire hydrants via hoses or 19 mm nozzles while maintaining a minimum pressure of 0.35 MPa at any hydrant. In addition, where a foam system is provided for protection of the helicopter deck, the pump is to be capable of maintaining a pressure of 0.7 MPa at the foam installation, or a pressure capable of delivering foam to all parts of the helideck in all weather conditions in which the helideck is intended to be available for helicopter operations

6.2.8.2 When the pump supplies water to monitors, water spraying or foam systems, the pressure required for such systems is to be provided.

6.2.8.3 The pressure at any hydrant is not to exceed that at which the effective control of a fire hose can be demonstrated.

6.2.8.4 Protective measures are to be provided in conjunction with fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants, valves and hoses.

6.2.9 Control of fire pumps

Fire pumps are to be capable of being started automatically, remotely and locally.

6.2.10 Hydrants

A fire hydrant is to consist of a valve and a snap so that any fire hose may be removed while the fire pumps are in operation.

6.2.11 Arrangement of hydrants

6.2.11.1 Hydrants are to be so arranged that at least two jets of water not emanating from the same hydrant reach any fire risk area of the unit from different directions.

6.2.11.2 Hydrants are preferably to be fitted near access to each area or space.

6.2.12 Fire hose

6.2.12.1 Fire hoses are to be of corrosion-, mould-, oil- and chemical corrosion-proof material. Each hose is to be provided with a nozzle and the necessary couplings. Hoses specified in this Section as "fire hoses" is, together with any necessary fittings and tools, to be kept ready for use in conspicuous positions near the water service hydrants or connections.

6.2.12.2 Fire hoses are to have a length of at least 10 m, but not more than:

(1) 15 m in machinery spaces;

(2) 20 m in other spaces and open decks; and

(3) 25 m for open decks with a maximum breadth exceeding 30 m.

6.2.12.3 At least one fire hose is to be provided for each hydrant and kept for ready use.

6.2.13 Fire nozzles

6.2.13.1 Fire nozzles are to be made of corrosion-proof material.

6.2.13.2 Standard nozzle sizes are to be 12 mm, 16 mm and 19 mm or as near thereto as possible. With the approval of CCS, nozzles of larger sizes may be used. For accommodation and service spaces, nozzles of sizes larger than 12 mm do not have to be used. For machinery spaces and exterior locations, the nozzle size should be such as to obtain the maximum discharge possible from two jets at pressure specified in paragraph 6.2.8 from the smallest pump, provided that a nozzle size greater than 19mm need not be used

6.2.13.3 Nozzles are to be of an approved dual-purpose type (i.e. spray/jet type).

6.2.14 Fire monitors

Where fire monitors are fitted on the unit, the capacity of each fire monitor is not to be less than 100 m^3/h.

6.2.15 Arrangement of fire monitors

The arrangement of fire monitors on the unit, if fitted, is to consider:

(1) At least two monitors are available for each blowout fire;

(2) At least two monitors are available in each fire location for fire control, fire extinguishing and cooling protections;

(3) Monitors may be automatically, remotely or manually controlled. Manually operated monitors are to be installed in a protected position, and in emergency cases, easily accessible and operated.

6.2.16 International shore connections

6.2.16.1 Units which need fire fighting assistance from ships are to be provided with such connections.

6.2.16.2 The dimensions of flanges for the international shore connections are to be in accordance with Table 6.2.16.2.

6.2.16.3 International shore connection shall be made of steel or other suitable materials, and is designed to withstand the 1.0 MPa working pressure, with one end of flat flange, and the other end of interface supporting with fire hydrant and fire hose on the unit. International shore connection can be stored on the unit together with 1 gasket in any material, 4 bolts (50 mm long, diameter 16 mm) with matched mating nuts, and 8 washers which can withstand 1.0 MPa.

Dimensions of Flanges for International Shore Connections Table 6.2.16.2

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

6.2.16.3 International shore connections are to be made of steel or other equivalent material and are to be designed for 1.0 MPa services. The flange is to have a flat face on one side and, on the other side; it is to be permanently attached to a coupling that will fit the unit's hydrant and hose. The connection is to be kept obboard the unit together with a gasket of any material suitable for 1.0 MPa services, together with four bolts of 16 mm diameter and 50 mm in length, and eight washers.

Section 3 FIXED WATER SPRAY SYSTEMS

6.3.1 Objective

The objective specified in this Section is to:

(1) Provide cooling protection to the major equipment and pipes in explosive fluid system;

(2) Prevent flare's adverse impacts on unit structure and equipment;

(3) Provide water curtain protections to the transparent window on fire-resisting divisions.

6.3.2 Functional requirements

To achieve the objectives specified in this Section, the fixed water spray system is to provide the following functions:

(1) the design capacity of the system is sufficient to fulfill the function of cooling protections;

(2) Piping design and arrangement, deluge valve positioning and design, nozzle type and arrangement are suitable for intended purposes and environmental requirements.

6.3.3 Nozzles

6.3.3.1 Nozzles are to be of an approved type.

6.3.3.2 Nozzles are to be of heat-resisting and corrosion-proof material.

6.3.3.3 Nozzles are to have a single hole of not less than 10 mm in diameter for preventing them from being clogged.

6.3.3.4 Nozzles are to be so arranged as to ensure an average distribution of water in the protected area.

6.3.4 Piping

6.3.4.1 The pipes of the spray system are to be made of steel and galvanized both internally and externally, or equivalent material.

6.3.4.2 The spray system is to be divided into sections, with deluge valves fitted on each section.

6.3.4.3 The spray system is to be connected to the fire main, with a stop check valve fitted on the pipe connecting them so that the water in the spray system will not flow into the fire main system.

6.3.5 Deluge valves

6.3.5.1 Deluge valves may be designed to be manually operated and automatically controlled, or controlled both locally and remotely.

6.3.5.2 Deluge valves are to be provided with indication for showing whether they are open or closed. Deluge valves are to be fitted outside the protected spaces and easily accessible, and are not to be isolated in the event of a fire in the protected sections.

6.3.5.3 Thermal detectors are to be capable of automatically activating deluge valves and detectors of other types may also be capable of doing so provided that they are provided with appropriate means to ensure proper action.

6.3.6 Water-supply pumps

6.3.6.1 A dedicated water-supply pump with its power source is to be provided outside the protected space.

6.3.6.2 A fire pump of the fire main system may be accepted as the dedicated water-supply pump and in this case, the spray system and the fire main system are connected to the same fire main. The fire pump is to comply with 6.2.6 of this Chapter in addition to the requirements of this Section.

6.3.6.3 The capacity of the water-supply pump is to be sufficient for cooling protection of drilling well, oil and gas processing equipment within the largest protected space. Where the protected

space have a large area, the capacity of the pump need only be sufficient for one section and the dimension selected for each section is to be approved by CCS.

6.3.7 Design of the system

6.3.7.1 The water supply rate of places requiring water spraying shall meet the following requirements:

(1) Wellhead area: 20 l/min·m^2;

(2) Pressure vessels, equipments and manifolds: 10 l/min·m^2. For calculation of the water flow rate needed, the vessel's area is to be based on the surface area;

(3) Structural cooling protection: 4 l/min·m^2;

(4) Fire control and extinguishing in the enclosed space: 5 l/min·m^2;

(5) Water curtain protections: 15-45 l/min·m.

6.3.7.2 The design of the entire system is to be verified by hydraulic calculation so that the capacity and pressure of pumps and the diameter of pipes will be compatible with the flow rate and pressure of nozzles.

6.3.7.3 The design, installation and arrangement of the spray system are not to interfere with normal operation and maintenance of the unit.

6.3.7.4 Effective draining means are to be taken into account in designing the spray system.

6.3.7.5 Release stations for water sprinkler systems and necessary isolation valves shall be located outside the protected area.

6.3.8 Testing

The spray system is to be subject to a performance test prior to being put into service.

Section 4 HIGH PRESSURE WATER MIST FIRE-EXTINGUISHING SYSTEMS

6.4.1 Objective

The objective specified in this Section is to provide efficient fire extinguishing service to accommodation spaces and machinery spaces.

6.4.2 Functional requirements

To achieve the objective specified in this Section, the high-pressure water mist fire-extinguishing system is to have the following functions:

(1) The system capability is to be designed based on the areas of the largest protected space and maximum water flow rate calculated from testing;

(2) The system is to be kept readily for use (automatically released and manually operated);

(3) The system is to be supplied both by main power and emergency power;

(4) The system is to be capable of supplying water continuously for 30 min. Where the local application system is used to extinguish fires of diesel engines, continuous water supply for only 20 min is required;

(5) The system is to be capable of withstanding the ambient temperature changes, shocks, humidity, impacts, collision and corrosions commonly encountered on unit, and the components in protected spaces are to withstand the possible high temperature during fire.

(6) The system is to be fitted with permanent sea water inlets and operating continuously with sea water.

(7) The system is to be provided with testing devices, to ensure the pressures and flows needed are

always available.

6.4.3 Pumps

Redundancy is necessary for the provision of pumps, along with the availability of pressures and flows needed for the system.

6.4.4 Water supply

6.4.4.1 Sources supplying water to the system are to be readily available. The water storage tank is at least to be of sufficient capacity for the pump to operate for 1 min under rated pressure and with rated flow.

6.4.4.2 Capacity of fresh water tank is at least to be sufficient for the system to operate for 30 min continuously.

6.4.5 Piping

Dimension of the piping is to be determined by means of hydraulic calculation, to ensure the availability of pressures and flows for effective operation of the system.

When Hazen-Williams method is adopted, the Friction Factor *C* is to be selected as per Table 6.4.5.1:

Friction Factor **Table 6.4.5.1**

Types of pipes	C
Black pipe or galvanized mild steel pipe	100
Copper and copper alloy pipes	150
Stainless steel pipe	150

6.4.6 Nozzles

6.4.6.1 Nozzles of approved types are to be selected.

6.4.6.2 Nozzles are to be marked in accordance with approved standards.

6.4.6.3 Constants of nozzle flows are to be determined in accordance with the following formula:

$$K = Q / P^{0.5}$$

where: P — pressure, in bar;

Q — flow, in *l*/min.

6.4.6.4 Spares for nozzle of each type are to be provided as per Table 6.4.6.4:

Spares of nozzle **Table 6.4.6.4**

Number of nozzles to be installed	Minimum spares
＜50	3
50 ~ 300	6
301 ~ 1000	12
＞1000	24

6.4.7 Distributing valve

6.4.7.1 Each protected space or branch is to be fitted with distribution valves.

6.4.7.2 The operation of distribution valves is to initiate audible and visual alarms in the protected

space or manned control station.

6.4.8 Operation and maintenance

6.4.8.1 At each operation site, an operational instruction is to be posted.

6.4.8.2 System is to be maintained and serviced in accordance with the instructions provided by the manufacturer.

6.4.9 Additional requirements for the application system in accommodation spaces

6.4.9.1 The system is to comply with the requirements of IMO A.800 (19).

6.4.9.2 The system is to be of the wet pipe type but small exposed sections may be of the dry pipe, pre-action, deluge or antifreeze type where this is necessary.

6.4.9.3 The system is to be capable of fire control or suppression under a wide variety of fire loading, fuel arrangement, room geometry and ventilation conditions.

6.4.9.4 In accommodation and service spaces the spray are to have a nominal temperature rating of 57℃ to 79℃, except that in locations where high ambient temperatures might be expected, the nominal temperature may be increased by not more than 30℃ above the expected high temperature.

6.4.9.5 The system is to be capable of both detecting fires and acting to control and suppress fires.

6.4.10 Additional requirements for local application system in machinery spaces

6.4.10.1 The system is to comply with the requirements of IMO MSC/Circ.913.

6.4.10.2 The system is to be capable of fire suppression with forced ventilation fans running and supplying air to the protected area, or a method of automatically shutting air supply fans upon release of the system is to be provided to ensure that the fire-fighting medium is not dispersed.

6.4.10.3 The activation of the system is not to result in loss of electrical power.

6.4.10.4 Nozzle positioning is to take into account obstructions to the spray of the fire-fighting system.

6.4.10.5 The electrical components of the pressure source for the system are to have a minimum rating of IP 54.

6.4.10.6 Pressure source components of the system are to be located outside of the protected areas.

6.4.10.7 The system may be part of the central mist fire-extinguishing system.

6.4.10.8 To prevent mis-operations, the simultaneous operations of at least two types of fire detectors are needed to activate the automatic operation of the mist system.

6.4.11 Application system in the machinery spaces

6.4.11.1 The system is to comply with the requirements of IMO MSC/Circ.1165, MSC/Circ.1237 and MSC/Circ.1269.

6.4.11.2 The system is also to meet the requirements of 6.4.10.5, 6.4.10.6 and 6.4.10.8 of this Section.

Section 5 FIXED FOAM FIRE-EXTINGUISHING SYSTEMS

6.5.1 Objective

The main objective specified in this Section is to extinguish possible oil fires.

6.5.2 Functional requirements

To achieve the objectives specified in this Section, the fixed foam fire-extinguishing system is to

have the following functions:

(1) The storage capacity of foam concentrates is to be sufficient for the largest space to be protected;

(2) Pumps, foam monitors, foam applicators and nozzles are to comply with the requirements for foam supply rate;

(3) The system is to be easy and quick to use.

6.5.3 Water supply pump

6.5.3.1 The water supply pump of the foam system may be a dedicated pump or supplied with water by a fire pump. When a fire pump is applied, the capacity is to comply with the requirements of 6.2.6 of this Chapter.

6.5.4 Rate and duration of supplying foam solution

6.5.4.1 Deck of protected spaces

(1) Rate of 6.5 *l*/m^2 · min and duration of 15 min for protein foam and fluoroprotein foam;

(2) Rate of 4.1 *l*/m^2 · min and duration of 15 min for aqueous film-forming foam (AFFF) and film-forming fluoroprotein foam.

6.5.4.2 Fixed-top oil storage tanks

(1) Rate of 6.5 *l*/m^2·min and duration of 65 min when protected by foam monitors or applicators;

(2) Rate of 4.1 *l*/m^2·min and duration of 55 min when protected by fixed nozzles supplying foam into tanks.

6.5.5 Available quantities of foam concentrate

6.5.5.1 Available quantities of foam concentrate are to be sufficient for the largest protected space specified by 6.5.4 of this Chapter. For any practical design, the quantity required for the largest protected deck or that required for the largest oil storage tank is to be taken, whichever is greater.

6.5.5.2 The foam expansion rate (i.e., the ratio of the volume of foam produced to the volume of the mixture of water and foam-making concentrate supplied) is generally not to exceed 12 to 1. Where the expansion ratio of foam produced by the system is in excess of 12 to 1, the quantity of foam solution available is to be calculated as for 12 to 1 expansion ratio.

6.5.6 Foam monitors and applicators

6.5.6.1 Open decks are preferably to be protected by monitors. Where a monitor is used, a proper number of foam applicators are to be fitted to protect the areas not covered by the monitor.

6.5.6.2 The protected space may be provided with a separate applicator system. Where applicators are used for protected spaces, two applicators are to be available for simultaneous operation in fire fighting in each space. The capacity of each applicator is not to be less than 400 *l*/min.

6.5.6.3 Foam monitors and applicators are to be so provided and arranged that foam can reach all positions in the protected space, and that fire fighters are at the most favorably protected position. Consideration is to be given to fitting monitors or applicators at the entrance of each deck, the side of utility machinery areas facing any hazardous area and adjacent to the side of living quarter area facing any possible oil fire.

6.5.7 Protection of oil storage tanks

6.5.7.1 Oil storage tanks having a diameter greater than 18 m are not to be protected by monitors. Oil storage tanks having a diameter greater than 9 m or a height over 6 m are not to be protected by applicators. Such oil storage tanks are to be fitted with fixed foam nozzles on side walls of the tank top, and foam generators are to be provided at nozzles.

6.5.7.2 The foam nozzles are to be provided with sealing means to prevent flammable gas running

from the tank into foam piping through the nozzles during normal operations. However, the sealing means are not to be so strong as to prevent foam from entering the tank.

6.5.7.3 Oil storage tanks having a diameter less than 24 m may be provided with a foam nozzle. Oil storage tanks having a diameter not greater than 36 m but greater than 24 m are to be fitted with at least two nozzles. Oil storage tanks having a diameter greater than 36 m are to be fitted with an additional nozzle for each increased meter in diameter.

6.5.7.4 Means are to be provided for foam to smoothly reach the oil surface in the tank so that the foam will not rush down below the oil surface.

6.5.7.5 Upon the approval, foams may be delivered from the bottom of the tank.

6.5.7.6 Decks surrounding the oil storage tank are to be provided with at least two foam applicators to extinguish the potential oil spill fires.

6.5.8 Isolation valves

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

6.5.9 Testing

The system is to be subject to a foam delivery test after completion of manufacture.

Section 6 FIXED FOAM FIRE-EXTINGUISHING SYSTEMS ON HELICOPTER DECKS

6.6.1 Objective

The objective specified in this Section is to extinguish fires on helicopter decks or in the area where refueling system are located.

6.6.2 Functional requirements

Functional requirements for the fixed foam fire-extinguishing systems on helicopter decks are given in 10.4.1.4(3) of Chapter 10 of PART EIGHT.

Section 7 FIXED HIGH-EXPANSION FOAM FIRE-EXTINGUISHING SYSTEMS REQUIRED IN MACHINERY SPACES

6.7.1 Purpose

The objective of this Section is to extinguish oil fires in the machinery spaces.

6.7.2 Functional requirements

To achieve the objective specified in this Section, high-expansion foam fire extinguishing systems are to have the following functions:

(1) The available foam solution quantity that generated from stored concentrate is to be sufficient to produce a volume of foam equal to five times the volume of the largest space to be protected.

(2) The fixed high-expansion foam system is to be capable of rapidly discharging through fixed discharge outlets a quantity of foam sufficient to fill the greatest space to be protected at a rate of at least 1 m in depth per minute.

(3) The expansion ratio of the foam is not to exceed 1,000 to 1.

6.7.3 Technical requirements

The high-expansion foam fire-extinguishing systems used in machinery spaces are to comply with the applicable requirements of Resolution MSC.327 (90) adopted by Maritime Safety Committee on May 25th, 2012.

Section 8 DRY POWDER FIRE-EXTINGUISHING SYSTEMS

6.8.1 Objective

The objective of this Section is to apply dry powder fire-extinguishing system to extinguish oil, gas and electric fires.

6.8.2 Functional requirements

To achieve the objective specified in this Section, the dry power fire-extinguishing system is to have the following functions:

(1) Multi-purpose dry powder medium is preferably used.

(2) The release quantity per unit area is not to be less than 1.0 kg/m^2 in open spaces.

(3) The release quantity per unit volume is not to be less than 0.6 kg/m^3 in enclosed spaces.

(4) The fire-extinguishing medium is to be capable of being completely released into the protected space within 30 seconds.

(5) Precautions are to be taken to prevent stored powder from becoming hardened.

(6) The release ducting is to be designed to facilitate flow of powder.

Section 9 FIXED GAS FIRE-EXTINGUISHING SYSTEMS

6.9.1 Objective

The objective of this Section is to safely and effectively extinguish the fires in the protected enclosed spaces.

6.9.2 Functional requirements

For the objective specified in this Section, the fixed gas fire-extinguishing system is to have following functions:

(1) The quality and concentration of the fire-extinguishing medium is adequate to extinguish fire in the space where fire occurs;

(2) Before the release of medium, the oil source, wind source and all openings in the space where the medium is going to be released are ensured to be closed, and personnel evacuated;

(3) Vessels for storage of medium and pipes for transferring medium comply with the requirements for strength, tightness and duration of release;

(4) Proper medium vessel storage room is provided.

6.9.3 General requirements

6.9.3.1 The necessary pipes for conveying fire-extinguishing medium into the protected spaces are to be provided with control valves so marked as to indicate clearly the spaces to which the pipes are led. Suitable provision is to be made to prevent inadvertent release of the medium into the space.

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

6.9.3.3 Means are to be provided to close all openings which may admit air to, or allow gas to

escape from, a protected space.

6.9.3.4 Means are to be provided for automatically giving audible warning of the release of fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm is to operate for at least 20 s before the medium is released.

6.9.3.5 Pressure vessels required for the storage of fire-extinguishing medium are to be located outside the protected spaces.

6.9.3.6 The means of controlling the system are to be readily accessible and simple to operate and are to be grouped in as few locations as possible. Such locations are to be sufficiently illuminated, and an emergency lighting is to be provided in addition to the main lighting. The means of control are to be at positions where they will not be cut off by a fire in the protected space. At each location there are to be clear instructions relating to the operation of the system having regard to the safety of personnel.

6.9.3.7 Means of automatically releasing fire-extinguishing medium are in general not be used in manned spaces. Such means may be used provided that the reliability of the automatic fire detection device and a medium the concentration of which is little hazardous to human body are approved by CCS. The master valve used for release of fire-extinguishing medium into the protected space and the release valve on the vessels are to be capable of manually operated.

6.9.3.8 Vessels for the storage of fire-extinguishing medium and associated pressure components are to be designed with regard to their locations and maximum ambient temperatures expected in service.

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

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

6.9.3.11 Vessel storage stations are to comply with the following:

(1) The stations are to be completely separated from the protected space and gastight from any adjacent space.

(2) The stations are to be so ventilated that air changes within them are not less than 6 times per hour.

(3) The stations are to be used solely for the storage of vessels and other components and parts of the system.

(4) The stations are to be provided with direct communications to the main control station.

(5) The key to the vessel storage stations or control stations is to be stowed in a box with glass cover which is to be situated in an easily accessible and conspicuous position near the door.

(6) In each station there is to be displayed a clear and permanent schematic diagram showing the arrangement of the vessels, manifold, piping and fittings relating to the release of extinguishing medium, together with concise instructions for the operation of the system.

6.9.4 High-pressure carbon dioxide systems

6.9.4.1 Piping of carbon dioxide is to comply with the following requirements:

(1) Each connecting pipe led from each bottle head valve to the collecting pipe is to be provided with a non-return valve.

(2) The manifold connecting the collecting pipes and control valves is to be provided with a pressure gauge having a range of 0 to 24.5 MPa.

(3) The CO_2 piping is not to be led through accommodation and service spaces.

(4) For machinery spaces or control stations, the piping is to be provided with sufficient number

and adequate size of nozzles so that 85% of carbon dioxide can be discharged into the space within 2 min. Approximately 10% of the total quantity of CO_2 is to be discharged to the protected space below the floor in the engine room.

(5) The diameter of carbon dioxide piping leading to the above-mentioned spaces as stated in 6.9.4.1 (4) is to be determined in accordance with the proposed quantity conveyed by the piping. The maximum quantity of carbon dioxide conveyed by the corresponding pipe diameters is given in Table 6.9.4.1(5).

Internal Diameter of Pipes and Conveyed Quantity Table 6.9.4.1 (5)

Internal diameter of pipes, in mm	Maximum quantity of carbon dioxide conveyed by the pipe, in kg
15	60
20	100
25	135
32	275
40	500
50	1100
65	1600
80	2400
90	3300
100	4750
114	6800
127	9500
152	15250

Minimum Wall Thickness of CO_2 Pipes Table 6.9.4.1 (6)

External diameter of pipes, in mm	Wall thickness, mm	
	Piping forward of control valve	Piping after control valve
21.3～26.9	3.2	2.6
30.0～48.3	4.0	3.2
51.0～60.3	4.5	3.6
63.5～76.1	5.0	3.6
82.5～88.9	5.6	4.0
101.6	6.3	4.0
108.0～114.3	7.1	4.5
127.0	8.0	4.5
133.0～139.7	8.0	5.0
152.4～168.3	8.8	5.6

(6) The minimum wall thickness of CO_2 pipes is given in Table 6.9.4.1(6). Slight difference from the thickness listed in the Table will be accepted for the purpose of selecting standard pipes.

(7) Piping or distribution valve case is to be provided with compressed air cleaning connections at its manifold.

(8) CO2 pipes are to be of seamless steel, except that flexiblemetallic pipes can be used as the connecting pipe led from each bottle head valve to the collecting pipe in accordance with recognized standards.

(9) The melting point of all releasing pipes, fittings and nozzles located in the protected spaces is to be higher than 925oC, and piping and associated equipment are to be adequately supported.

6.9.4.2 Carbon dioxide bottles are to comply with the following requirements:

(1) CO_2 vessels are to be of seamless steel bottles and subjected to a hydraulic test under pressure 24.5 MPa. Each bottle is to be furnished with a certificate and to have on its body permanent identifications of weight, capacity, hydraulic test pressure, date of tests, manufacturer' serial number and also inspection stamp.

(2) The bottles are to be wholly painted in bright colour but white in way of the markings, and with letters of "carbon dioxide (or CO_2)".

(3) The charging ratio for CO_2bottles is not to be more than 0.67 kg/*l*.

(4) Bottle head valves are to be associated with steel or copper seamless tubes having a diameter of 10 to 12 mm snipped off at their lower end and terminated near the bottom of the bottles.

(5) Bottle head valves are to be provided with safety diaphragms or other approved safety devices. The bursting pressure of the safety diaphragms is to be 18.6±1 MPa. After bursting of safety diaphragms, the escape gas is to be led to the open atmosphere through suitable piping. But if the storage room of carbon dioxide cylinders is equipped with special mechanicalpower ventilation system which can change of air at least six times every hourwhich is sized to provide at least 6 air changes per hour, and guarantee the temperature in the storage room is ensured not more than 45 ℃ and provided with temperature alarm device, the exhaust pipe may not be set provided.

(6) Bottles head valves are to be made of forged bronze or other suitable material.

(7) CO_2 bottles are to be divided into groups according to the required quantity for different spaces to be protected. When the discharge device is controlled by artificial directly, the number of bottles in each group is not to exceed 12.

6.9.4.3 CO_2 bottles and bottle head valves are to be subjected to a hydraulic test of 24.5 MPa. Safety diaphragms are to be burst-tested by selecting 10% at random. The bursting pressure of the safety diaphragms is to be 18.6±1 MPa.

6.9.4.4 On completion of fitting the bottle head valves, CO_2 bottles are to be subjected to an air-tightness test in the workshop to a pressure equal to the design pressure of the bottle.

6.9.4.5 The pipes and valves of CO_2 piping systems are to be subjected to a hydraulic test with a pressure of at least 11.8 MPa for control valves and pipes between bottle head valves and control valves, and 1.0 MPa for pipes between control valves and nozzles. The above tests may be carried out in workshop. On completion of the hydraulic test, CO_2 piping is to be subjected to an air-tightness test of at least 0.69 MPa with the ends closed so as to check tightness of connections.

6.9.4.6 On completion of installation on board, the CO_2 piping system is to be function-tested with a pneumatic pressure not less than 2.47 MPa for checking the operation of releasing mechanism.

6.9.4.7 The control of carbon dioxide systems is to comply with the following requirements:

(1) Two separate controls are to be provided for releasing carbon dioxide into a protected space and to ensure the activation of the alarm. One control is to be used to discharge the gas from its storage vessels and a second control is to be used to open the valve of the piping which conveys the gas into the protected space.

(2) The two controls are to be located inside a release box clearly identified for the particular space. If the box containing the controls is to be locked, a key to the box is to be in a break-glass-type enclosure conspicuously located adjacent to the box.

6.9.4.8 The CO_2 quantity required for protected spaces is specified as follows:

(1) The minimum volume of free carbon dioxide is to be equal to 35% of the gross volume of a machinery space, rooms containing electrical installations or control station.

(2) The minimum volume of free carbon dioxide is to be equal to 45% of the gross volume of a space of oil fire risk with a flash point below 60℃.

(3) The volume of free carbon dioxide is to be calculated at 0.56 m^3/kg.

6.9.5 Low-pressure carbon dioxide systems

6.9.5.1 The time of discharge of carbon dioxide in the fire-extinguishing system into the protected space, location of nozzles in the protected spaces, signals warning that the system is activated and the amount of carbon dioxide required for the protected space are to comply with the relevant requirements of this Section for CO_2 high-pressure systems.

6.9.5.2 Vessel(s), refrigerating plants, control devices and other equipment of the system are to be located in a space complying with the requirements applying to CO_2 high-pressure systems.

6.9.5.3 Vessel (s) and relevant devices are to comply with the following requirements:

(1) The rated amount of liquid carbon dioxide is to be stored in vessel(s) under the working pressure of 1.8 to 2.2 MPa. The normal liquid charge in the vessel is to be limited to provide sufficient vapour space to allow for expansion of the liquid under the maximum storage temperature. The charge is not to exceed 95% of the volumetric capacity of the vessel.

(2) The vessel(s) are to be designed, constructed and tested in accordance with PART THREE of CCS Rules for Classification of Sea-going Steel Ships. Besides, provision is to be made for:

① pressure gauge;

② high pressure alarm: to be warning at 2.2 MPa;

③ low pressure alarm: to be warning at 1.8 MPa;

④ safety diaphragms;

⑤ branch pipes with stop valves for filling the vessel;

⑥ discharge pipes;

⑦ liquid CO_2 level indicator, fitted on the vessel(s), and remote level indicator located in the place where the remote control of the CO_2 release, if any, is fitted;

⑧ two safety relief valves arranged so that either valve can be shut off while the other is connected to the vessel. The setting of the relief valves is to be not less than 2.2 Mpa. The capacity of each valve is to be such that the vapours generated under fire condition can be discharged with a pressure rise not more than 20% above the setting pressure. The discharge from the safety valves is to be led to the open air.

(3) The vessel(s) and output pipes permanently filled with carbon dioxide are to provided with thermal insulation so as to prevent the operation of the safety valve within 24 hours after the refrigerating plant has lost electrical power at the ambient temperature of 45℃. The insulating materials and their liners are to be to the satisfaction of CCS, particular attention is to be given to fire resistance and mechanical properties of materials as well as protection against penetration of water vapours.

6.9.5.4 The refrigerating plant is to meet the following requirements:

(1) The vessel(s) are to be serviced by two dedicated automated refrigerating units which are fully independent, each comprising a compressor and the relevant prime mover, evaporator and condenser.

(2) The capacity and the automatic control of each refrigerating plant are to be such as to maintain that CO_2 vessel(s) will not exceed the required temperature under conditions of continuous operation during 24 hours at the most unfavorable water temperature and ambient temperature of the sea area in which the unit is operating.

(3) In the event of failure of either one of the refrigerating plants, the other is to be actuated automatically. Provision is to be made for local manual control of the refrigerating plant.

(4) Each electric refrigerating plant is to be supplied from the main switchboard bus-bars by a separate feeder.

(5) Cooling water supply to the refrigerating plant is to be provided from at least two circulating pumps, one of which being used as a standby. The standby pump may be a pump used for other services so long as its use for cooling would not interfere with any other essential service of the unit.

6.9.5.5 Pipes are to meet the following requirements:

(1) The pipes, valves and fittings are to be in accordance with the relevant requirements of Chapter 2 of PART FOUR of the Rules for a design pressure not less than that of the CO_2 vessel.

(2) Safety relief devices are to be provided in each section of pipe that may be isolated by block valves and in which there could be a build-up of pressure in excess of the design pressure of any of the components.

(3) The piping system is to be designed in such a way that the CO_2 flows through in liquid phase up to the discharge nozzles. To this end the pressure at the nozzles is to be not less than 1.0 MPa.

6.9.5.6 The fire control station and the related operators' cabins are to be equipped with audible and visual alarms activated when:

(1) the pressure in the vessel(s) reaches the low or high values according to 6.9.5.3(2);

(2) any one of the refrigerating units fails to operate;

(3) the lowest permissible level of the liquid in the vessels is reached.

6.9.5.7 Means of release control of low-pressure carbon dioxide systems are to meet the following requirements:

(1) The release of CO_2 is to be initiated manually and any automatic release is subject to the agreement of CCS.

(2) If a device is provided which automatically regulates the discharge of the rated quantity of carbon dioxide into the protected space, it is to be also possible to regulate the discharge manually.

(3) If the system serves more than one space, means for control of discharge quantities of CO_2 are to be provided, e.g. automatic timer or accurate level indicators located at the control position(s).

6.9.5.8 Testing of low-pressure carbon dioxide systems is to comply with the following requirements:

(1) The pipes, valves and fittings and manifolds are to be tested in compliance with the requirements of Section 7, Chapter 2 of PART FOUR of the Rules.

(2) The pipes from the vessel(s) to the release valves on the distribution manifold are to be subject to a pressure test to 1.5 times the design pressure. The test may be carried out in workshop.

(3) The pipes from the release valves on the distribution manifold to the nozzles are to be tested for tightness with a pressure of 1.0 MPa and free flow of CO_2, after they are assembled on board.

(4) The refrigerating plant, after installed onboard, is to be checked for its proper operation.

(5) Upon completion, functional test is to be carried out for the CO_2 system to check the operation of release mechanism.

Section 10 CLEAN AGENT FIRE-EXTINGUISHING SYSTEM

6.10.1 Objective

The objective specified in this Section is to apply clean and environment-friendly fire-extinguishing medium to extinguish fire in enclosed spaces.

6.10.2 Functional requirements

To achieve the objectives specified in this Section, the clean agent fire-extinguishing system is to have the following functions:

(1) Proper fire-extinguishing medium vessel storage room is provided;

(2) Fire-extinguishing medium vessels and piping comply with the requirements for strength and tightness;

(3) The quality and concentration of the fire-extinguishing medium is adequate to extinguish fire in the protected area and keep the personnel in the protected area in safe;

(4) Fire-extinguishing medium is capable of fast and even release in the space;

(5) System control is provided with redundancy.

6.10.3 Fire-extinguishing medium storage room

6.10.3.1 Dedicated fire-extinguishing medium vessel storage room is to be provided onboard the

unit, which is gastight from other spaces and easily accessible from open deck.

6.10.3.2 It is to be displayed a clear and permanent schematic fire-extinguishing system diagram, together with instructions for the operational procedures in the storage room.

6.10.3.3 The storage room and fire-extinguishing control station are to be provided with direct communications to the central control station.

6.10.3.4 Ventilation arrangements are to be installed in the storage room, giving at least 6 air changes per hour.

6.10.3.5 Temperature in the storage room is not to be more than 50℃.

6.10.3.6 Emergency lighting is to be provided in the storage room.

6.10.4 Vessels

6.10.4.1 Vessels are to be made of seamless steel cylinders.

6.10.4.2 Vessels are to be made in according with GB or industrial standards.

6.10.4.3 Vessels are to be provided with a permanent nameplate indicating serial number, volume and tare weight of the vessel, and name of the medium, quantitycharged, charging date and pressure, etc.

6.10.4.4 Vessels are to be fitted with pressure gauge and over-pressure protection devices.

6.10.4.5 Vessels are to be supported with racks, and reliably fixed.

6.10.4.6 Vessels are to be so arranged as to facilitate maintenance and operation.

6.10.5 Piping

6.10.5.1 The manifolds are to be made of steel, and fitted with pressure gauge and over-pressure protection device.

6.10.5.2 A flexible connection is to be provided between manifolds and vessels.

6.10.5.3 Distribution control valves are to be provided on branch piping to each protected area, with a nameplate indicating the protected area;

6.10.5.4 Pipes and fittings are to be made of seamless steel complying with national or industrial standards, and be processed against corrosion both inside and outside. Cupper tube may be used for conveying the pilot gas.

6.10.5.5 Pipes with the nominal diameter is larger than 50 mm are to be connected by welding or flange joints.

6.10.6 Nozzles

6.10.6.1 Nozzles are to be so arranged that the released fire-extinguishing medium is to be evenly distributed in the protected areas. The ejections of nozzles are not to be directly headed toward the liquid surface.

6.10.6.2 Height and radius covered by nozzles are to meet the following requirements:

(1) The Maximum height covered is not to be greater than 6.5 m, and the minimum is not to be less than 0.3 m.

(2) Where the installation height is less than 1.5 m, the radius covered is not to be greater than 4.5 m.

(3) Where the installation height is not less than 1.5 m, the radius covered is not to be greater than 7.5 m.

6.10.6.3 Nozzles are preferably to be installed close to the celling of the protected areas, at a maximum distance not to be greater than 0.5 m from the celling.

6.10.7 Spaces to be protected

6.10.7.1 The enclosed spaces to be protected by the clean agent fire-extinguishing systems onboard units include:

(1) machinery spaces;

(2) control stations;

(3) rooms containing electrical installations;

(4) drilling fluid processing area.

6.10.7.2 Area of a single protected space is not to exceed 800 m^2, and the capacity is not to exceed 3600 m^3.

6.10.8 Fire-extinguishing medium

6.10.8.1 Quality of clean agents is to comply with GB and industrial standards;

6.10.8.2 Quantity of the fire-extinguishing medium reserved is not to be less than the quantity needed for the largest protected area on a unit.

6.10.9 Duration of release

6.10.9.1 For the control room and rooms containing electrical installations protected by the HFC-227ea fire-extinguishing system, the designed duration of release is not to be longer than 8 s, and for other protected spaces, the designed duration of delivery is not to be longer than 10 s.

6.10.9.2 When 95% of the designed dosage of INERGEN fire-extinguishing medium is released, the duration of release is not to be longer than 60 s but not shorter than 48 s.

6.10.10 Quantity of fire-extinguishing medium required per unit volume

6.10.10.1 HFC-227ea

(1) The quantity of the fire-extinguishing medium required per unit volume of the protected space is not to be less than 0.6338 kg/m^3, by taking the net volume of the protected space.

(2) For manned areas, the actual concentration of fire extinguishing medium used is to be calculated, which is not to be greater than 10.5%.

6.10.10.2 INERGEN

(1) The quantity of the fire-extinguishing medium required per unit volume the protected space is not to be less than 0.7342 kg/m^3, by taking the net volume of the protected space.

(2) For manned areas, the actual concentration of fire extinguishing medium used is to be calculated, which is not to be greater than 52%.

6.10.11 Operation and control

6.10.11.1 The system is to be designed with three modes of starting: automatic control, manual remote control or manual emergency operation.

6.10.11.2 Automatic control is to be started after receiving two independent fire signals. In the manned protected areas, a controllable delayed delivery for not more than 30 seconds is to be provided. For unmanned protected areas delivery without delay is to be provided.

6.10.11.3 Manual remote control is to be remotely started in the central control room and out of the escape door of each protected area.

6.10.11.4 Manual control means manually opening the distribution valve, the pilot gas cylinder and manually and directly opening the fire-extinguishing medium storage vessel. Failure of automatic control and manual remote control are not to influence manual emergency operation.

6.10.11.5 Opening of distribution valves by any control mode is not to be later than the opening of fire-extinguishing medium storage vessel.

6.10.11.6 For the protected areas where the actual fire-extinguishing concentration is higher than NOAEL concentration (9% for HFC-227ea and 43% for INERGEN), a switch-over between manual and automatic control is to be provided. The automatic mode is to be switched over to the manual mode when personnel enter the protected areas. The manual mode is switched back to the automatic mode after the personnel leave the area. Manual/automatic control status indicators are to be provided both inside and outside of the protected areas.

6.10.11.7 Buttons for manual operation of the fire-extinguishing system are to be provided with means against misoperation.

6.10.12 Safety for personnel into the spaces where fire-extinguishing medium has been released

6.10.12.1 Fire-extinguishing medium is to be capable of maintaining at least 20 minutes after being released so as to completely extinguish the fire.

6.10.12.2 Sufficient ventilation is to be provided before personnel enter the space where fire extinguishing medium has been released. A minimum of 5 air changes are to be provided before entering.

Section 11 WET CHEMICAL FIRE-EXTINGUISHING SYSTEM

6.11.1 Objective

The objective specified in this Section is to guarantee the fire-extinguishing effectiveness by applying wet chemical fire-extinguishing system in gallery.

6.11.2 Functions

To achieve the objectives specified in this Section, the wet chemical fire-extinguishing system is to have the following functions:

(1) The system is so designed to be suitable for use in the marine environment;

(2) The system is to be capable of functioning properly under a temperature conditions from 0℃ to 49℃;

(3) The system is to be a product approved or inspected by CCS ;

(4) The chemical and physical characteristics of material in the system are to be compatible with the wet chemical solution;

(5) The material in the system are to be fire-resistance and corrosion-resistant. No galvanized steel pipes and fittings are allowed in the piping;

(6) Nozzles are to be designed for their intended use. Nozzles are to be provided with caps not influencing the release of fire-extinguishing medium, so as to prevent the entrance of grease vapors or other foreign material into the piping;

(7) Fire detectors are to be thee approved heat detectors;

(8) Wet chemical fire-extinguishing medium is approved by the Administration or an Authority;

(9) Wet chemical fire-extinguishing medium of different types cannot be mixed;

(10) Wet chemical vessels and expellant gas assemblies are to be accessible for operation, maintenance and recharge;

(11) Amount of the medium stored and amount and pressure of expellant gas are such that they may be readily inspected ;

(12) The system is to have both automatic and manual methods of actuation. Means for manual activation is to be located in a path of entrance or exit to the galley;

(13) Upon activation of the fire-extinguishing system, sources of fuel and power to the equipment protected are to be automatically shut down;

(14) Any equipment that will allow fire propagation from one area to another is to be protected by a single fire-extinguishing system as far as possible. Where two or more systems are used, these systems are to operate simultaneously.

Section 12 PROVISION OF FIRE EXTINGUISHING APPLIANCE

6.12.1 Objective

The objective specified in this Section is to provide fire control and extinguishment in each fire risky space.

6.12.2 Functional requirements

To achieve the objective specified this Section, the functional requirements for fire-extinguishing appliance are as follows:

(1) Each accessible space of fire risk is to be provided with portable fire extinguishers for extinguishing incipient fires.

(2) Each space of higher oil fire risk is to be provided with large movable fire extinguishers and/or portable foam applicators.

(3) Each space of fire risk is to be provided with fixed fire-extinguishing system for extinguishing great fires.

(4) Each fire-extinguishing means mentioned above is to have a redundancy.

6.12.3 Living quarter area

6.12.3.1 At least three portable extinguishers in compliance with the requirements of Section 1 of this Chapter are to be provided on each deck within living quarter . No carbon dioxide fire extinguisher is to be used.

6.12.3.2 Fire hydrants in compliance with the requirements of Section 2 of this Chapter are to be provided on each deck within living quarter area.

6.12.3.3 The high-pressure water-spraying fire-extinguishing system provided within living quarter area, if any, is to comply with the requirements of Section 4 of this Chapter.

6.12.4 Machinery spaces of category A containing oil fuel unit

6.12.4.1 At least three portable foam or dry power extinguishers in compliance with the requirements of Section 1of this Chapter are to be provided.

6.12.4.2 At least one large foam or equivalent dry power extinguisher having a capacity of not less than 135 *l* is to be provided.

6.12.4.3 At least a portable foam applicator complying with Section 1 of this Chapter is to be provided.

6.12.4.4 One of the following fixed fire-extinguishing systems is to be provided:

(1) one high-pressure water-spraying system complying with Section 4 of this Chapter;

(2) one high-expansion foam system complying with Section 7 of this Chapter;

(3) one dry powder system complying with Section 8 of this Chapter.

(4) one fixed gas fire extinguishing system complying with Section 9 of this Chapter;

(5) one clean agent fire extinguishing system complying with Section 10 of this Chapter;

6.12.4.5 Fire hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.5 Machinery spaces of category A containing internal combustion engine

6.12.5.1 One portable foam or dry powder extinguisher complying with Section 1 of this Chapter is to be provided at each access to such spaces and for every 10 m walking distance therein.

6.12.5.2 At least one large foam or equivalent dry power extinguisher having a capacity of not less than 45 *l* is to be provided.

6.12.5.3 The requirements of 6.12.4.3, 6.12.4.4 and 6.12.4.5 of this Section apply also to the machinery spaces of category A containing internal combustion engine.

6.12.6 Machinery spaces other than those of category A

6.12.6.1 At least two portable fire extinguishers are to be provided.

6.12.6.2 Pump rooms and thruster rooms of column-stabilized units are to comply with the requirements of 6.12.4.4 of this Section.

6.12.6.3 In case a certain quantity of fuels is stored in the space, the requirements of 6.12.4.4 of this Section are to be complied with; fixed fire-extinguishing systems may be exempted for machinery spaces of lower fire risk.

6.12.6.4 Hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.7 Wellhead area

6.12.7.1 On the drilling deck or wellhead deck, at least two portable foam fire extinguishers or dry powder fire extinguishers are to be provided.

6.12.7.2 Water spray systems complying with the requirements of Section 3 of this Chapter or at least two fire monitors complying with the requirements of Section 2 of this Chapter are to be provided for protection of the wellhead area.

6.12.7.3 Hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.8 Drill fluid processing area

6.12.8.1 For each 10 meters of walking distance, a portable foam fire extinguisher or dry powder fire extinguisher is to be provided;

6.12.8.2 Foam fire extinguishing system is to be provided in compliance with Section 5 of this Chapter.

6.12.8.3 Enclosed mud processing area may be fitted with the fixed gas fire-extinguishing system complying with Section 9 of this Chapter or clean agent fire-extinguishing system complying with Section 10 of this Chapter to replace the foam fire-extinguishing system.

6.12.8.4 Hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.9 Well Test areas

6.12.9.1 At least two portable foam or dry powder extinguishers are to be provided.

8.12.9.2 Two foam or equivalent dry powder extinguishers having a capacity of not less than 45 *l* are to be provided.

8.12.9.3 Water spray system complying with Section 3 of this Chapter or at least two fire monitors complying with the requirements of Section 2 of this Chapter are to be provided for protection of the well test areas.

6.12.9.4 Hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.10 Oil, gas and water processing areas

6.12.10.1 One portable foam or dry powder extinguisher is to be provided for every 10 m walking distance, with one at each access to such areas.

6.12.10.2 Two foam or equivalent dry powder extinguishers having a capacity of not less than 45 *l* are to be provided.

6.12.10.3 Foam systems complying with Section 5 of this Chapter are to be provided.

6.12.10.4 Water spray systems complying with Section 3 of this Chapter are to be provided.

6.12.10.5 Hydrants complying with Section 2 of this Chapter are to be provided.

6.12.11 Crude Oil storage area

6.12.11.1 The internal protection of crude oil storage tanks is to be provided by a foam system complying with Section 5 of this Chapter.

6.12.11.2 The decks in the crude oil storage area are to be protected by at least 2 foam applicators.

6.12.11.3 Hydrants complying with Section 2 of this Chapter are to be provided.

6.12.12 Helicopter deck

Provision of fire-extinguishing equipment for helicopter deck is to comply with Section 4, Chapter 10 of PART EIGHT.

6.12.13 Switch room and control room

6.12.13.1 At least two portable gas fire extinguishers are to be provided, which may be installed out of but adjacent to the doors for smaller spaces.

6.12.13.2 For control rooms independent of living quarter area, gas fire-extinguishing systems complying with Section 9 or Section 10 of this Chapter are to be provided.

6.12.14 Paint lockers and flammable liquid lockers

6.12.14.1 Fixed fire-extinguishing systems complying with 6.12.4.4 of this Section are to be provided.

6.12.14.2 For paint lockers and flammable liquid lockers of an area of less than 4 m^2, portable CO_2 or dry powder extinguishers may be accepted in lieu of fixed systems, complying with relevant requirements for concentration, as appropriate, in respect to the quantity of medium. A discharge port is to be arranged in the locker to allow the discharge of the extinguisher without having to enter into the locker. The required portable fire extinguisher is to be stowed adjacent to the port.

6.12.15 Enclosure of internal combustion engine

6.12.5.1 A gas system or a self-contained gas fire-extinguishing device complying with Section 9 or Section 10 of this Chapter is to be arranged.

6.12.15.2 Two portable dry powder extinguishers are to be provided outside the enclosure.

6.12.16 Heat medium heaters

6.12.16.1 A gas system or a self-contained gas fire-extinguishing device in compliance with Section 9 or Section 10 of this Chapter is to be provided within thermal oil heaters.

6.12.16.2 For heaters installed in an enclosure, the requirements of 6.12.15 of this Section are to be complied with.

6.12.17 Scavenging air receivers of two-stroke diesel engines

Scavenging air receivers of two-stroke diesel engines are preferably to be protected with a self-contained gas fire-extinguishing device.

6.12.18 Galley

6.12.18.1 At least one portable fire-extinguisher is to be provided within each galley or adjacent to the door.

6.12.18.2 Wet chemical fire-extinguishing system complying with Section 11 of this Chapter or other suitable fire-extinguishing system is to be provided for protection of exhaust ducts and galley ranges.

6.12.18.3 Hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.19 Storage areas of oxygen and acetylene cylinders

6.12.19.1 The fire-fighting provision for enclosed space where oxygen and acetylene cylinders permanently stored is to comply with the relevant requirements of 6.12.4.4 of this Chapter.

6.12.19.2 Hydrants complying with the requirements of Section 2 of this Chapter are to be provided.

6.12.20 Cold vent stacks for natural gas

6.12.20.1 Cold vent stacks for natural gas are to be provided with fire-extinguishing means in the event of vent gas being ignited. Fire-extinguishing nozzles are to be so located below the top of the stack to a distance of 10 times the stack diameter and enable the fire-extinguishing medium directly flow into the stack . A minimum of two nozzles are to be fitted.

6.12.20.2 Where CO_2 is used, the volume quantity of CO_2 entering into the stack is to be at least 5 time that of natural gas for a duration of not less than 30 seconds. Spare CO_2 cylinders are to be available.

6.12.20.3 Other equivalent fire-extinguishing means may be used, subject to agreement of CCS.

CHAPTER 7 CLASSIFICATION OF HAZARDOUS AREAS

Section 1 GENERAL PROVISIONS

7.1.1 Objective

The objective of identifying and classifying hazardous areas is to individually and reasonably select explosion-proof electrical installations, cables and machinery installation and to eliminate other potential ignition sources for prevention of any explosion.

7.1.2 Functional requirements

Functional requirements for identification of hazardous areas are as follows:

(1) Identification of different hazardous areas;

(2) Determination of the scopes of different hazardous areas.

7.1.3 Categories of hazardous areas

As required for the selection of explosion-proof electrical installations and based on the possibility and duration of presence of explosive gas, the hazardous areas are classified as follows:

(1) Zone 0: a zone in which an explosive gas-air mixture is continuously present or present for long periods in normal operating conditions;

(2) Zone 1: a zone in which an explosive gas-air mixture is likely to occur in normal operating conditions;

(3) Zone 2: a zone in which an explosive gas-air mixture is not likely to occur, and if it occurs, it will exist only for a short time.

7.1.4 Release sources and hazardous areas

7.1.4.1 The presence of an explosive gas-air mixture is normally related to whether a explosive fluid conveyed or stored in a closed system is properly released, i.e., hazardous areas are related to the sources of release as defined in Section 2 of Chapter 1 of this part. The area where a source of continuous release exists will result in a hazardous area Zone 0, the area where a source of category 1 release exists will result in a hazardous area Zone 1 and the area where a source of category 2 release exists will result in a hazardous area Zone 2.

7.1.4.2 Piping connected solely by welding are considered as being without any source of release provided that they are not fitted with any dismountable connections and the arrangement of the piping is in compliance with relevant requirements of the Rules.

7.1.5 Ventilation and hazardous areas

7.1.5.1 The duration of presence of an explosive gas-air mixture is often related to ventilation. The spaces classified as hazardous Zone 1 or 2 are to be satisfactorily ventilated and if not so or no ventilation is available, they are to be classified as a more hazardous Zone accordingly.

7.1.5.2 In special cases, a hazardous zone may be classified as a less hazardous one by means of intensified ventilation, subject to agreement of CCS.

7.1.6 Structural features and hazardous areas

Where explosive gas accumulates and will not be easily dispersed due to structural obstructions or indentations, the hazardous zone where this occurs is to be classified as a more hazardous one or is to be extended accordingly.

7.1.7 Nature of gas and hazardous areas

Where the specific gravity of a flammable gas is greater than that of air, the range of its dispersion

will increase from the source of release downward or along floor.

7.1.8 Venting rate and hazardous areas

Where a high-speed vent valve with a venting rate of more than150 m/s is fitted, the areas below the venting outlet will not reach the range of explosion. Basic principles for identification of hazardous areas are given in paragraphs 7.1.4 to 7.1.8 of this Section and embodied throughout this Chapter. Any hazardous areas not covered by Section 2 of this Chapter are to be classified according to such principles.

7.1.9 Change of hazardous areas

7.1.9.1 Where the as-built drawings are different from the originally approved ones, hazardous areas are to be re-classified according to the as-built drawings.

7.1.9.2 When the unit has undergone modification of a major character, hazardous areas are to be re-classified.

7.1.10 Indication of categories of flammable gases in hazardous areas

The categories of flammable gases in each hazardous area are to be clearly indicated to facilitate selection of explosion-proof electrical installations.

Section 2 CATEGORIES AND EXTENT OF HAZARDOUS AREAS

7.2.1 Hazardous Areas Zone 0

The spaces classified as hazardous areas Zone 0 are as follows:

(1) the internal spaces of the mud circulating system between the well and the final degassing discharge;

(2) all internal spaces containing hydrocarbon in oil, gas and water processing systems between the christmas tree and processing terminals;

(3) the internal spaces of crude oil storage vessels and outlet system;

(4) all other internal spaces conveying, storing and processing explosive liquids.

7.2.2 Hazardous Areas Zone 1

The spaces classified as hazardous areas Zone 1 are as follows:

(1) the open areas 3 m beyond the mud circulating system between the well and the final degassing discharge. Where the mud circulating system is located in an enclosed space, the complete enclosed space is to be classified as Zone 1;

(2) enclosed or semi-enclosed areas in the drilling derrick;

(3) outdoor locations below the drill floor and within a radius of 3 m from a possible source of release gas such as a drilling nipple;

(4) semi-enclosed, obstructed and poorly ventilated spaces around and below the christmas tree;

(5) areas within a radius of 3 m from any drainage and degassing discharge in oil, gas and water processing systems and crude oil storage system;

(6) areas within a radius of 3 m from venting outlets of crude oil storage tanks and all other cool discharges of natural gas;

(7) internal spaces of tanks used for storage of fuel oil;

(8) any enclosed spaces containing a release source of category 1 and satisfactorily ventilated.

7.2.3 Hazardous areas Zone 2

The spaces classified as hazardous areas Zone 2 are as follows:

(1) enclosed spaces which contain open sections of the mud circulating system from the final degassing discharge to the mud pump suction connection at the mud pit;

(2) outdoors locations within the boundaries of the drilling derrick up to a height of 3 m above the drill floor;

(3) semi-enclosed locations below and contiguous with the drill floor and to the boundaries of the derrick or to the extent of any enclosure which is liable to trap gases;

(4) the areas occupied by the entire oil, gas and water processing systems, other than those specified in 7.2.1 and 7.2.2 of this Section, including the areas 3 m beyond the boundaries consisting of any equipment and piping in the oil, gas and water processing systems;

(5) the crude oil storage area including the areas 3 m beyond the boundaries consisting of piping and oil storage tanks;

(6) the areas 3 m beyond the piping and equipment of all other systems conveying, storing and processing explosive fluids;

(7) internal spaces of ventilation ducts of natural gas or crude oil fuel pipes or internal spaces of housings of combustion equipment fuelled by natural gas or crude oil;

(8) areas within a radius of 7 m from hazardous areas Zone 1 around cool discharges of natural gas and vents of crude oil storage tanks;

(9) any enclosed spaces containing a release source of category 2 and satisfactorily ventilated;

(10) the enclosed space containing crude oil hoses in paint lockers;

(11) air lock spaces specified in Section 3 of this Chapter;

(12) enclosed spaces used for storage of acetylene cylinders and where such cylinders are stored in an open area, areas 3 m beyond the cylinder head valve.

Section 3 DESIGN REQUIREMENTS FOR ACCESSES BETWEEN AREAS

7.3.1 Openings, access and ventilation conditions affecting the extent of hazardous areas

7.3.1.1 Except for operational reasons, access doors or other openings are not to be provided:

(1) between a non-hazardous area and a hazardous area; or

(2) between a Zone 2 space and a Zone 1 space.

7.3.1.2 Any enclosed space having a direct access to any Zone 1 location or Zone 2 location becomes the same Zone as the location except that:

(1) an enclosed space with direct access to any Zone 1 location can be considered as Zone 2 if:

① the access is fitted with a gastight door opening into the Zone 2 space;

② ventilation is such that the air flow with the door open is from the Zone 2 space into the Zone 1 location; and

③ loss of ventilation is alarmed at a manned station.

(2) an enclosed space with direct access to any Zone 2 location is not considered hazardous if:

① the access is fitted with a self-closing gastight door that opens into the non-hazardous location;

② ventilation is such that the air flow with the door open is from the non-hazardous space into the Zone 2 location; and

③ loss of ventilation is alarmed at a manned station.

(3) an enclosed space with direct access to any Zone 1 location is not considered hazardous if:

① The access is fitted with an air lock space complying with (4) of this paragraph

② The space has ventilation overpressure of not less than 25 Pa in relation to the hazardous space; and

③ Loss of ventilation overpressure is alarmed at a manned station.

Where ventilation arrangements of the intended enclosed non-hazardous space are considered sufficientby the Surveyor to prevent any ingress of gas from the Zone 1 location, the two self-closing doors forming an air lock may be replaced by a single self-closing gastight door which opens into the non-hazardous location and has no hold-back device, provided that loss of ventilation overpressure is alarmed at a manned station.

(4) Air lock space

① The air lock space is to be provided with two gastight doors spaced not less than 1.5 m, but not greater than 2.5 m apart.

② The gastight doors are to be self-closing and have no hold-back device. Where one of the doors is required to be weathertight or watertight, it is not to be fitted with a self-closing appliance, provided that it is normally closed and attached with a warning sign that the door is normally to be closed.

③ The air lock space is to be mechanically ventilated from a non-hazardous space and have overpressure in relation to any adjacent hazardous area.

CHAPTER 8 EQUIPMENT SUITABLE FOR USE IN HAZARDOUS AREAS

Section 1 GENERAL PROVISIONS

8.1.1 Objective

The objective specified in this Section is to eliminate all potential ignition sources within the hazardous areas.

8.1.2 Functional requirements

8.1.2.1 No ignition sources capable of causing an explosion are permitted in hazardous areas.

8.1.2.2 Surface temperature of the equipment in hazardous areas is not to be higher than 80% of the self-ignition point of flammable gases.

8.1.2.3 Means are to be provided to prevent moving parts in hazardous areas from producing, due to collision and friction, sparks and high surface temperatures enabling cause an explosion.

8.1.2.4 Tools are to beso used in hazardous areas that no sparks will be produced due to impact.

8.1.2.5 Precautions are to be taken to prevent sparks induced by radio frequencies in hazardous areas.

8.1.2.6 The temperature of any heating medium entering hazardous areas is not to be higher than 80% of the self-ignition point of flammable gases that may exist.

8.1.2.7 Equipment and systems located in hazardous areas are to be provided with anti-static measures.

8.1.2.8 Electrical equipment in the hazardous areas, if installed, is to be certified as explosion-proof.

8.1.2.9 Electrical cables used in hazardous areas are to be certified as suitable for use in hazardous area.

8.1.2.10 Pumps and compressors used in the hazardous areas, if any, are to comply with the requirements of Section 2 of this Chapter.

8.1.2.11 Combustion equipment is not allowed to be installed in hazardous areas and where this is unavoidable; Section 3 of this Chapter is to be complied with.

Section 2 PUMPS AND COMPRESSORS SUITABLE FOR USE IN HAZARDOUS AREAS

8.2.1 General requirements

There are normally no formal certifying requirements for pumps and compressors used in the hazardous areas. However, practical testing and inspections are to be carried out to prove that they will not cause explosion.

8.2.2 Testing

Full-load test is required before the initial use or after maintenance to ensure that:

(1) the surface temperature of the equipment is lower than 200℃ or lower than 80% of the self-ignition point of flammable gases that may exist in the area where the equipment is located;

(2) no mechanical sparks are observed;

(3) full electric bonding and grounding is provided to the equipment;

(4) in case of belt driving, the belt is to prevent static electricity.

8.2.3 High-temperature alarming

Pumps and compressors whose surface temperature may exceed 150℃ when in operation are to be fitted with high-temperature alarming devices.

Section 3 Combustion Equipment Suitable for Use in Hazardous Areas

8.3.1 Diesel engines

Diesel engines are not to be installed in hazardous areas Zone 1. However, they may be installed in hazardous areas Zone 2 provided that the following means are provided:

(1) exhaust pipes are cooled by water to a surface temperature lower than 200℃, or lower than 80% of the self-ignition point of flammable gases that may exist in the areas where the pipes are located;

(2) the surface temperature of the engine body under overload is lower than 200℃ or lower than 80% of the self-ignition point of flammable gases that may exist in the area where the engine is located;

(3) no indicator valve is to be permitted to fit on cylinder head;

(4) exhaust outlet is fitted with flame arrester;

(5) where an electrical starting system is used, the electrical equipment and cables are to be of a certified explosion-proof type.

8.3.2 Protected fired pressure vessels

Heater exchangers heated directly by fire and used in processing crude oil, if provided with the following means, may be used in hazardous areas Zone 2:

(1) surface temperatures of equipment and stacks are lower than 200℃, or lower than 80% of the self-ignition point of flammable gases that may exist in the areas where the stacks are located;

(2) stacks are fitted with flame arresters;

(3) means are to be provided to keep combustion within the closed combustion chamber and prevent flames from reaching outside the chamber;

(4) precautions are to be taken against deflagration during ignition.

CHAPTER 9 DETENTION OF FLAMMABLE GASES AND HYDROGEN SULFIDE GAS

Section 1 FIXED DETECTION AND ALARM SYSTEMS

9.1.1 Objective

The objective specified in this Chapter is to detect flammable gases and hydrogen sulfide gas, and give warning and alarms for dangerous concentration.

9.1.2 Functional requirements

To achieve the objective specified in this Chapter, the detection system is to have the following functions:

(1) A fixed gas detection system is to be capable of continuous and automatic monitoring of the leakage of flammable gases and hydrogen sulfide gas.

(2) The set value of warning of the concentration is not to be higher than 25% of the lower explosive limit of flammable gas. Set value for high-concentration alarms is not to be higher than 60% of the lower explosive limit of flammable gas. High-concentration alarm is to becapable of sending audio and visual signals to indicate the danger and shut off any source of oil gas leakage and any source liable to cause an explosion.

(3) In spaces fitted with hydrogen sulfide detectors, low-concentration alarms are to begiven respectively at a concentration of 10 ppm, and high-concentration alarms are given at a concentration not more than 300 ppm. In case of high-concentration alarms, the warning to escape from the unit is to be sent out.

(4) In case the hydrogen sulfide gas alarm in main control station does not receive any respond in 2 minutes, the toxic (hydrogen sulfide gas) alarm and helicopter deck status lights will automatically be started.

(5) Detectors are to be connected with the audio and visual alarm system fitted with indicators in the main control room. The system is to clearly indicate the position of flammable gas and hydrogen sulfide gas.

(6) The system is to be capable of automatically monitoring circuit failures.

(7) The system is to be designed to withstand normal voltage changes and instant fluctuations, ambient temperature changes, vibration, dampness, shocks, impacts and corrosion.

(8) No less than 2 sets of power supply shall be used for flammable gas and hydrogen sulfide gas detection and alarm system, of which 1 set shall be emergency power supply.

9.1.3 Control and indication

9.1.3.1 The main control station is to be provided with audible and visual alarms to indicate the location of abnormal accumulation of flammable gases and hydrogen sulfide gas. Such stations are to be so manned and equipped that any alarm given by the system will be received by the watch-keeper(s).

9.1.3.2 Diagrams or texts are to be displayed at each indicating device of the system showing the spaces covered, and suitable instructions for testing and maintenance are to be available.

9.1.4 Arrangement of feeders

9.1.4.1 The power is to be supplied by separate feeders reserved solely for that purpose and connected to an automatic change-over switch on the console at or adjacent to the detection system. The feeders are to be so arranged as to avoid enclosed spaces of high fire risk except in so far as it is necessary for detection in the space or for connection to appropriate switchboards.

9.1.4.2 Detectors and cables passing through hazardous areas are to be of an approved

explosion-proof type and suitable for use in the hazardous zones where they are installed.

9.1.5 Provision and fitting of detectors

9.1.5.1 Flammable gas detectors are to be provided for the following spaces and areas:

(1) enclosed spaces classified as hazardous areas Zone 1 or 2 and their discharge outlets;

(2) ventilation inlets of enclosed non-hazardous spaces adjacent to hazardous areas;

(3) within enclosures of combustion equipment fuelled by natural gas or crude oil;

(4) ventilation ducts in which natural gas or crude oil fuel pipes are installed; (5) air intakes of the living quarter specified in 4.2.1.4 of Chapter4 of PART FOUR;

(6) locations deemed by CCS as necessary for special monitoring.

9.1.5.2 Sulfide hydrogen gas detectors are to be provided for the following spaces and areas:

(1) cellar deck, drilling fluid processing areas and oil and gas well testing areas;

(2) wellhead area, possible sulfide hydrogen leakage points in the production system and oil, gas and water processing system and storage installations.

(3) air intakes of the living quarter specified in 4.2.1.4 of Chapter 4 of PART FOUR.

9.1.5.3 The number of gas detectors to be fitted in each space is to be determined according to the size of the space and possible leakage sources, but not less than two.

9.1.5.4 The gas detectors are to be so arranged that any gas leakage will be detected as early as possible, having regard to characteristic specific gravity of the gas to be detected, location of any possible leakage source, geometry of the space, and airflow direction.

Section 2 PORTABLE GAS DETECTORS

9.2.1 Technical requirements

9.2.1.1 Portable detectors shall comply with the IMO Guidelines for Facilitating the Selection of Portable Air Detecting Instruments in Enclosures as required by SOLAS XI-I/7 (MSC.1/Circ.1477), be capable of measuring the concentrations of oxygen, combustible gases or vapors, hydrogen sulfide and carbon monoxide at least before entering the enclosure, and shall be readily available. Access to closed places on the unit shall comply with IMO's Revised Recommendations for Access to Closed Places on Ships (A.1050 (27)).

9.2.1.2 For units provided with inert gas systems, the flammable gas detectors are to be capable of not only measuring the concentration of flammable gases in the atmosphere, but also in the inerted atmosphere.

9.2.1.3 Such instruments shall be additional to those equipped by unit firefighters.

9.2.2 Provision of detectors

At least two portable flammable gas detectors are to be provided for each unit where flammable gas leakage may exist, and at least two sulfide hydrogen gas detectors are to be provided for each unit where sulfide hydrogen gas leakage may exist.

Section 3 HYDROGEN SULFIDE PROTECTIVE BREATHING APPARATUS

Hydrogen sulfide protective breathing apparatuses are to comply with the relevant requirements of Chapter 12 of this part.

CHAPTER 10 INERT GAS SYSTEMS

Section 1 GENERAL PROVISIONS

10.1.1 Application

The crude oil tanks which contribute to the overall structural strength of the unit are to be protected by inert gas. Oil storage tank of an independent structure on the open deck may not be protected by inert gas.

10.1.2 Objective

The objective specified in this Chapter is to inert the crude oil tank to prevent explosions.

10.1.3 Functional requirements

To achieve the objective specified in this Chapter, the system is to be capable of:

(1) inerting protected tanks by reducing the oxygen content of the atmosphere in each tank to a level at which combustion cannot be supported;

(2) maintaining the atmosphere in any part of any protected tank with an oxygen content not exceeding 8% by volume and at a positive pressure at all times in service;

(3) eliminating the need for air to enter a tank during normal operations;

(4) purging empty oil tanks of a hydrocarbon gas, so that subsequent gas-freeing operations will at no time create a flammable atmosphere within the tank.

10.1.4 Supply of inert gas

10.1.4.1 The inert gas supply may be treated flue gas or nitrogen or any other gas meeting an equivalent standard of safety. The flue gas may be discharged from the combustion equipment or generated by a dedicated installation. Systems using stored carbon dioxide are not to be permitted unless CCS is satisfied that the risk of ignition from generation of static electricity by the system itself is reduced to an acceptable level.

10.1.4.2 The system is to be capable of delivering inert gas to the protected tanks at a rate of at least 125% of the maximum rate of discharge capacity of the unit expressed as a volume.

10.1.4.3 The oxygen content in the inert gas supply main is to be not more than 5% by volume.

10.1.5 Arrangement of equipment

10.1.5.1 Inert gas generators, scrubbers, blowers and gas regulation valves are to be installed in non-hazardous areas.

10.1.5.2 Non-return devices of the inert gas supply main are to be fitted in hazardous areas.

10.1.6 Testing

10.1.6.1 Pressure piping of inert gas are to be subject to hydraulic tests under a pressure 1.5 times the design pressure in workshop and after installation on board, to a tightness test under a pressure 1.25 times the design pressure.

10.1.6.2 After completion of installation, the inert gas system including alarm and safety devices are to be tested under operating conditions.

10.1.7 Operations

Instruction manuals are to be provided on board, covering maintenance, safety and operations of the system, and operators are to be qualified.

Section 2 FUEL GAS GENERATOR SYSTEMS

10.2.1 Prevention of flue gas leakage

10.2.1.1 Scrubber and blowers with relevant piping and fittings are to be designed and arranged to prevent flue gas leakages into enclosed spaces.

10.2.1.2 To permit safe maintenance, an additional water seal or other effective means of preventing flue gas leakage is to be fitted between the flue gas isolating valves and scrubber or incorporated in the gas entry to the scrubber.

10.2.2 Flue gas isolating valves

Flue gas isolating valve are to be fitted in the inert gas supply mains between the boiler uptakes and the flue gas scrubbers. These valves are to be provided with indicators to show whether they are open or shut and interlocked with boiler soot blowers or provided with other effective means to ensure that boiler soot blowers cannot be operated when the corresponding valve is open. In addition, blowing means are to be provided to maintain the valves gastight and keep the seatings clear of soot.

10.2.3 Fuel oil pumps

Oil-fired inert gas generators are to be fitted with two fuel oil pumps. It may be allowed only one fuel oil pump provided that sufficient spares for the fuel oil pump and its prime mover are carried on board.

10.2.4 Scrubbers

10.2.4.1 A flue gas scrubber is to be fitted which will effectively cool the gas and remove solids and sulphur combustion products.

10.2.4.2 Filters or equivalent devices are to be fitted to minimize the amount of water carried over to the inert gas blowers.

10.2.5 Blowers

10.2.5.1 At least two inert gas blowers are to be fitted and they are to comply with 10.1.3.2 of this Chapter when operated simultaneously.

10.2.5.2 The inert gas system is to be so designed that the maximum pressure which it can exert on any protected tank will not exceed the test pressure of that tank.

10.2.5.3 Suitable shutoff arrangements are to be provided on the suction and discharge connections of each blower.

10.2.5.4 Arrangements are to be provided to enable gas-freeing of protected tanks with fresh air. If the blowers are to be used for gas-freeing, their air inlets are to be provided with blanking arrangements.

10.2.6 Cooling water

10.2.6.1 The cooling water arrangements for the scrubber is to be such that an adequate water supply will always be available without interfering with any other services on the unit. In addition to the main pump, provision is also to be made for an alternative supply of cooling water.

10.2.7 Inert gas regulation valves

10.2.7.1 An automatically controlled gas regulating valve is to be fitted in the inert gas supply main. This valve is to be capable of being automatically closed in one of the following cases:

(1) the pressure or flow rate of cooling water supplied to the scrubber is reduced to a predetermined limit;

(2) the water level in the scrubber is increased to a predetermined limit;

(3) the temperature of inert gas is increased to a predetermined limit;

(4) an inert gas blower fails.

10.2.7.2 This valve is also to be capable of automatically regulating the flow of inert gas to the protected tanks unless means are provided to automatically control the speed of the inert gas blowers.

10.2.8 Non-return devices

10.2.8.1 At least two non-return devices, one of which is to be a water seal, are to be fitted in the inert gas supply main between the gas regulation valve and the aftermost connection to any protected tank, in order to prevent the return of hydrocarbon vapor to any gas-safe spaces. The water seals are to be fitted in hazardous areas.

10.2.8.2 The deck water seal is to be capable of being supplied by two separate pumps, each of which is to be capable of maintaining an adequate supply at all times. The arrangement of the seal and its associated fittings are to be such that it will prevent backflow of hydrocarbon vapors and will ensure the proper functioning of the seal under operating conditions.

10.2.8.3 Provision is to be made to ensure that the water seal is protected against freezing, in such a way that the integrity of seal is not impaired by overheating.

10.2.8.4 A water loop or other approved arrangement is to be fitted to each associated water supply and drain pipe and each venting or pressure-sensing pipe leading to gas-safe spaces. Means are to be provided to prevent such loops from being emptied by vacuum.

10.2.8.5 The deck water seal and loop arrangements are to be capable of preventing return of hydrocarbon vapors at a pressure equal to the test pressure of the protected tanks.

10.2.8.6 The second non-return device referred to in 10.2.8.1 above is to be a non-return valve or equivalent capable of preventing the return of hydrocarbon vapors or liquids and fitted between the deck water seal and the protected tanks. It is to be provided with positive means of closure. As an alternative to positive means of closure, an additional valve having such means of closure may be provided forward of the non-return valve to isolate the deck water seal from the inert gas main to the protected tanks.

10.2.8.7 As an additional safeguard against the possible leakage of hydrocarbon vapors or liquids back from the deck main, means are to be provided to permit this section of the line between the valve having positive means of closure and the gas regulation valve to be vented in a safe manner when the valve having positive means of closure referred to in 10.2.8.6 above is closed.

10.2.9 Inert gas lines

10.2.9.1 The inert gas main may be divided into two or more branches forward of the non-return devices referred to in 10.2.8.1 above.

10.2.9.2 The inert gas supply main is to be fitted with branch piping leading to each protected tank. Branch piping for inert gas is to be fitted with either stop valves or equivalent means of control for isolating each tank when necessary. Where stop valves are fitted, they are to be provided with locking arrangements.

10.2.9.3 Means are to be provided to protect tanks against the effect of overpressure or vacuum caused by thermal variations when the tanks are isolated from the inert gas mains.

10.2.9.4 Piping systems are to be so designed as to prevent the accumulation of liquids in the piping under all normal conditions.

10.2.9.5 Arrangements are to be provided to enable the inert gas main to be connected to an external supply of inert gas.

10.2.9.6 One or more means of protection against pressure/vacuum are to be provided to prevent the protected tanks from being subjected to a positive pressure higher than the test pressure of the tanks or a negative pressure below a water jet of 700 mm. Such means are to be fitted in the inert gas supply main.

10.2.9.7 Circulating piping or equivalent is to be provided in the system to enable the functioning

of the inert gas plant to be stabilized before commencing oil discharge.

10.2.9.8 If a connection is fitted between the inert gas supply main and the crude oil piping system, arrangements are to be made to ensure an effective isolation having regard to the large pressure difference which may exist between the systems. This is to consist of two shutoff valves with an arrangement to vent the space between the valves in a safe manner or an arrangement consisting of s spool piece with associated blanks.

10.2.9.9 The valve separating the inert gas supply main from the crude oil main and which is on the crude oil main side is to be a non-return valve with a positive means of closure.

10.2.10 Inerting, purging and gas-freeing of empty tanks

10.2.10.1 For empty crude oil tanks and other tanks requiring inerting, gas purging and degassing, the inerting and purging device shall minimize the accumulation of hydrocarbon gas formed in the inner space of the purged tank. The tank shall be equipped with an exhaust pipe for inerting and purging empty cabin. The inlet of the exhaust pipe may be located at a height level with the deck or not higher than 1m above the bottom of the tank, and its outlet height shall not be less than 6m. These outlets shall be equipped with appropriate devices to prevent flame from passing through.

10.2.10.2 The cross-sectional area of such gas outlet pipes is to be such that an exit velocity of at least 20 m/s can be maintained when any three tanks are being simultaneously supplied with inert gas.

10.2.10.3 The gas outlet pipes are to be positioned as far as practicable from the inert gas/air inlet, and each gas outlet is to be fitted with suitable blanking arrangements.

10.2.10.4 For the tanks required to be gas-freed, such operations may be carried out only after such tanks are purged to reduce the concentration of hydrocarbon gas in them to below 2% by volume.

10.2.11 Instrumentation and alarms

10.2.11.1 The main control station and other locations continuously attended by watch-keepers are to be provided with the following instruments for monitoring the condition of inert gas:

(1) means for continuously indicating the temperature and pressure of the inert gas at the discharge side of the gas blowers;

(2) sensors for indicating and recording the pressure of the inert gas supply mains, fitted in the mains between the non-return valve and the protected tank;

(3) means for indicating and recording the oxygen content of the inert gas in the inert gas supply mains on the discharge side of the gas blowers.

10.2.11.2 The following devices are to be provided at the inert gas generator:

(1) means for continuously indicating pressure as required by 10.2.11.1(2) above;

(2) means for indicating the oxygen content of the inert gas in the inert gas supply mains on the discharge side of the gas blowers.

10.2.11.3 Portable instruments for measuring oxygen and flammable vapor concentration are to be provided. In addition, suitable arrangement is to be made on each protected tank such that the condition of the tank atmosphere can be determined using these portable instruments.

10.2.11.4 Suitable means are to be provided for the zero and span calibration of both fixed and portable gas concentration measurement instruments, referred to in 10.2.11.1, 10.2.11.2 and 10.2.11.3.

10.2.11.5 Inert gas systems are to be provided with audible and visual alarms and automatic shut-down devices as indicated in Table 10.2.11.5 (1). For the provision of alarms and safeguards for unattended inert gas generators, see Table 10.2.11.5 (2).

Audible and Visual Alarms and Automatic Shutdown Table 10.2.11.5 (1)

No.	Item	Alarm actuated	Relevant requirements
1	Oxygen content of inert gas	Excessive (8% by volume)	Inert gas quality to be immediately improved, otherwise operations of crude oil tanks ceased and isolation valves shut off
2	Temperature of inert gas	High	Gas blowers to be stopped and gas regulation valve shut off automatically at a predetermined high temperature
3	Pressure of inert gas	Low (1 kPa)	Oil pumping from tanks to be stopped
		High	——
4	Pressure or flow rate of water supplied to scrubber	Low	Gas blowers to be stopped and gas regulation valve shut off automatically at a predetermined value
5	Water level in scrubber	High	Gas blowers to be stopped and gas regulation valve shut off automatically at a predetermined value
6	Water level in deck water seal	Low	Alarms to be in working condition while inert gas is not supplied
7	Inert gas blower	Failure	Gas regulation valve to be shut off automatically
8	Power supply to automatic control system of gas regulation valve and indication means	Failure	——

Alarm and Protection of Unattended Inert Gas Generator Table 10.2.11.5 (2)

No.	Item	Alarm actuated	Remarks
1	Temperature of inert gas outlet	High	Automatically shutting down the fuel oil
2	Combustion air pressure	Low	Automatically shutting down the fuel oil
3	Fuel pressure	Low	——
4	Fuel temperature or viscosity	Low and high	Only applicable to heavy oil
5	Flare and ignition	Failure	Automatically shutting down the fuel oil
6	Cooling water pressure or flow rate	Low	Automatically shutting down the fuel oil
7	Cooling water temperature	High	——
8	Fuel oil supply	Insufficient	——
9	Power supply	Failure	Automatically closing the inert gas regulation valve
10	Automatic control power supply	Failure	——

10.2.11.6 For inert gas systems of oil-fired inert gas generator type, in addition to complying with Table 10.2.11.5 below, alarms are to be provided to indicate:

(1) insufficient fuel oil supply;

(2) failure of the power supply to the generator; and

(3) failure of the power supply to the automatic control system for the generator.

10.2.11.7 The alarms required for excessive oxygen content and under pressure of inert gas and for failure of the power supply to the automatic control system of the gas regulation valve and indication means are to be fitted at the main control station, but in each case in such a position that they are immediately received by responsible members of the crew.

10.2.11.8 An audible alarm system independent of the inert gas alarms listed in Item 3 of Table 10.2.11.5(1) or automatic shutdown of crude oil pumps are to be provided to operate on predetermined limits of low pressure in the inert gas main being reached.

Section 3 NITROGEN GENERATOR SYSTEMS

10.3.1 General requirements

10.3.1.1 The requirements of this Section are specific only to the nitrogen generator system and apply where nitrogen is produced by separating air into its component gases by passing compressed air through a bundle of hollow fibres, semi-permeable membranes or adsorber materials.

10.3.1.2 The appropriate requirements of 10.2.7, 10.2.9, 10.2.10 and 10.2.11 of Section 2 of this Chapter or equivalent requirements of IMO Resolution A.567(14) remain applicable for the piping arrangements, alarms and instrumentation downstream of the gas generator.

10.3.1.3 A nitrogen generator system consists of a feed air treatment system and any number of membrane or adsorber modules in parallel necessary to meet the required capacity.

10.3.1.4 The air compressor and the nitrogen generator may be installed in a separate compartment. A separate compartment is to be treated as one of "other machinery spaces" with respect to fire protection, as defined in 5.2.2.2 (7) of Chapter 5 of this part.

10.3.1.5 A separate compartment referred to in 10.3.1.4 above is to be fitted with an independent mechanical extraction ventilation system providing 6 air changes per hour. A low oxygen alarm is to be fitted as well. The compartment is to have no direct access to accommodation spaces, service spaces and control stations.

10.3.1.6 The nitrogen generator is to be capable of delivering high purity nitrogen with O_2 content not exceeding 5% by volume. The system is to be fitted with automatic means to discharge "off-spec" gas to the atmosphere during start-up and abnormal operation.

10.3.2 Air compressors

The system is to be provided with two air compressors. The total required capacity of the system is preferably to be divided equally between the two compressors, and in no case is one compressor to have a capacity less than 1/3 of the total capacity required. Only one air compressor may be accepted provided that sufficient spares for the air compressor and its prime mover are carried on board to enable their failure to be rectified by the unit's crew.

10.3.3 Feed air treatment system

A feed air treatment system is to be fitted to remove free water, particles and traces of oil from the compressed air, and to preserve the specification temperature.

10.3.4 Nitrogen receiver/buffer

10.3.4.1 Where fitted, a nitrogen receiver/buffer tank may be installed in a dedicated compartment or in the separate compartment containing the air compressor and the generator. Where the nitrogen receiver/buffer tank is installed in an enclosed space, the access is to be arranged only from the open deck and the access door is to open outwards. Permanent ventilation and alarm are to be fitted as required in 10.3.1.5 of this Section.

10.3.4.2 The oxygen-enriched air from the nitrogen generator and the nitrogen-product enriched gas from the protective devices of the nitrogen receiver are to be discharged to a safe location on the open deck. The safe locations for these two types of discharge need to be determined respectively:

(1) The safe location to which the oxygen-enriched air from the nitrogen generator is to be discharged refers to:

① locations outside the hazardous areas;

② locations not within 3m radius of personnel activity areas;

③ locations not within 6m radius of air inlets of machinery spaces (engines and boilers) and all ventilation inlets.

(2) The safe location to which the nitrogen-product enriched gas from the protective devices of the

nitrogen receiver is to be discharged refers to the locations specified in (1)② and (1)③ of this subsection.10.3.4.3 In order to permit maintenance, means of isolation are to be fitted between the generator and the receiver.

10.3.5 Non-return devices

The following two non-return devices are to be fitted in the nitrogen supply main

(1) Double block and bleed arrangement consisting of two shut-off valves in series with a venting valve in-between. The following conditions apply:

The operation of the valve is to be automatically executed. Signal(s) for opening/closing is (are) to be taken from the process directly, e.g. gas flowor differential pressure. Alarm for faulty operation of the valves is to be provided;

(2) A non-return device equipped with positive means of closure.

10.3.6 Alarm and instruments

10.3.6.1 Instrumentation is to be provided for continuously indicating the temperature and pressure of air:

(1) at the discharge side of the compressor;

(2) at the entrance side of the nitrogen generator.

10.3.6.2 Instrumentation is to be fitted for continuously indicating and permanently recording the oxygen content of the inert gas downstream of the nitrogen generator when inert gas is being supplied. Such Instrumentation is to be fitted at the main control station.

10.3.6.3 Audible and visual alarms are to be provided to indicate:

(1) low feed-air pressure from compressor as referred to in 10.3.6.1(1) of this Section;

(2) high air temperature as referred to in 10.3.6.1(1) of this Section;

(3) high condensate level at automatic drain of water separator as referred to in 10.3.3 of this Section;

(4) failure of electrical heater, if fitted;

(5) oxygen content in excess of that required in 10.3.1.6 of this Section;

(6) failure of power supply to the instrumentation as referred to in 10.3.6.2 of this Section.

10.3.6.4 Automatic shutdown of the system is to be arranged upon alarm conditions as required in 10.3.6.3(1) to (5) of this Section.

10.3.6.5 The alarms required in 10.3.6.3(1) to (6) of this Section, where provided, are to be fitted in the main control station or other manned spaces.

CHAPTER 11 EMERGENCY SHUTDOWN

Section 1 GENERAL PROVISIONS

11.1.1 Application

For the purpose of this Chapter, emergency shutdown means:

(1) In a fire, shut down the facilities that continue to provide fuel for the fire and close the fans and enclosure openings that continue to provide combustion improvers for the fire;

(2) in the event of blowout, manually shutting down the blowout preventer and selectively shutting down the mechanical and electrical equipment that are not explosion-proof and ventilation facilities;

(3) manually and selectively shutting down processing stations of the production system including subsea pipelines and stop all production operations in the event of abnormal leakage in the production system;

(4) in case of fire in the space where the production system is located, the fusible-plug loop automatically shutting down the production system;

(5) shutting down the inlets and outlets of oil storage tanks on the oil storage units;

(6) manually actuating shutdown of the whole unit when abandoning it.

11.1.2 Objective

The objective specified in this Chapter is to reduce the excessive leakage of oil gas and prevent the escalation of fires.

11.1.3 Functional requirements

To achieve the objectives specified in this Chapter, the emergency shutdown system is to have the following functions:

(1) in the event of fire, manually shutting down any facilities supplying fuel to the fire (e.g. oil lines, flammable gas lines, inlets and outlets of oil tanks, oil pumps and flammable gas compressors) and closing any fans and enclosed openings contributing to the fire;

(2) diverter and blowout preventer are fitted on the drilling unit, and the mechanical and electrical equipment that are not explosion-proof and ventilation facilities can be selectively shut down;

(3) On the production unit, means are provided to shut down the production system;

(4) For each unit, all equipment and systems on the unit can be turned off when the unit is abandoned, except the equipment specified in 11.2.2.2 of this Section.

Section 2 REQUIREMENTS FOR ARRANGEMENT OF EMERGENCY SHUTDOWN

11.2.1 General requirements for units of various types

11.2.1.1 Shutdown of oil supply

(1) Every oil fuel suction pipe from a storage, settling or daily service tank above the double bottom is to be fitted with a cock or valve, which is to be capable of being shut down from outside of the space where the tank is situated in case of fire in such space. In the special case of deep tanks situated in any shaft or pipe tunnel, valves are to be fitted on such tanks, but control in the event of fire may be executed by means of additional valves fitted on pipes or lines outside the tunnel.

(2) Fuel oil transfer pumps, oil fuel pumps and other similar fuel pumps are to be fitted with a remote control outside the spaces where the pumps are situated, so that they may be shut down in

the event of fire in such spaces.

11.2.1.2 Shutdown of ventilation

(1) Facilities are to be fitted to stop the ventilation fans in accommodation spaces, service spaces, control stations, machinery spaces and operation spaces, and to close all the doorways to these spaces, the ventilators, funnel spaces and other openings. In the event of fire, the facilities can be controlled from outside of these spaces.

(2) Machinery spaces, gallery, main control room (central control station) or hazardous areas are to be fitted with independent power ventilation shutdown devices.

11.2.1.3 Shutdown of the whole unit

The whole unit is to be capable of being shut down from:

(1) survival craft embarkation stations;

(2) helicopter deck;

(3) emergency evacuation position;

(4) main control station;

(5) bridge gangway between platforms (if fitted);

(6) other locations deemed necessary.

11.2.2 Additional requirements for drilling units

11.2.2.1 For emergency conditions due to drilling operations, in view of exceptional conditions in which the explosion hazard may extend outside the areas normally classified as hazardous, special arrangements are to be provided to facilitate the selective disconnection or shutdown of:

(1) ventilation systems, except fans necessary for supplying combustion air to prime movers for the production of electrical power;

(2) main generators prime movers, including their ventilation systems;

(3) emergency generator prime movers;

(4) all electrical equipment outside Zone 1 areas, except where of a certified safe type for Zone 1 applications;

(5) any emergency equipment other than that referred to in 11.2.2.2.

Disconnection or shutdown is to be possible from at least two locations, one of which is to be close to the drilling control room and the other is to be manned outside hazardous area.

11.2.2.2 At least the following facilities are to be operable after an emergency shutdown:

(1) emergency lighting in alleyways, stairways, exits and personnel lift cars within accommodation spaces for half an hour;

(2) emergency lighting for all control stations or control positions in machinery spaces for half an hour;

(3) emergency lighting for survival craft embarkation stations for half an hour;

(4) blow-out preventer control system;

(5) general alarm system;

(6) public address system;

(7) battery-supplied radio communication installations.

11.2.2.3 Equipment which is located in spaces other than enclosed spaces and arranged to be operated after complete shutdown is to be suitable for installation in Zone 2 locations.

11.2.2.4 Where a dynamic positioning system is used on the unit, the disconnection or shutdown

of machinery and equipment necessary to maintain the operability of the dynamic positioning system shall be based on the shutdown logic system to maintain operational control over the integrity and position retention capability of the oil (gas) well. The shutdown of generators and associated power supply equipment required for the operation of the dynamic positioning system shall be divided into separate groups to respond to gas detection alarms while maintaining the same position.

11.2.3 Additional requirements for production units

11.2.3.1 Emergency shutdown systems are to be provided to shut down the well and processing stations of oil, gas and water processing systems including subsea pipelines and stop all production operations.

11.2.3.2 The emergency shutdown system may be divided into separate subsystems and when necessary, the electrical power plant and fire safety system are to be operable after an emergency shutdown.

11.2.3.3 Fusible plugs of the fire detection loop may be integrated into the control loop for emergency shutdown.

11.2.4 Additional requirements for oil storage units

Oil storage units are to be provided with an emergency shutdown system for crude oil inlet and outlet.

Section 3 TECHNICAL REQUIREMENTS FOR EMERGENCY SHUTDOWN

11.3.1 General requirements

11.3.1.1 The emergency shutdown is to be so designed that the inadvertent shutdown due to incorrect operation or failure is minimized.

11.3.1.2 The emergency shutdown systems are to be arranged according to the fail-safe principle. The assessment of characteristics of fail-safe operations is to be based on the complete installation, not merely on the emergency shutdown systems and associated machinery and process.

11.3.1.3 The emergency shutdown is to be carried out according to a predefined logic. The defined logic and response time is to take the interaction between systems and dynamic effects into account.

11.3.1.4 The shutdown logic is to respond according to different levels of emergency and the logic is to be simple as far as practicable.

11.3.1.5 The emergency shutdown of oil production system is not to lead to unfavorable interlocking effects. The processing station (facility) may be maintained in a safe condition by means of other protective systems. The shutdown system is to be such that any ongoing operation will be safely ended upon initiated shutdown.

11.3.1.6 The shutdown at a higher level is to automatically cover the shutdown at lower level(s).

11.3.1.7 Emergency shutdown valves are to be of heat-resisting and corrosion-proof material.

11.3.2 Operation of emergency shutdown systems

11.3.2.1 The emergency shutdown systems are to be manually operated. Alternatively, they may be automatically actuated for the fusible plug loop in the fire detection system where malfunction will not occur. Each manually operated button is to be provided with means against malfunction.

11.3.2.2 Each shutdown station is capable of indicating the shutdown function, and the shutdown position.

11.3.2.3 The emergency shutdown systems are to be provided with manual resetting.

11.3.2.4 The override of emergency shutdown systems, if fitted, is to prevent incorrect operation. The overriding actions are to be visually indicated at the main control station.

11.3.3 Power sources and alarms

11.3.3.1 The cables of emergency shutdown systems are to be selected according to the relevant requirements of Chapter 2 of PART FIVE of the Rules and run as far away from all dangerous sources as practicable.

11.3.3.2 The emergency shutdown systems are to be provided with means for automatically changing over to a reserve power source in the event of failure of the main source.

11.3.3.3 Any fault in the power source of emergency shutdown systems is to initiate an audible and visual alarm.

11.3.3.4 The batteries for pneumatic and hydraulic systems are to have sufficient capacity so that no recharging will be needed during sequential shutdown.

CHAPTER 12 ESCAPE

Section 1 GENERAL PROVISIONS

12.1.1 General requirements

12.1.1.1 The requirements of this Chapter are aimed at quick evacuation of the unit's personnel in the event of uncontrollable gas leakage, blowout or fire.

12.1.1.2 The radio communication installations and lifesaving appliances used by the unit's personnel during escape are to comply with the statutory requirements of the Administration under whose jurisdiction the unit is operating.

12.1.1.3 The unit is to be provided with the emergency operation procedures required by the Administration.

12.1.1.4 For accommodation units, where there are a large number of persons living thereon, it is recommended that the suitability of the means of escape be assessed by an evacuation analysis.

Section 2 NOTIFICATION OF EVACUATION

12.2.1 General emergency alarm system

The unit is to be provided with a general emergency alarm system as specified in Section 3, Chapter 3 of PART FIVE of the Rules for summoning of the personnel to muster stations for evacuation.

Section 3 MEANS OF ESCAPE

12.3.1 Principles of arrangement

12.3.1.1 Two widely separated and safe escape routes clear of obstacles are to be provided from every manned space of the unit to an emergency muster station or another evacuation station. The escape routes are to be so designed that at least one route will be available in the event of a casualty in any location. In general, the escape routes are to be arranged along both sides of the unit.

12.3.1.2 The means of escape for spaces not specified below are to be arranged according to the requirement of 12.3.1.1 above and it may exempt one of the means of escape, due regard of the size and nature of a space.

12.3.2 Machinery spaces below the weather deck

12.3.2.1 Means of escape are to be provided from each machinery space of category A in compliance with one of the following provisions:

(1) two sets of steel ladders, as widely separated as possible, leading to doors in the upper part of the space, similarly separated and from which access is provided to the weather deck. One of these ladders is to provide continuous fire shelter from the lower part of the space it serves to a safe position outside the space, and a self-closing fire door is to be fitted in the lower part of the space. The fire shelter and the areas adjacent to machinery spaces of category A are to be insulated to "A – 60" class standard. The fire shelter is to have minimum internal dimensions of at least 800 mm × 800 mm, and is to have emergency lighting provisions; or

(2) one steel ladder leading to a door in the upper part of the space from which access is provided to the weather deck and, additionally, in the lower part of the space and in a position well separated from the ladder referred to, a steel door capable of being operated from each side and which provides access to a safe escape route from the lower part of the space to the weather deck.

12.3.2.2 From machinery spaces other than those of category A, two escape routes are to be provided except that a single escape route may be accepted for spaces that are entered only

occasionally and for spaces where the maximum travel distance to the door is 5 m or less.

12.3.3 Enclosed living quarter area

12.3.3.1 Two escape routes lead to the weather deck and an evacuation station, as widely separated as possible, are to be provided. 12.3.3.2 No dead-end corridors having a length of more than 7 m is to be accepted.

12.3.3.3 Electrical lifts are not to be used as the means of escape.

12.3.4 Control stations

The main control station, navigating bridge and radio room are to be provided with two exits.

12.3.5 Alleyways, stairways, straight ladders and doors

12.3.5.1 The surfaces underfoot and stair steps along the escape routes are to be slip-free, easily cleanable and not liable to have liquid trapped.

12.3.5.2 Where an escape route changes its direction horizontally, a stairway is to be used and straight ladders are generally not to be used.

12.3.5.3 Stairways are preferably to be inclined to 45°, but not over 50°. However, this limit may be relaxed to 60° in machinery spaces.

12.3.5.4 The doors along the escape routes are to be easily operable and open to the direction of escape. However, doors of cabins and small offices may open to any direction. In special cases, a door not open to the direction of escape may be granted provided that a clear instruction on the opening direction is provided on the door.

12.3.6 Dimensions of means of escape

The means of escape are to be suitably sized to facilitate quick and effective escape of persons concerned, the use of stretchers and the moving of fire-fighting appliances.

Section 4 MUSTER STATIONS

The unit is to be provided with an emergency muster station capable of accommodating the total number of persons on board. The muster station is to be located at a protected position near survival craft in their stowed positions.

Section 5 EMERGENCY LIGHTING, MARKINGS AND WARNING SIGNS

12.5.1 Emergency lighting

12.5.1.1 All spaces where persons work or rest are to be provided with emergency lighting for quick response in an emergency.

12.5.1.2 Escape routes, passageways and exits are to be provided with suitable emergency lighting.

12.5.1.3 Muster station, survival craft stations and helicopter embarkation station are to be provided with suitable emergency lighting.

12.5.1.4 The requirements for the emergency source of electrical power and emergency lighting are to be in compliance with relevant requirements of Section 2, Chapter 2 of PART FIVE of the Rules.

12.5.2 Markings and warning signs

12.5.2.1 Escape routes are to be marked clearly different from other passageways.

12.5.2.2 Sufficient warning signs indicating exit and direction of escape are to be displayed along escape routes.

12.5.2.3 The unit's name is to be marked clearly visible both on day and night on all sides to facilitate rescue by ship or helicopter.

Section 6 EMERGENCY ESCAPE BREATHING DEVICES

12.6.1 Technical requirements

Emergency escape breathing devices (EEBDs) is to comply with the requirements of the International Code for Fire Safety Systems. Spare emergency escape breathing apparatuses are to be kept on board.

12.6.2 Requirements for Provision

12.6.2.1 Emergency escape breathing devices are to be provided as follows:

(1) In machinery spaces of category A containing internal combustion engine used for main propulsion, EEBDs are to be positioned as follows:

① one EEBD in the engine control room, if located within the machinery space;

② one EEBD in workshop areas. If there is, however, a direct access to an escape way from the workshop, an EEBD is not required; and

③ one EEBD on each deck or platform level near the escape ladder constituting the second means of escape from the machinery space (the other means being an enclosed escape trunk or watertight door at the lower level of the space).

④ Alternatively, a different number or location may be determined by CCS taking into consideration the layout and dimensions or the normal manning of the space.

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

(3) For other machinery spaces, the number and location of EEBDs are to be determined on a case by case basis.

12.6.2.2 If a hydrogen sulfide protective breathing apparatus can meet the requirements for EEBD and both types of breathing apparatuses are required in the same space, provision of hydrogen sulfide protective breathing apparatus only may be allowed.

Section 7 HYDROGEN SULFIDE PROTECTIVE BREATHING APPARATUS

12.7.1 Requirements for Provision

12.7.1.1 The anti-hydrogen-sulfide breathing apparatuses on the drilling unitsMODUs and other similar units which may suffer hydrogen sulfide shall comply with the requirements of 12.7.1.2 or 12.7.1.3.

12.7.1.2 Each person working in the operational spaces onboard the unit that may be exposed to hydrogen sulfide gas is to be provided with a set of hydrogen sulfide protective breathing apparatus in compliance with the following requirements:

(1) the apparatus is to be of a positive-pressure self-contained type;

(2) the apparatus is to be with full-face piece;

(3) the apparatus's air supply is to be rated to a minimum of 30 min.

Each person in other areas is to be provided with a set of hydrogen sulfide protective breathing apparatus in compliance with the requirements of 12.7.1.2 (1) and (2), with an air supply rated to a minimum of 15 min.

12.7.1.3 Each person on the unit shall be equipped with the anti-hydrogen-sulfide breathing apparatus which shall meetare to comply with following requirements:

(1) the apparatus is to comply with the requirements of 12.7.1.2 (1) and (2);

(2) the apparatus is to be capable of being used in combination with the fixed breathing air system;

(3) the apparatus is to be fitted with air cylinder low-pressure alarming device;

(4) the apparatus's air supply is to be rated to a minimum of 15 min.

12.7.2 Arrangement of air station

The air supply stations for fixed breathing air system specified in 12.7.1.3(2) are to be located in the following sites:

(1) living quarter;

(2) evacuation/muster station;

(3) wellhead areas;

(4) mud processing areas;

(5) other working spaces.