RULES
FOR THE CLASSIFICATION AND CONSTRUCTION OF MOBILE OFFSHORE DRILLING UNITS

PART IV
MACHINERY INSTALLATIONS

July
2024

GDAŃSK

CONTENTS

.2
.3
.4
.5
.6 used
.7 -
.8
.9 oil units
.10
.11
.12
.13 unit
.14 unit . installations â
.15 installations â
.16
.17
.18
.19
.20 and
.21 unit

Rules.

1.6.2 Operation documentation and emergency procedures

1.6.2.1 be provided

1.6.2.2

1.6.2.3

1.6.2.4 The information provided in the operating manuals shall, where necessary, be supported by additional material provided in the form of plans, manufacturers' manuals and other data necessary for the efficient operation and maintenance of the unit. Detailed information provided in manufacturers' manuals need not be repeated in the operating manuals. The information shall be referenced in the operating manual, readily identified, located in an easily accessible place on the unit and be available at all times. (MODU Code, 14.1.5)

1.6.2.5 Operating and maintenance instructions and engineering drawings for machinery installations and equipment essential to the safe operation of the unit shall be written in a language understandable by those officers and crew members who are required to understand such information in the performance of their duties. (MODU Code, 14.1.6)

1.7 Scope of supervision

1.7.1 The general survey regulations for classification, construction supervision and surveys of units during service within the scope of machinery installations are given in *Part I – Classification Regulations*.

1.7.2 Machinery installations and equipment, the documentation of which is subject to consideration and approval, are subject to PRS supervision during construction or alteration of the unit.

1.7.3 Machinery and components of machinery installations, shall be delivered with PRS *Type Approval Certificate* or another certificate of a recognized institution allowing for use in marine conditions, for acceptance by PRS or Administration.

1.7.4 Pumps of machinery installations, combustion engines, boilers, steering gears, windlass, etc. are subject to acceptance and operation tests at the manufacturer's in the presence of PRS Surveyor.

1.7.5 Compressed gas cylinders and pressure vessels of machinery installations are subject to acceptance and pressure tests at the manufacturer's in the presence of PRS Surveyor.

1.8 Onboard acceptance and tests

After being installed on the unit, machinery installations are subject to acceptance and operation tests under PRS Surveyor supervision, according to an agreed acceptance and test program.

2 MACHINERY INSTALLATIONS FOR ALL TYPES OF UNITS

2.1 General*

* Refer to the *Guidelines for engine-room layout, design and arrangement (MSC/Circ.834).*

2.1.1 The requirements regarding machinery and electrical installations contained in this *Part IV* and *Part VI* (chapters 4 to 8 of *MODU Code*) provide protection for personnel from fire, electric shock or other physical injuries. The provisions apply to both marine and industrial machinery. (MODU Code, 4.1.1)

2.1.2 Codes and standards of practice which have been proven to be effective by actual application by the offshore drilling industry which are not in conflict with this *Part IV* (*MODU Code*), and which are acceptable to the Administration, may be applied in addition to these requirements. (MODU Code, 4.1.2)

2.1.3 All machinery, electrical equipment, boilers and other pressure vessels, associated piping systems, fittings and wiring shall be of a design and construction adequate for the intended service and shall be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design shall have regard to materials used in construction, and to the marine and industrial purposes for which the equipment is intended, the working conditions and the environmental conditions to which it will be subjected. Consideration shall be given to the consequences of the failure of systems and equipment essential to the safety of the unit. (MODU Code, 4.1.3)

2.1.4 All machinery, components and systems essential to the safe operation of a unit shall be designed to operate under the following static conditions of inclination:

.1 column-stabilized units – from upright to an angle of inclination of 15° in any direction;
.2 self-elevating units – from upright to an angle of inclination of 10° in any direction;
.3 surface units – from upright and in level trim to an angle of inclination of 15° either way and simultaneously trimmed up to 5° by the bow or stern.

The Administration may permit or require deviations from these angles, taking into consideration the type, size and service conditions of the unit. (MODU Code, 4.1.4) (IACS UR D9.1.3.1/Rev.4)

2.1.5 The requirements contained in this *Part IV* apply to the machinery essential for the safe operation of the unit. They do not apply to equipment and systems used solely for the drilling operation, except in so far as safety is concerned.

Systems and equipment that are used solely for drilling and that may affect the safety of the unit on which they are installed may be designed to the alternative requirements of recognized standards acceptable to PRS. (IACS UR D9.1.1/Rev.4)

2.1.6 On self-propelled and non-self-propelled units, all propulsion and auxiliary machinery, steering arrangements, pressure vessels, pumps and piping systems necessary for the safe operation of the unit are to be constructed and installed in accordance with the relevant requirements of this *Part IV* and other applicable requirements of PRS *Rules*. (IACS UR D9.1.2/Rev.4)

Unless expressly stated otherwise, for the purposes of this *Part IV,* the applicable requirements of the *Rules for the Classification and Construction of Sea-going Ships, Part VI - Ship and Machinery Piping Systems and Part VII – Main and Auxiliary Machinery and Equipment*, shall apply.

2.2 Alternative design and arrangements

When alternative design or arrangements deviate from the prescriptive requirements of this *Part IV* (the Code), an engineering analysis, evaluation and approval of the design and arrangements shall be carried out in accordance with *SOLAS* regulation II-1/55 based on the guidelines developed by IMO.* (MODU Code, 4.2)

* Refer to *Revised Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III (MSC.1/ Circ.1212/Rev.1).*

2.3 Machinery

2.3.1 All boilers, all parts of machinery, all steam, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time.

2.3.2 Adequate provisions and arrangements shall be made to facilitate safe access, cleaning, inspection and maintenance of machinery including boilers and pressure vessels.

2.3.3 Where risk from overspeeding of machinery exists, means shall be provided to ensure that the safe speed is not exceeded.

2.3.4 Where machinery including pressure vessels or any parts of such machinery are subject to internal pressure and may be subject to dangerous overpressure, means shall, where applicable, be provided which will protect against such excessive pressure.

2.3.5 All gearing, shafts and couplings used for transmission of power to machinery shall be designed and constructed so that they will withstand the maximum working stresses to which they may be subjected in all service conditions, taking into account the type of engines by which they are driven or of which they form part.

2.3.6 Internal combustion engines of a cylinder diameter of 200 mm or a crankcase volume of 0.6 m3 and above shall be provided with crankcase explosion relief valves of an approved type with sufficient relief area. The relief valves shall be arranged or provided with means to ensure that discharge from them is directed so as to minimize the possibility of injury to personnel.

2.3.7 Where applicable, machinery shall be provided with automatic shut-off arrangements or alarms in the case of failures, such as lubricating oil supply failure, which could lead rapidly to complete breakdown, damage or explosion. The Administration may permit provisions for overriding automatic shutoff devices.

2.3.8 Means shall be provided whereby normal operation of vital systems, such as ballast systems in semisubmersible units, jacking systems in self-elevating units and blow-out preventers, can be sustained or restored even though one of the essential auxiliaries becomes inoperable.

2.3.9 Means shall be provided to ensure that machinery can be brought into operation from the "dead ship condition" without external aid. (MODU Code, 4.3)

2.4 Steam boilers and boiler feed systems

2.4.1 Every steam boiler and every unfired steam generator shall be provided with not less than two safety valves of adequate capacity. However, the Administration may, having regard to the output or any other features of any boiler or unfired steam generator, permit only one safety valve to be fitted if it is satisfied that adequate protection against overpressure is provided.

2.4.2 Every oil-fired boiler which is intended to operate without manual supervision shall have safety arrangements which shut off the fuel supply and give an alarm at an attended location in the case of low water level, air supply failure or flame failure.

2.4.3 Every steam generating system which could be rendered dangerous by the failure of its feedwater supply shall be provided with not less than two separate feedwater systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. For those services not essential for the safety of the unit, only one feedwater system is required if automatic shutdown of the steam generating system upon loss of the feedwater supply is provided. Means shall be provided which will prevent overpressure in any part of the feedwater system.

2.4.4 Boilers shall be provided with means to supervise and control the quality of the feedwater. As far as practicable, means shall be provided to preclude the entry of oil or other contaminants which may adversely affect the boiler.

2.4.5 Every boiler essential for the safety of the unit and which is designed to have a water level shall be provided with at least two means for indicating its water level, at least one of which shall be a direct-reading gauge glass. (MODU Code, *4.4*)

2.5 Steam pipe systems

2.5.1 Every steam pipe and every fitting connected thereto through which steam may pass shall be so designed, constructed and installed as to withstand the maximum working stresses to which it may be subjected.

2.5.2 Efficient means shall be provided for draining every steam pipe where dangerous water hammer action might otherwise occur.

2.5.3 If a steam pipe or fitting may receive steam from any source at a pressure higher than that for which it is designed, a suitable reducing valve, relief valve and pressure gauge shall be fitted. (MODU Code, 4.5)

2.6 Machinery controls

2.6.1 Machinery essential for the safety of the unit shall be provided with effective means for its operation and control.

2.6.2 Automatic starting, operational and control systems for machinery essential for the safety of the unit shall, in general, include provisions for manually overriding the automatic controls. Failure of any part of the automatic and remote control system shall not prevent the use of the manual override. Visual indication shall be provided to show whether or not the override has been actuated. (MODU Code, 4.6)

2.7 Air pressure systems

2.7.1 In every unit means shall be provided to prevent excess pressure in any part of compressed air systems and where water jackets or casings of air compressors and coolers might be subjected to dangerous excess pressure due to leakage into them from air pressure parts. Suitable pressure-relief arrangements shall be provided for all systems.

2.7.2 The starting air arrangements for internal combustion engines shall be adequately protected against the effects of backfiring and internal explosions in the starting air pipes.

2.7.3 Starting air pipes from the air receivers to internal combustion engines shall be entirely separate from the compressor discharge pipe system.

2.7.4 Provision shall be made to reduce to a minimum the entry of oil into the starting air pressure systems and to drain these systems. (MODU Code, 4.7)

2.8 Arrangements for oil fuel, lubricating oil and other flammable oils

2.8.1 Arrangements for the storage, distribution and utilization of oil fuel shall be such as to ensure the safety of the unit and persons on board.

2.8.2 Arrangements for the storage, distribution and utilization of oil used in pressure lubrication systems shall be such as to ensure the safety of the unit and persons on board.

2.8.3 Arrangements for the storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heat transfer systems shall be such as to ensure the safety of the unit and persons on board.

2.8.4 In machinery spaces pipes, fittings and valves carrying flammable oils shall be of a material approved by the Administration, having regard to the risk of fire.

2.8.5 Location and arrangement of vent pipes for fuel oil service, settling and lubrication oil tanks shall be such that, in the event of a broken vent pipe, the risk of ingress of rainwater or seawater is minimized.

2.8.6 Two fuel oil service tanks for each type of fuel used on board necessary for propulsion and vital systems or equivalent arrangements shall be provided, each with a capacity of at least eight hours at the maximum continuous rating of the propulsion plant, if any, and normal operating load of the generator plant.

2.8.7 High pressure fuel delivery lines:

.1 all external high pressure fuel delivery lines between the high pressure fuel pumps and fuel injectors shall be protected with a jacketed piping system capable of containing fuel from a high pressure line failure. A jacketed pipe incorporates an outer pipe into which the high pressure fuel pipe is placed forming a permanent assembly. The jacketed piping system shall include a means for collection of leakages and arrangements shall be provided for an alarm to be given of a fuel line failure.

.2 all surfaces with temperatures above 220°C, which may be impinged as a result of a fuel system failure, shall be properly insulated.

.3 oil fuel lines shall be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages onto hot surfaces, into machinery air intakes, or other sources of ignition. The number of joints in such piping systems shall be kept to a minimum. (MODU Code, 4.8)

2.9 Bilge pumping arrangements

2.9.1 General requirements

2.9.1.1 An efficient bilge pumping system shall be provided, capable of pumping from and draining watertight compartments other than spaces permanently appropriated for the carriage of fresh water, water ballast, oil fuel or liquid cargo and for which other efficient means of pumping are provided, under all practical conditions whether the unit is upright or inclined, as specified in par. 2.1.4 (4.1.4 of the *Code*). Additional suctions shall be provided in large compartments or compartments of unusual form, as deemed necessary by the Administration. Arrangements shall be made whereby water in the compartment may find its way to the suction pipes. Compartments not provided with a bilge suction may be drained to other spaces provided with bilge pumping capability. Means shall be provided to detect the presence of water in such compartments which are adjacent to the sea or adjacent to tanks containing liquids and in void compartments through which pipes conveying liquids pass. If the Administration is satisfied that the safety of the unit is not impaired the bilge pumping arrangements and the means to detect the presence of water may be dispensed with in particular compartments.

In general, the bilge system shall be in accordance with PRS *Rules*. Compartments below deck containing essential equipment for operation and safety of the unit shall have a permanently installed bilge or drainage system. These compartments shall be drained with at least two bilge pumps, or equal. (IACS UR D9.6.1/Rev.4)

2.9.1.2 At least two self-priming power pumps connected to each bilge main shall be provided. Sanitary, ballast and general service pumps may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system. (IACS UR D9.6.1/Rev.4)

2.9.1.3 All bilge pipes shall be of steel or other suitable material having properties acceptable to the Administration. Special consideration shall be given to the design of bilge lines passing through ballast tanks taking into account effects of corrosion or other deterioration.

2.9.1.4 The arrangement of the bilge pumping system shall be such as to prevent the possibility of water passing from the sea into dry spaces, or inadvertently from one compartment to another.

2.9.1.5 All distribution boxes and manually operated valves in connection with the bilge pumping arrangements shall be in positions which are accessible under ordinary circumstances. Where such valves are located in normally unmanned spaces below the assigned load line and not provided with high bilge water level alarms, they shall be operable from outside the space. (IACS UR D9.6.1/Rev.4)

2.9.1.6 A means to indicate whether a valve is open or closed shall be provided at each location from which the valve can be controlled. The indicator shall rely on movement of the valve spindle.

2.9.1.7 Drainage of hazardous areas shall be given special consideration having regard to the risk of explosion (see par. 6.3.2 of MODU Code).

2.9.1.8 The following additional requirements are applicable to column-stabilized units:

.1 chain lockers which, if flooded, could substantially affect the unit's stability shall be provided with a remote means to detect flooding and a permanently installed means of dewatering. Remote indication of flooding shall be provided at the central ballast control station;

.2 at least one of the pumps referred to in par. 2.7.2 (4.9.2 of the Code) and pump-room bilge suction valves shall be capable of both remote and local operation; (IACS UR D9.6.9/Rev.4)

.3 propulsion rooms and pump-rooms in lower hulls shall be provided with two independent systems for high bilge water level detection providing an audible and visual alarm at the central ballast control station. (MODU Code, 4.9)

2.9.2 Size of bilge main

The cross-sectional area of the main bilge line is not to be less than the combined areas of the two largest branch suctions. (IACS UR D9.6.2/Rev.4)

2.9.3 Size of bilge branch suctions

The internal diameter of branch suctions from each compartment shall be not less than stipulated by the following formula, to the nearest 5 mm:

$$d = 2.15\,A + 25 \quad [\text{mm}]$$

where A is wetted surface in m^2 of the compartment, excluding stiffening members when the compartment is half filled with water. The internal diameter of any bilge line is not to be less than 50 mm. (IACS UR D9.6.3/Rev.4)

2.9.4 Size of Bilge Pumps

Each bilge pump is to be capable of giving a speed of water through the bilge main of not less than 2 m per second. When more than two pumps are connected to the bilge system, their aggregate capacity is not to be less effective. (IACS UR D9.6.4/Rev.4)

2.9.5 Chain Lockers

Chain lockers are to be capable of being drained by a permanently installed bilge or drainage system or by portable means. Means shall be provided for removal of mud and debris from the bilge or drainage system. (IACS UR D9.6.5/Rev.4)

2.9.6 Void Compartments

Void Compartments adjacent to the sea or to tanks containing liquids, and void compartments through which piping conveying liquids passes, are to be drained by permanently installed bilge or drainage systems or by portable means. If portable pumps are used, two are to be provided and both pumps and arrangements for pumping are to be readily accessible.

Void compartments as defined above which are not provided with bilge or drainage systems in compliance with the above shall be accounted for in the units stability analysis. (IACS UR D9.6.6/Rev.4)

2.9.7 Bilge alarm

Propulsion rooms or pump rooms in lower hulls of column stabilized units which normally are unattended shall be provided with two independent systems of high level detection. (IACS UR D9.6.7/Rev.4)

2.9.8 Bilge suctions from hazardous areas

Hazardous and non-hazardous areas shall be provided with separate drainage or pumping arrangements. (IACS UR D9.6.8/Rev.4)

2.10 Ballast pumping arrangements on column-stabilized units

Ballast pumps and piping

2.10.1 Units shall be provided with an efficient pumping system capable of ballasting and deballasting any ballast tank under normal operating and transit conditions. Alternatively, Administrations may permit controlled gravity ballasting.

Each ballast tank shall be capable of being pumped out by at least two power-driven pumps. (IACS UR D9.5.1/Rev.4)

2.10.2 The ballast system shall provide the capability to bring the unit, while in an intact condition, from the maximum normal operating draught to a severe storm draught, or to a greater distance, as may be specified by the Administration, within three hours.

2.10.3 The ballast system shall be arranged to provide at least two independent pumps so that the system remains operational in the event of failure of any one such pump. The pumps provided need not be dedicated ballast pumps, but shall be readily available for such use at all times.

The ballast pumps shall be of the self-priming type or be provided with a separate priming system. (IACS UR D9.5.1/Rev.4)

2.10.4 The ballast system shall be capable of operating after the damage specified in par. 3.5.10 of *MODU Code* and shall have the capability of restoring the unit to a level trim and safe draught condition without taking on additional ballast, with any one pump inoperable. The Administration may permit counter-flooding as an operational procedure. Counter-flooding shall not be considered as a means to improve the suction head available to the ballast pumps when considering the operability of the ballast system after the damage specified in par. 3.5.10 of MODU Code.

The ballast system shall be arranged so that even with any one pump inoperable, it is capable of restoring the unit to a level trim condition and draft acceptable to PRS with respect to stability, when subject to the damage conditions specified in IACS UR D3.7.3. (IACS UR D9.5.4/Rev.4)

2.10.5 The ballast system shall be arranged and operated so as to prevent inadvertent transfer of ballast water from one tank or hull to another, which could result in moment shifts leading to excessive angles of heel or trim.

The ballast system shall be arranged to prevent an inadvertent transfer of ballast water from one quadrant to any other quadrant of the unit. The system is also to be arranged so that the transfer of ballast water from one tank to any other tank through a single valve is not possible except where such a transfer could not adversely affect the stability of the unit. (IACS UR D9.5.3/Rev.4)

2.10.6 It shall be possible to supply each ballast pump provided to meet par. 2.10.3 (4.10.3 of the Code) from the emergency source of power. The arrangements shall be such that the system is capable of restoring the unit from an inclination specified in par. 2.1.4.1 (4.1.4.1 of the *MODU Code*) to a level trim and safe draught condition after loss of any single component in the power supply system.

2.10.7 All ballast pipes shall be of steel or other suitable material having properties acceptable to the Administration. Special consideration shall be given to the design of ballast lines passing through ballast tanks, taking into account effects of corrosion or other deterioration.

2.10.8 All valves and operating controls shall be clearly marked to identify the function they serve. Means shall be provided locally to indicate whether a valve is open or closed.

2.10.9 Air pipes shall be provided on each ballast tank sufficient in number and cross-sectional area to permit the efficient operation of the ballast pumping system under the conditions referred to in par. 2.10.1 to 2.10.8 (4.10.1 to 4.10.8 of the *MODU Code*). In order to allow deballasting of the ballast tanks intended to be used to bring the unit back to normal draught and to ensure no inclination after damage, air pipe openings for these tanks shall be above the worst damage waterline specified in chapter 3 of *MODU Code*. Such air pipes shall be positioned outside the extent of damage, as defined in chapter 3 of MODU Code.

Control and indicating systems

2.10.10 A central ballast control station shall be provided. It shall be located above the worst damage waterline and in a space not within the assumed extent of damage referred to in chapter 3 of *MODU Code* and adequately protected from weather. It shall be provided with the following control and indicating systems, having appropriate audible and visual alarms, where applicable:

.1 ballast pump control system;
.2 ballast pump status-indicating system;
.3 ballast valve control system;
.4 ballast valve position-indicating system;
.5 tank level indicating system;
.6 draught indicating system;
.7 heel and trim indicators;
.8 power availability indicating system (main and emergency);
.9 ballast system hydraulic/pneumatic pressure-indicating system. (IACS UR D9.5.5/Rev.4)

2.10.11 In addition to remote control of the ballast pumps and valves from the central ballast control station, all ballast pumps and valves shall be fitted with independent local control operable in the event of remote control failure. The independent local control of each ballast pump and of its associated ballast tank valves shall be in the same location. (IACS UR D9.5.5/Rev.4)

2.10.12 The control and indicating systems listed in par. 2.10.10 (4.10.10 of *the MODU Code*) shall function independently of one another, or have sufficient redundancy, such that a failure in one system does not jeopardize the operation of any of the other systems. (IACS UR D9.5.5/Rev.4)

2.10.13 Each power-actuated ballast valve shall fail to the closed position upon loss of control power. Upon reactivation of control power, each such valve shall remain closed until the ballast control operator assumes control of the reactivated system. The Administration may accept ballast valve arrangements that do not fail to the closed position upon loss of power provided the Administration is satisfied that the safety of the unit is not impaired. (IACS UR D9.5.5/Rev.4)

2.10.14 The tank level indicating system under par. 2.10.10.5 (4.10.10.5 of the Code) shall provide means to:

.1 indicate liquid levels in all ballast tanks. A secondary means of determining levels in ballast tanks, which may be a sounding pipe, shall be provided. Tank level sensors shall not be situated in the tank suction lines;

.2 indicate liquid levels in other tanks, such as fuel oil, fresh water, drilling water or liquid storage tanks, the filling or emptying of which, in the view of the Administration, could affect the stability of the unit. Tank level sensors shall not be situated in the tank suction lines.

2.10.15 The draught indicating system shall display the draught as measured at each corner of the unit or at representative positions as required by the Administration.

2.10.16 Enclosures housing ballast system electrical components, the failure of which would cause unsafe operation of the ballast system upon liquid entry into the enclosure, shall comply with par. 2.6.21 of *Part VI* (5.6.21 of *the Code*).

2.10.17 A means to indicate whether a valve is open or closed shall be provided at each location from which the valve can be controlled. The indicators shall rely on movement of the valve spindle, or be otherwise arranged with equivalent reliability.

2.10.18 Means shall be provided at the central ballast control station to isolate or disconnect the ballast pump control and ballast valve control systems from their sources of electrical, pneumatic or hydraulic power.

Internal communication

2.10.19 A permanently installed means of communication, independent of the unit's main source of electrical power, shall be provided between the central ballast control station and spaces that contain ballast pumps or valves, or other spaces that may contain equipment necessary for the operation of the ballast system. (MODU Code, 4.10) (IACS UR D9.5.5(iv) /Rev.4)

2.11 Protection against flooding

2.11.1 Each seawater inlet and discharge in spaces below the assigned load line shall be provided with a valve operable from an accessible position outside the space on:

.1 all column-stabilized units;

.2 all other units where the space containing the valve is normally unattended and is not provided with high bilge water level detection.

Inlet and discharge valves in compartments situated below the assigned load line (normally unattended compartments) shall be provided with remote controlled valves. Where remote operation is provided by power actuated valves for sea-water inlets and discharges for operation of propulsion and power generating machinery, power supply failure of the control system shall not result in:

- closing open valves
- opening closed valves.

Consideration will be given to accepting bilge alarms in lieu of remote operation for surface type and self-elevating units only. (IACS UR D9.4.2/Rev.4)

2.11.2 The control systems and indicators provided in par. 3.6.5.1 of *MODU Code* shall be operable in both normal conditions and in the event of main power failure. Where stored energy is provided for this purpose, its capacity shall be to the satisfaction of the Administration.

2.11.3 Non-metallic expansion joints in piping systems, if located in a system which penetrates the unit's side and both the penetration and the non-metallic expansion joint are located below the deepest load waterline, shall be inspected as part of the dry-dock survey in sec. 1.6 of *MODU Code* and replaced as necessary, or at an interval recommended by the manufacturer. (MODU Code, 4.11)

2.12 Anchoring arrangements for surface and column-stabilized units*

* Refer to the *Guidelines on anchoring systems for MODUs (MSC/Circ.737).*

2.12.1 Anchoring arrangements, where fitted as the sole means for position keeping, shall be provided with adequate factors of safety and be designed to maintain the unit on station in all design conditions. The arrangements shall be such that a failure of any single component shall not cause progressive failure of the remaining anchoring arrangements.

2.12.2 The anchors, cables, shackles and other associated connecting equipment shall be designed, manufactured and tested in accordance with an internationally recognized standard for offshore mooring equipment. Documentation of testing, where applicable, shall be maintained on board the unit. Provisions shall be made on board for the recording of changes to and inspection of the equipment.

2.12.3 Anchor cables may be of wire, rope, chain or any combination thereof.

2.12.4 Means shall be provided to enable the anchor cable to be released from the unit after loss of main power.

2.12.5 Fairleads and sheaves shall be designed to prevent excessive bending and wear of the anchor cable. The attachments to the hull or structure shall be such as to adequately withstand the stresses imposed when an anchor cable is loaded to its breaking strength.

2.12.6 Suitable anchor stowage arrangements shall be provided to prevent movement of the anchors in a seaway.

2.12.7 Each windlass shall be provided with two independent power-operated brakes. Each brake shall be capable of withstanding a static load in the anchor cable of at least 50% of its breaking strength. Where the Administration so allows, one of the brakes may be replaced by a manually operated brake.

2.12.8 The design of the windlass shall provide for adequate dynamic braking capacity to control normal combinations of loads from the anchor, anchor cable and anchor handling vessel during the deployment of the anchors at the maximum design payout speed of the windlass.

2.12.9 On loss of power to the windlasses, the power-operated braking system shall be automatically applied and be capable of withstanding 50% of the total static braking capacity of the windlass.

2.12.10 Each windlass shall be capable of being controlled from a position which provides a good view of the operation.

2.12.11 Means shall be provided at the windlass control position to monitor cable tension and windlass power load and to indicate the amount of cable paid out.

2.12.12 A manned control station shall be provided with means to indicate and automatically record cable tensions and the wind speed and direction.

2.12.13 Reliable means shall be provided to communicate between locations critical to the anchoring operation.

2.12.14 Special consideration shall be given to arrangements where the anchoring systems provided are used in conjunction with thrusters to maintain the unit on station. (MODU Code, 4.12)

2.13 Dynamic positioning systems *

* Refer to *Guidance for dynamic position system (DP) operator training (MSC.1/Circ.738/Rev.2).*

Dynamic positioning systems used as a sole means of position keeping shall provide a level of safety equivalent to that provided for anchoring arrangements.(MODU Code, 4.13)

Units equipped with a dynamic positioning system shall comply with the *Requirements for ships and craft with a dynamic positioning system (DP)* contained in Publication 120/P, developed on the basis of the guidelines contained in MSC.1/Circ.1580.

2.14 Elevating systems for self-elevating units

Machinery

2.14.1 Jacking mechanisms shall be:

.1 arranged to maintain the safety of the unit so that a single failure of any component does not cause an uncontrolled descent of the unit;

Suitable monitoring shall be provided at a manned control station to indicate such failure. (IACS UR D9.2/Rev.4)

.2 designed and constructed for the maximum lowering and lifting loads of the unit as specified in the unit's operation manual in accordance with par. 14.1.2.8 of *MODU Code*;

.3 able to withstand the forces imposed on the unit from the maximum environmental criteria for the unit; and

.4 constructed such that the elevation of the leg relative to the unit can be safely maintained in case of loss of power (e.g., electric, hydraulic, or pneumatic power).

Control, communication and alarms

2.14.2 The elevating system shall be operable from a central jacking control station.

2.14.3 The jacking control station shall have the following:

.1 audible and visual alarms for jacking system overload and out-of-level. Units whose jacking systems are subject to rack phase differential shall also have audible and visual alarms for rack phase differential; and

.2 instrumentation to indicate:

.2.1 the inclination of the unit on two horizontal perpendicular axes;

.2.2 power consumption or other indicators for lifting or lowering the legs, as applicable; and

.2.3 brake release status.

2.14.4 A communication system shall be provided between the central jacking control and a location at each leg. (MODU Code, 4.14)

2.15 Piping systems

2.15.1 Pipes shall be arranged inboard of the zone of assumed damage penetration unless special consideration has been taken in the damage stability review.

2.15.2 Piping systems carrying non-hazardous fluids are generally to be separate from piping systems which may contain hazardous fluids. Cross connection of the piping systems may be permitted where means for avoiding possible contamination of the non-hazardous fluid system by the hazardous medium are provided.

2.15.3 Where air or steam is used to atomize well bore fluids prior to flaring, a non-return valve is to be fitted in the air or steam line. This valve shall be part of the permanently installed piping, readily accessible and as close as possible to the burner boom.

2.15.4 Alternative arrangements shown to provide an equivalent level of safety may be accepted by PRS. (IACS UR D9.9.3/Rev.4)

2.16 Valve arrangements

Where valves of piping systems are arranged for remote control and are power operated, a secondary means of operating the valves which, may be manual control, shall be provided. (IACS UR D9.4.1/Rev.4)

2.17 Tank vents and overflows

2.17.1 General requirements

2.17.1.1 Tank vents and overflows shall be located giving due regard to damage stability and the location of the final calculated immersion line in the assumed damage condition (See IACS UR D.7.4.2(c)). Tank vents and overflows which could cause progressive flooding shall be avoided unless special consideration has been taken in the damage stability review.

2.17.1.2 In cases where tank vents and overflows terminate externally or in spaces assumed flooded, the vented tanks shall be also considered flooded. In cases where tanks are considered damaged, the spaces in which their vents or overflows terminate shall also be considered flooded.

2.17.1.3 Vents and overflows from tanks not considered flooded as a result of damage and located above the final calculated immersion line may require to be fitted with automatic means of closing. (IACS UR D9.7.1/Rev.4)

2.17.2 Vent size

The size of the vents shall be in accordance with the PRS *Rules* with due consideration being given to the design pressure of the tank. (IACS UR D9.7.2/Rev.4)

2.17.3 Vent pipes protection

Location and arrangement of vent pipes serving fuel oil tanks and lubrication tanks shall be designed in a way providing protection against ingress of seawater or rain water in case of accidental vent pipes damage. (IACS UR D9.7.3/Rev.4)

2.18 Sounding arrangements

2.18.1 General

All tanks are to be provided with separate sounding pipes, or approved remote level indicating system. Where a sounding pipe exceeds 20 m in length, the minimum internal diameter 38 mm as required by the *Rules* shall be increased to at least 50 mm. (IACS UR D9.8.1/Rev.4)

2.18.2 Additional sounding

Where a remote level indicating system is used, an additional sounding system shall be provided for tanks which are not always accessible. (IACS UR D9.8.2/Rev.4)

2.18.3 Void compartments

Void compartments adjacent to the sea or tanks containing liquids, and void compartments through which piping carrying liquids passes shall be fitted with separate sounding pipes, approved tank liquid level indicating apparatus or be fitted with means to determine if the void tanks contain liquids. Voids as defined above which do not comply with this requirement shall be accounted for in the unit's stability analysis. (IACS UR D9.8.3/Rev.4)

2.19 Low flash point fuels

2.19.1 General

Where it is intended to burn fuels of a flash point below 60°C but not less than 43°C (closed cup test), this fact shall be indicated clearly in the documentation submitted. Vent heads of an approved type with flame arrestors shall be fitted to vent pipes. Consideration may be given to other arrangements. The use of fuels of a flash point lower than 43°C (closed cup test) will require special consideration of the use of storage and handling facilities and controls as well as the electrical installation and ventilation provisions. (IACS UR D9.9.1/Rev.4)

2.19.2 Fuel storage for helicopter facilities

Areas where such fuel tanks are situated and fuelling operations conducted shall be suitable isolated from enclosed spaces or other areas which contain a source of vapour ignition. Vent heads of an approved type with flame arrestors shall be fitted to vent pipes. Fuel storage tanks shall be of approved metallic construction and shall be adequate for the installation. Special attention shall be given to the design, mounting and securing arrangements and electrical bonding of the tank and fuel transfer system. The storage and handling area shall be permanently marked. Coamings or other arrangements shall be provided to contain fuel-oil spills. (IACS UR D9.9.2/Rev.4)

2.20 Machinery installations in hazardous areas

2.20.1 Combustion engines in hazardous areas

Generally, combustion engines shall not be installed in hazardous areas. When this cannot be avoided, special consideration may be given to the arrangement. (IACS UR D9.10.1/Rev.4)

2.20.2 Boilers in hazardous areas

Fired boilers shall not be installed in hazardous areas. (IACS UR D9.10.2/Rev.4)

2.21 Installation of internal combustion engines and boilers

2.21.1 Exhaust outlets

Exhaust outlets of internal combustion engines shall be fitted with efficient spark arresting devices and shall discharge outside the hazardous areas. Exhaust outlets of fired boilers shall discharge outside hazardous areas. (IACS UR D9.11.1/Rev.4)

2.21.2 Exhaust pipes

Exhaust piping shall be installed in accordance with the PRS *Rules*. Exhaust pipe insulation shall be protected against possible oil absorption. (IACS UR D9.11.2/Rev.4)

2.21.3 Air intakes

Air intakes for internal combustion engines shall be located not less than 3 m from the hazardous areas as delineated in sec. 3.2 of *Part VI* (UR D8.2). (IACS UR D9.11.3/Rev.4)

2.22 High pressure piping for drilling operations

Permanently installed piping systems for drilling operations shall comply with an acceptable standard or code. (IACS UR D9.12.1/Rev.4)

2.23 Initial start arrangement

Provision shall be made for initial starting on board with the unit in a "dead ship" mode without the use of external aid. (IACS UR D9.13.1/Rev.4)

2.24 Control and monitoring

Where propulsion machinery spaces are normally unattended during transit, the control and monitoring systems shall be constructed and installed in accordance with the applicable requirements of the PRS *Rules*. (IACS UR D9.14.1/Rev.4)

3 MACHINERY INSTALLATIONS FOR SELF-PROPELLED UNITS

3.1 General

3.1.1 The requirements of this chapter apply to units which are designed to undertake self-propelled passages without external assistance and are not applicable to units which are fitted only with means for the purpose of positioning or of assistance in towing operations. These requirements are additional to those in sub-chapter 2 of this *Part IV* and sub-chapters 2 and 3 of *Part VI* (4, 5 and 6 of the *Code*).

3.1.2 Means shall be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration shall be given to the malfunction of:

- **.1** a generator set which serves as a main source of electrical power;
- **.2** the sources of steam supply;
- **.3** the arrangements for boiler feedwater;
- **.4** the arrangements which supply fuel oil for boilers or engines;
- **.5** the sources of lubricating oil pressure;
- **.6** the sources of water pressure;
- **.7** a condensate pump and the arrangements to maintain vacuum in condensers;
- **.8** the mechanical air supply for boilers;
- **.9** an air compressor and receiver for starting or control purposes; and

.10 the hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable-pitch propellers.

However, the Administration, having regard to overall safety considerations, may accept a partial reduction in capability from full normal operation.

3.1.3 Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the unit shall, as fitted in the unit, be capable of operating under the static conditions under par. 2.1.4 (4.1.4 of the *Code*) and the following dynamic conditions:

.1 column-stabilized units 22.5° in any direction;
.2 self-elevating units 15° in any direction;
.3 surface units 22.5° rolling and simultaneously pitching 7.5° by bow or stern.

The Administration may permit deviation from these angles, taking into consideration the type, size and service conditions of the unit. (IACS UR D9.1.3.2/Rev.4)

3.1.4 Special consideration shall be given to the design, construction and installation of propulsion machinery systems so that any mode of their vibrations could not cause undue stresses in this machinery in the normal operating ranges. (MODU Code, 7.1)

3.2 Means of going astern

3.2.1 Units shall have sufficient power for going astern to secure proper control of the unit in all normal circumstances.

3.2.2 The ability of the machinery to reverse the direction of thrust of the propeller in sufficient time and so to bring the unit to rest within a reasonable distance from maximum ahead service speed shall be demonstrated.

3.2.3 The stopping times, unit headings and distances recorded on trials, together with the results of trials to determine the ability of units having multiple propellers to navigate and manoeuvre with one or more propellers inoperative, shall be available on board for the use of the master or other designated personnel.*

---

* Refer to the *Recommendation on the provision and display of manoeuvring information on board ships, adopted by IMO by resolution A.601(15).*

3.2.4 Where the unit is provided with supplementary means for manoeuvring or stopping, these shall be demonstrated and recorded as referred to in par. 3.2.2 and 3.2.3 (7.2.2 and 7.2.3 of the *Code*). (MODU Code, 7.2)

3.3 Steam boilers and boiler feed systems

3.3.1 Water tube boilers serving turbine propulsion machinery shall be fitted with a high--water-level alarm.

3.3.2 Every steam generating system which provides services essential for the propulsion of the unit shall be provided with not less than two separate feedwater systems from and including the feed pumps, noting that a single penetration of the steam drum is acceptable. Means shall be provided which will prevent overpressure in any part of the systems. (MODU Code, 7.3)

3.4 Machinery controls

3.4.1 Main and auxiliary machinery essential for the propulsion of the unit shall be provided with effective means for its operation and control. All control systems essential for the propulsion,

control and safety of the unit shall be independent or designed such that failure of one system does not degrade the performance of another system. A pitch indicator shall be provided on the navigating bridge for controllable-pitch propellers.

3.4.2 Where remote control of propulsion machinery from the navigating bridge is provided and the machinery spaces are intended to be manned, the following shall apply:

.1 the speed, direction of thrust and, if applicable, the pitch of the propeller shall be fully controllable from the navigating bridge under all sailing conditions, including manoeuvring;

.2 the remote control shall be performed, for each independent propeller, by a control device so designed and constructed that its operation does not require particular attention to the operational details of the machinery. Where more than one propeller is designed to operate simultaneously, these propellers may be controlled by one control device;

.3 the main propulsion machinery shall be provided with an emergency stopping device on the navigating bridge and independent from the bridge control system;

.4 propulsion machinery orders from the navigating bridge shall be indicated in the main machinery control station or at the manoeuvring platform as appropriate;

.5 remote control of the propulsion machinery shall be possible from only one station at a time; at one control station interconnected control units are permitted. At each station an indicator showing which station is in control of the propulsion machinery shall be provided. The transfer of control between navigating bridge and machinery spaces shall be possible only in the machinery space or machinery control room;

.6 it shall be possible to control the propulsion machinery locally, even in the case of failure in any part of the remote control system;

.7 the design of the remote control system shall be such that in case of its failure an alarm will be given and the preset speed and direction of thrust be maintained until local control is in operation, unless the Administration considers it impracticable;

.8 indicators shall be fitted on the navigating bridge for:

.8.1 propeller speed and direction in case of fixed-pitch propellers;

.8.2 propeller speed and pitch position in case of controllable-pitch propellers;

.9 an alarm shall be provided at the navigating bridge and in the machinery space to indicate low starting air pressure set at a level which still permits main engine starting operations. If the remote control system of the propulsion machinery is designed for automatic starting, the number of automatic consecutive attempts which fail to produce a start shall be limited to safeguard sufficient starting air pressure for starting locally; and

.10 automation systems shall be designed in a manner which ensures a threshold warning of impending or imminent slowdown or shutdown of the propulsion system is given to the officer in charge of the navigational watch in time to assess navigational circumstances in an emergency. In particular, the systems shall control, monitor, report, alert and take safety action to slow down or stop propulsion while providing the officer in charge of the navigational watch an opportunity to manually intervene, except for those cases where manual intervention will result in total failure of the engine and/or propulsion equipment within a short time, for example in the case of overspeed.

3.4.3 Where the main propulsion and associated machinery including sources of main electrical supply are provided with various degrees of automatic or remote control and are under continuous manned supervision from a control room, this control room shall be designed, equipped and installed so that the machinery operation will be as safe and effective as if it were under direct supervision; for this purpose of sec. 4.3 to 4.6 (8.3 to 8.6 of *the Code*) shall apply as appropriate. Particular consideration shall be given to protection against fire and flooding. (MODU Code, 7.4)

3.5 Steering

3.5.1 Except as provided in par. 3.5.18 (7.5.18 of the Code), units shall be provided with a main steering gear and an auxiliary steering gear to the satisfaction of the Administration. The main steering gear and the auxiliary steering gear shall be so arranged that a single failure in one of them so far as is reasonable and practicable will not render the other one inoperative.

3.5.2 The main steering gear shall be of adequate strength and sufficient to steer the unit at maximum service speed and this shall be demonstrated. The main steering gear and rudder stock shall be so designed that they will not be damaged at maximum astern speed but this design requirement need not be proved by trials at maximum astern speed and maximum rudder angle.

3.5.3 The main steering gear shall, with the unit at its deepest seagoing draught, be capable of putting the rudder over from 35° on one side to 35° on the other side with the unit running ahead at maximum service speed. The rudder shall be capable of being put over from 35° on either side to 30° on the other side in not more than 28 s, under the same conditions.

3.5.4 The main steering gear shall be operated by power where necessary to fulfil the requirements of par. 3.5.3 (7.5.3 of *the Code*) and in any case in which the Administration would require a rudder stock of over 120 mm diameter in way of the tiller.

3.5.5 The main steering gear power unit or units shall be arranged to start automatically when power is restored after a power failure.

3.5.6 The auxiliary steering gear shall be of adequate strength and sufficient to steer the unit at navigable speed and capable of being brought speedily into action in an emergency.

3.5.7 The auxiliary steering gear shall be capable of putting the rudder over from 15° on one side to 15° on the other side in not more than 60 s with the unit at its deepest seagoing draught while running at one half of its maximum speed ahead or seven knots, whichever is the greater.

3.5.8 The auxiliary steering gear shall be operated by power where necessary to fulfil the requirements of par. 3.5.7 (7.5.7 of *the Code*), and in any case in which the Administration would require a rudder stock of over 230 mm diameter in way of the tiller.

3.5.9 Where the main steering gear comprises two or more identical power units an auxiliary steering gear need not be fitted if the main steering gear is capable of operating the rudder in accordance with the requirements of par. 3.5.3 (7.5.3 of *the Code*) while operating with all power units. As far as is reasonable and practicable the main steering gear shall be so arranged that a single failure in its piping or in one of the power units will not impair the integrity of the remaining part of the steering gear.

3.5.10 Control of the main steering gear shall be provided both on the navigating bridge and in the steering gear compartment. If the steering gear control system which provides for control from the navigating bridge is electric, it shall be supplied from the steering gear power circuit from a point within the steering gear compartment.

3.5.11 When the main steering gear is arranged according to par. 3.5.9 (7.5.9 of *the Code*) two independent control systems shall be provided, each of which can be operated from the navigating bridge. Where the control system comprises a hydraulic telemeter, the Administration may waive the provisions for a second independent control system.

3.5.12 Where the auxiliary steering gear is power operated, it shall be provided with a control system operated from the navigating bridge and this shall be independent of the control system for the main steering gear.

3.5.13 Means shall be provided in the steering gear compartment to disconnect the steering gear control system from the power circuit.

3.5.14 A means of communication shall be provided between the navigating bridge and:
.1 the steering gear compartment; and
.2 the emergency steering position, if provided.

3.5.15 The exact angular position of the rudder, if power operated, shall be indicated on the navigating bridge. The rudder angle indication shall be independent of the steering gear control system.

3.5.16 The angular position of the rudder shall be recognizable in the steering gear compartment.

3.5.17 An alternative power supply, sufficient at least to supply a steering gear power unit which complies with the requirements of par. 3.5.7 (7.5.7 of the Code) and also its associated control system and the rudder angle indicator, shall be provided, automatically, within 45 s, either from the emergency source of electrical power or from another independent source of power located in the steering gear compartment. This independent source of power shall be used only for this purpose and shall have a capacity sufficient for 10 min of continuous operation.

3.5.18 Where a non-conventional rudder is installed, or where a unit is steered by means other than a rudder, the Administration shall give special consideration to the steering system so as to ensure that an acceptable degree of reliability and effectiveness, which is based on par. 3.5.1 (7.5.1 of *the Code*), is provided. (MODU Code, 7.5)

3.6 Electric and electrohydraulic steering gear

3.6.1 Indicators for running indication of the motors of electric and electrohydraulic steering gear shall be installed on the navigating bridge and at a suitable machinery control position.

3.6.2 Each electric or electrohydraulic steering gear comprising one or more power units shall be served by at least two circuits fed from the main switchboard. One of the circuits may pass through the emergency switchboard. An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the circuits supplying this main steering gear. The circuits supplying an electric or electrohydraulic steering gear shall have adequate rating for supplying all motors which can be simultaneously connected to it and have to operate simultaneously.

3.6.3 Short-circuit protection and an overload alarm shall be provided for these circuits and motors. Protection against excess current, if provided, shall be for not less than twice the full load current of the motor or circuit so protected, and shall be arranged to permit the passage of the appropriate starting currents. Where a three-phase supply is used, an alarm shall be provided that will indicate failure of any one of the supply phases. The alarms required in the subparagraph shall be both audible and visual and be situated in a position on the navigating bridge where they can be readily observed. (MODU Code, 7.6)

3.7 Communication between the navigating bridge and the engine-room

Units shall be provided with at least two independent means for communicating orders from the navigating bridge to the position in the machinery space or control room from which the engines

are normally controlled, one of which shall provide visual indication of the orders and responses both in the engine-room and on the navigating bridge. Consideration shall be given to providing a means of communication to any other positions from which the engines may be controlled.

3.8 Engineers' alarm

An engineers' alarm shall be provided to be operated from the engine control room or at the manoeuvring platform, as appropriate, and clearly audible in the engineers' accommodation. (MODU Code, 7.8)

4 PERIODICALLY UNATTENDED MACHINERY SPACES FOR ALL TYPES OF UNITS

4.1 General

The requirements of this chapter are additional to those of sec. 2 and 3 of this *Part IV,* sec. 2 and 3 of *Part VI* and *Part V* (chapters 4 to 7 and 9 of *the Code*) and apply to periodically unattended machinery spaces specified herein. The arrangements shall ensure that the safety of the unit in the marine mode, including manoeuvring, and in machinery spaces of category A during drilling operations, where applicable, is equivalent to that of a unit having manned machinery spaces. (MODU Code, 8.1)

4.2 Application

4.2.1 The requirements of sec. 4.3 to 4.9 (8.3 to 8.9 of *the Code*) apply to units which are designed to undertake self-propelled passages without external assistance.

4.2.2 Units other than those designed for unassisted passages, having periodically unattended spaces in which machinery associated with the marine mode is located, shall comply with the applicable parts of sec. 4.3, 4.4, 4.7, 4.8 and 4.9 (8.3, 8.4, 8.7, 8.8 and 8.9 of *the Code*).

4.2.3 Where in any unit machinery spaces of category A for drilling purposes are intended to be periodically unattended, the application of sec. 4.3 and 4.9 (8.3 and 8.9 of *the Code*) to machinery spaces of category A shall be considered by the Administration, due consideration shall be given to the characteristics of the machinery concerned and to the supervision envisaged to ensure safety.

4.2.4 Measures shall be taken to the satisfaction of the Administration to ensure that the equipment of every unit is functioning in a reliable manner and that satisfactory arrangements are made for regular inspections and routine tests to ensure continuous reliable operation.

4.2.5 Every unit shall be provided with documentary evidence, to the satisfaction of the Administration, of its fitness to operate with periodically unattended machinery spaces. (MODU Code, 8.2)

4.3 Fire protection

Fire prevention

4.3.1 Where necessary, oil fuel and lubricating oil pipes shall be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages on to hot surfaces or into machinery air intakes. The number of joints in such piping systems shall be kept to a minimum and, where practicable, leakages from high-pressure oil fuel pipes shall be collected and arrangements provided for an alarm to be given.

4.3.2 Where daily service oil fuel tanks are filled automatically, or by remote control, means shall be provided to prevent overflow spillages. Other equipment which treats flammable liquids

automatically, e.g., oil fuel purifiers, which, whenever practicable, shall be installed in a special space reserved for purifiers and their heaters, shall have arrangements to prevent overflow spillages.

4.3.3 Where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high-temperature alarm shall be provided if the flashpoint of the oil fuel can be exceeded.

Fire detection

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

4.3.5 The fire detection system shall comply with the following:

.1 this fire detection system shall be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is especially appropriate, detection systems using only thermal detectors shall not be permitted. The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed at the locations determined in accordance with par. 4.7.1 (8.7.1 of *the Code*).

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

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

4.3.6 Means shall be provided in case of fire:

.1 in boiler air supply casings and exhausts (uptakes); and

.2 in scavenging air belts of propulsion machinery,

to detect fires and give alarms at an early stage, unless the Administration considers this to be unnecessary in a particular case.

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

Fire fighting

4.3.8 An approved fixed fire-extinguishing system shall be provided in units (in machinery spaces and in spaces containing fired processes) that are not required to have this provision by chapter 9 of *Part V* (sec. 9.9 of the Code).

4.3.9 Provision shall be made for immediate water delivery from the fire main system at a suitable pressure, due regard being paid to the possibility of freezing, either:

.1 by remote starting arrangements for one of the main fire pumps. The starting positions shall be provided at strategic locations including the navigating bridge, if any, and a normally manned control station; or

.2 by permanent pressurization of the fire main system, either

.2.1 by one of the main fire pumps; or

.2.2 by a pump dedicated for the purpose with automatic starting of one of the main fire pumps on reduction of the pressure.

4.3.10 The Administration shall give special consideration to maintaining the fire integrity of the machinery spaces, to the location and centralization of the fire-extinguishing system controls and to the required shutdown arrangements (e.g., ventilation, fuel pumps, etc.); it may require additional fire-extinguishing appliances and other fire-fighting equipment and breathing apparatus. (MODU Code, 8.3)

4.4 Protection against flooding

Bilge-water level detection

4.4.1 High bilge-water level in periodically unattended machinery spaces below the assigned load line shall activate an audible and visual alarm at the locations determined in accordance with par. 4.7.1 (8.7.1 of MODU Code).

4.4.2 Bilge wells shall be provided, where practicable, in periodically unattended machinery spaces and shall be large enough to accommodate easily the normal drainage during unattended periods. They shall be located and monitored in such a way that the accumulation of liquids is detected at pre-set levels, at normal angles of inclination.

4.4.3 Where the bilge pumps are capable of being started automatically, means shall be provided to indicate at the locations determined in accordance with par. 4.7.1 (8.7.1 of *the Code*) when the influx of liquid is greater than the pump capacity or when the pump is operating more frequently than would normally be expected. In these cases, smaller bilge wells to cover a reasonable period of time may be permitted. Where automatically controlled bilge pumps are provided, special attention shall be given to oil pollution prevention requirements. (MODU Code, 8.4)

4.5 Bridge control of propulsion machinery

4.5.1 In the marine mode, including manoeuvring, the speed, direction of thrust and, if applicable, the pitch of the propeller shall be fully controllable from the navigating bridge.

4.5.2 Such remote control shall be performed by a single control device for each independent propeller, with automatic performance of all associated services, including, where necessary, means of preventing overload of the propulsion machinery. However, where more than one propeller is designed to operate simultaneously, these propellers may be controlled by a single control device.

4.5.3 The main propulsion machinery shall be provided with an emergency stopping device on the navigating bridge which shall be independent of the navigating bridge control system referred to in par. 4.5.2 (8.5.2 of MODU Code).

4.5.4 Propulsion machinery orders from the navigating bridge shall be indicated in the main machinery control station or at the propulsion machinery control position, as appropriate.

4.5.5 Remote control of the propulsion machinery shall be possible only from one location at a time; at such locations, interconnected control positions are permitted. At each location there shall be an indicator showing which location is in control of the propulsion machinery. The transfer of control between the navigating bridge and machinery spaces shall be possible only in the main machinery space or in the main machinery control station. The system shall include means to prevent the propelling thrust from altering significantly when transferring control from one location to another.

4.5.6 It shall be possible for all machinery essential for propulsion and manoeuvring to be controlled from a local position, even in the case of failure in any part of the automatic or remote control systems.

4.5.7 The design of the remote automatic control system shall be such that in case of its failure an alarm will be given on the navigating bridge and at the main machinery control station. Unless the Administration considers it impracticable, the pre-set speed and direction of thrust of the propeller shall be maintained until local control is in operation.

4.5.8 Indicators shall be fitted on the navigating bridge for:

.1 propeller speed and direction of rotation in the case of fixed-pitch propellers; or

.2 propeller speed and pitch position in the case of controllable-pitch propellers.

4.5.9 The number of consecutive automatic attempts which fail to produce a start shall be limited to safeguard sufficient starting air pressure. An alarm shall be provided to indicate low starting air pressure, set at a level which still permits starting operations of the propulsion machinery. (MODU Code, 8.5)

4.6 Communication

A reliable means of vocal communication shall be provided between the main machinery control station or the propulsion machinery control position as appropriate, the navigating bridge, the engineer officers' accommodation and, on column-stabilized units, the central ballast control station. (MODU Code, 8.6)

4.7 Alarm system

4.7.1 An alarm system shall be provided in the main machinery control station giving audible and visual indication of any fault requiring attention. It shall also:

.1 activate an audible and visual alarm at another normally manned control station;

.2 activate the engineers' alarm provided in accordance with sec. 3.8 (7.8 of *the Code*), or an equivalent alarm acceptable to the Administration, if an alarm function has not received attention locally within a limited time;

.3 as far as is practicable be designed on the fail-to-safety principle; and

.4 when in the marine mode, activate an audible and visual alarm on the navigating bridge for any situation which requires action by the officer on watch or which shall be brought to the attention of the officer on watch.

4.7.2 The alarm system shall be continuously powered and shall have an automatic change-over to a stand-by power supply in case of loss of normal power supply.

4.7.3 Failure of the normal power supply of the alarm system shall be alarmed.

4.7.4 The alarm system shall be able to indicate at the same time more than one fault and the acceptance of any alarm shall not inhibit another alarm.

4.7.5 Acceptance at the position mentioned in par. 4.7.1 (8.7.1 of the Code) of any alarm condition shall be indicated at the positions where it has been shown. Alarms shall be maintained until they are accepted and the visual indications shall remain until the fault has been corrected, when the alarm system shall automatically reset to the normal operating condition. (MODU Code, 8.7)

4.8 Special requirements for machinery, boiler and electrical installations

4.8.1 The special requirements for the machinery, boiler and electrical installations shall be to the satisfaction of the Administration and shall include at least the requirements of this section.

Change-over function

4.8.2 Where stand-by machines are required for other auxiliary machinery essential to propulsion, automatic change-over devices shall be provided. An alarm shall be given on automatic change-over.

Automatic control and alarm systems

4.8.3 The control systems shall be such that the services needed for the operation of the main propulsion machinery and its auxiliaries are ensured through the necessary automatic arrangements.

4.8.4 Means shall be provided to keep the starting air pressure at the required level where internal combustion engines are used for main propulsion.

4.8.5 An alarm system complying with sec. 4.7 (8.7 of *the Code*) shall be provided for all important pressures, temperatures and fluid levels and other essential parameters. (MODU Code, 8.8)

4.9 Safety systems

A safety system shall be provided to ensure that serious malfunction in machinery or boiler operations, which presents an immediate danger, shall initiate the automatic shutdown of that part of the plant and that an alarm shall be given at the locations determined in accordance with par. 4.7.1 (8.7.1 of *the Code*). Shutdown of the propulsion system shall not be automatically activated except in cases which could lead to serious damage, complete breakdown, or explosion. Where arrangements for overriding the shutdown of the main propelling machinery are fitted, these shall be such as to preclude inadvertent operation. Visual means shall be provided to indicate when the override has been activated. (MODU Code, 8.9)

5 MACHINERY INSTALLATIONS IN HAZARDOUS AREAS FOR ALL TYPES OF UNITS

Requirements concerning machinery installations and ventilation of enclosed spaces in hazardous areas – see *Part VI*, sec. 3.3 and 3.7.

List of reference IMO documents in Part *IV*

IMO Assembly Resolutions

1. A.601(15): Recommendation on the provision and display of manoeuvring information on board ships.

MSC Circulars

1. MSC/Circ.737: Guidelines on anchoring systems for MODUs.
2. MSC.1/Circ.738/Rev.2: Guidance for dynamic position system (DP) operator training
3. MSC/Circ.834: Guidelines for engine-room layout, design and arrangement.
4. MSC.1/Circ.1212/Rev.1: Revised Guidelines on alternative design and arrangements for SOLAS chapters II-1 and III.
5. MSC.1/Circ.1580: Guidelines for vessels and units with dynamic positioning (DP) systems.

List of IACS resolutions implemented to *Part IV*:

Unified Requirements (UR)

D2/Rev.2 Definitions
D9/Rev.4 Machinery