

**PART II      RULES FOR THE CONSTRUCTION  
AND CLASSIFICATION OF MOBILE  
OFFSHORE DRILLING UNITS**

**TITLE          MODU – MOBILE DRILLING  
OFFSHORE UNITS**

**SECTION 5      HULL ENGINES AND MECHANICS**

**CHAPTERS**

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## CHAPTER A APPROACH

### CHAPTER CONTENTS

#### A1. SCOPE OF APPLICATION

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#### A1. SCOPE OF APPLICATION

##### 100. General

101. The following Requirements apply to the machinery essential to 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.

102. The requirements in this Chapter are additional to those of the Ship Rules Part II, Title 11, Section 5.

103. 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 the Society.

##### 200. Self-propelled and non-self-propelled units

201. 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 the Ship Rules Part II Title 11 Section 5 and to the additional requirements of the Rules and as specified herein.

##### 300. Standards and references

301. The propulsion systems and all equipment and accessories employed on vessels covered by the present Rules are to be designed, constructed and tested according to the latest revisions of the relevant INMETRO standards and, in the absence of those, standards from the following organizations are to be used:

- a. ASTM - American RBNA for Testing and Materials;
- b. ANSI - American Standard RBNA Institute;
- c. ASME - American RBNA of Mechanical Engineers.

302. References:

- IMO MODU Code
- IACS UR D
- NORMAM 01 CHAPTER 9

## CHAPTER B TECHNICAL DOCUMENTATION

### CHAPTER CONTENTS

#### B1. SCOPE

#### B2. DOCUMENTS FOR APPROVAL

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##### B1. SCOPE

##### 100. Submission

101. The drawings are to contain all details necessary for full understanding of the design.

102. Wherever necessary, calculation sheets of the component parts, as well as description of the machinery are also to be submitted.

103. Any modification of the design or use of any component part of equipment or arrangement different from those already approved is subject to new submission of documents to RBNA before its manufacture.

104. Drawings and documents to be submitted to RBNA are to have all the dimensions and information required by the international system. Where different widely accepted dimensions from another unit system are employed, the corresponding values in the international system are to be indicated.

##### B2. DOCUMENTS FOR APPROVAL

##### 100. List of documents to be submitted

101. The documents to be submitted are in Part I, Title 01, Section 2, Chapter C of the Rules.

##### 200. Other documents to be provided

201. A copy of the manuals for operation and maintenance of the main engines and of the most important auxiliaries as compressors, pumps and others are also to be presented to RBNA for information.

## CHAPTER C MATERIALS

### CHAPTER CONTENTS

#### C1. MATERIALS FOR MACHINERY

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#### C1. MATERIALS FOR MACHINERY

##### 100. Materials for machinery

101. The requirements of materials for machinery are to be found at Part II, Titles 61 Section 2 and Title 62 of the Ship Rules.

## CHAPTER D PRINCIPLES OF INSTALLATION

### CHAPTER CONTENTS

#### D1. SPECIFIC CONDITIONS

#### D2. MACHINERY LAYOUT

#### D3. TRANSMISSION OF ORDERS

#### D4. MACHINERY IDENTIFICATION

#### D5. INSTALATION OF DIESEL-ELECTRIC PROPULSION – See Part II, Title 11, Section 5, D.2 of the Ship Rules

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#### D1. SPECIFIC CONDITIONS

##### 100. Ambient conditions

101. All equipment and systems on board must be designed and constructed to withstand the ambient conditions found on board such as temperature, ship's motions, vibrations, corrosive environment.

102. The ambient condition requirements of the present Chapter D1 are to be applied to the layout, selection and arrangement of all shipboard machinery, equipment and appliances as to ensure proper operation.

##### 200. Ambient conditions: temperatures

201. The ambient conditions specified under Table T.D1.201.1 are to be applied to the layout, selection and arrangement of all shipboard machinery, equipment and appliances as to ensure proper operation.

**TABLE T.D1.201.1 – AIR TEMPERATURES**

Installations, components	Location, arrangement	Temperature range (°C)
Machinery and electrical Installations (*)	In enclosed spaces	0 to +45 <sup>(**)</sup>
	On machinery components, boilers, In spaces subject to higher and lower temperatures	According to specific local conditions
	On the open deck	–25 to +45 <sup>(**)</sup>

**TABLE T.D1.201.1 – WATER TEMPERATURES**

Coolant	Temperature (°C)
Seawater Charge air coolant inlet to charge air cooler	+32 <sup>(**)</sup> See Item D1.400 below

**NOTES**

- (\*) Electronic appliances are to be suitable for proper operation even with an air temperature of +55°C.  
(\*\*) The RBNA may approve other temperatures in the case of ships not intended for unrestricted service.

### 300. Ambient conditions - Inclinations

301. **All units:** All machinery, components and systems essential to the safe operation of a unit are to be designed to operate under the following static conditions of inclination:

- a. when column stabilized units are upright and inclined to an angle up to 15° in any direction:
- b. when self-elevating units are upright and inclined to an angle up to 10° in any direction:
- c. when surface units are upright and level trim and when inclined to an angle of list up to 15° either way and simultaneously trimmed to an angle up to 5° by the bow
- d. or stern.

The Society may permit or require deviations from these angles, taking into consideration the type, size and service conditions of the unit.

302. **Self Propelled Units:** 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 required by D1.200 and D1.200 and the following dynamic conditions:

- a. column stabilized units 22.5° in any direction:
- b. self-elevating units 15° in any direction:
- c. surface units 22.5° rolling and simultaneously pitching 7.5° by bow or stern.

303. The Society may permit deviation from these angles, taking into consideration the type, size and service conditions of the unit.

304. **Emergency Source of Power** On all units, the emergency generator and its prime mover and any emergency accumulator battery are to be capable of supplying the required power when upright and when inclined to the greater of the first intercept angles at which compliance with the intact and damage stability criteria of Part II, Section 1, H6 of the Rules are satisfied.

305. However, in no case need the equipment be designed to operate when inclined more than:

- a. 25° in any direction on a column stabilized unit:
- b. 15° in any direction on a self-elevating unit: and
- c. 22.5° about the longitudinal axis and/or when inclined 10° about the transverse axis on surface unit.

### 400. Design reference conditions

401. For the design of the machinery installations and for the purpose of determining the power of main and auxiliary reciprocating internal combustion engines the following ambient reference conditions apply for ships of unrestricted service

- a. Total barometric pressure 1000 mbar
- b. Air temperature +45°C
- c. Relative humidity 60%
- d. Sea water temperature 32°C (charge air coolant-inlet)

402. NOTE: The engine manufacturer shall not be expected to provide simulated ambient reference conditions at a test bed

403. The temperature of any surface in the Engine Room, regardless of isolation, is not to exceed 200 °C under any circumstances. The measurement of the temperature of the Engine Room surfaces may be determined by one of the following processes:

- a. Control thermometer on the surface
- b. Laser heat trackers
- c. Infrared Thermoscan with video

404. The lowest water temperature shall be considered as 5° C, except at the Amazon River, where it may be considered to be 10 °C.

405 The ambient Engine Room temperature is not to exceed 45° C.

406. NOTE: The engine manufacturer shall not be expected to provide simulated ambient reference conditions at a test bed.

### 500. Low flash point fuels

501. Where it is intended to burn fuels of a flash point below 60°C (140°F) but not less than 43° C (110°F), closed cup test, this fact is to be indicated clearly on the arrangement submitted.

502. Vent heads of an approved type with flame arrestors are to be fitted to vent pipes.

503. Consideration may be given to other arrangements. The use of fuels of a flash point lower than 43°C (110°F) closed cup test will require special consideration of storage and handling facilities and controls as well as the electrical installation and ventilation provisions.

## **600. Fuel storage for helicopter facilities**

601. Areas where such fuel tanks are situated and fuelling operations conducted are to be suitable isolated from enclosed spaces or other areas which contain a source of vapour ignition.

602. Vent heads of an approved type with flame arrestors are to be fitted to vent pipes. Fuel storage tanks are to be of approved metallic construction and are to be adequate for the installation.

603. Special attention is to be given to the design, mounting and securing arrangements and electrical bonding of the tank and fuel transfer system. The storage and handling area is to be permanently marked. Coamings or other arrangements are to be provided to contain fuel-oil spills.

## **700. Installation of internal combustion engines and boilers**

701. **Exhaust outlets:** Exhaust outlets of internal combustion engines are to be fitted with efficient spark arresting devices and shall discharge outside the hazardous areas. Exhaust outlets of fired boilers are to discharge outside hazardous areas.

702. **Exhaust pipes:** Exhaust piping is to be installed in accordance with the Rules. Exhaust pipe insulation is to be protected against possible oil absorption.

703. **Air intakes:** Air intakes for internal combustion engines shall be not less than 3 m (10 ft) from the hazardous areas.

## **D2. MACHINERY ARRANGEMENT**

### **100. Alternative design and arrangements**

101. When alternative design or arrangements deviate from the prescriptive provisions of the Rules, 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 the Organization. \*

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

102. Equipment shall never be installed in escape routes or blocking access to any safety or fire fighting equipment.

## **200. Machinery arrangement**

201. 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.

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

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

204. 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.

205. 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.

206. Internal combustion engines of a cylinder diameter of 200 mm or a crankcase volume of 0.6 m<sup>3</sup> 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.

207. Machinery, where applicable, shall be provided with automatic shutoff 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 RBNA may permit provisions for overriding automatic shutoff devices.

208. 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.

209. Means shall be provided to ensure that machinery can be brought into operation from the "dead ship" condition without external aid.

### **300. Machinery installations in hazardous areas**

301. Mechanical equipment shall be limited to that necessary for operational purposes.

302. Mechanical equipment and machinery in hazardous areas shall be so constructed and installed as to reduce the risk of ignition from sparking due to the formation of static electricity or friction between moving parts and from high temperatures of exposed parts due to exhausts or other emissions.

303. Generally, combustion engines are not to be installed in hazardous areas. The installation of internal combustion machinery may be permitted in zone 1 and zone 2 hazardous areas, provided that the RBNA is satisfied that sufficient precautions have been taken against the risk of dangerous ignition.

304. **Boilers in hazardous areas:** Fired boilers are not to be installed in hazardous areas.

#### **400. Ventilation of hazardous spaces**

401. Hazardous enclosed spaces shall be adequately ventilated. Hazardous enclosed mud processing spaces shall be ventilated at a minimum rate of 12 air changes per hour. Where mechanical ventilation is applied it shall be such that the hazardous enclosed spaces are maintained with underpressure in relation to the less hazardous spaces or areas and non-hazardous enclosed spaces are maintained in overpressure in relation to adjacent hazardous locations.

402. All air inlets for hazardous enclosed spaces shall be located in non-hazardous areas.

403. Each air outlet shall be located in an outdoor area which, in the absence of the considered outlet, is of the same or lesser hazard than the ventilated space.

6.4.4 Where the ventilation duct passes through a hazardous area of a higher level, the ventilation duct shall have overpressure in relation to this area; where the ventilation duct passes through a hazardous area of a lower level, the ventilation duct shall have underpressure in relation to this area.

404. Ventilation systems for hazardous spaces shall be independent from those for non-hazardous spaces

#### **500. Accesses**

501. The access to machinery spaces is to be located so as to allow fast and unobstructed exit of personnel in case of accidents and removal of equipment for repairs.

502. One main entrance and at least one emergency access to the engine room spaces are to be provided.

503. All accesses to the engine room and pump room are to be clearly indicated and labeled so that following these signs anyone can quickly find the exit to the compartment.

#### **600. Lighting**

601. All workplaces are to be provided with sufficient lighting as NB-0151 (Calculation of Lighting Levels in Ships).

#### **700. Engine room bottom bilge**

701. All bilge sumps are to be accessible and easy to clean. Wastewater is not to flood and / or reach electrical equipment whatever the movements and inclinations of the vessel during operation.

702. The regulations regarding the drainage of oily waters are to be complied with.

#### **800. Thermal insulation**

801. Piping containing vapor or hot liquid, exhaust piping from the air compressors and equipments whose operating surface reaches temperature greater than 60 ° C are to be effectively isolated.

802. Exhaust gas piping is to be insulated and located so that no flammable material can trigger its ignition during the installation.

803. Insulating materials are to be non-flammable. Where oil spills or moisture could reach the insulation, it must be adequately protected by metal plates, which may be removed for maintenance or replacement of the insulation.

#### **900. Protective equipments and precautions.**

901. The machinery is to be arranged and secured so as to restrict to a minimum the possibility of accidents and fires. In addition to National regulations, the following is to be observed:

- a. moving parts, wheels, gears, transmissions belts and pulleys, shaft flanges and other parts that may be sources of accidents to operators are to be fitted with protection so that no moving part is exposed ;
- b. the discharges of relief valves and safety and drainage devices are to be lead out to safe places,
- c. machinery and equipment must be fixed in their bases, as well as parts of large dimensions;
- d. machinery foundations are to be of robust construction and properly secured to the hull, so that there is no displacement due to the movements of the vessel; they are to be designed and arranged to withstand the various stresses to which they are subjected and to distribute them to the hull, without transmitting loads to the machinery they support. For guidance, see Part II, Title 11, Section 2, Chapter I, Item I1.201;

- e. special attention is to be given to the arrangement of the foundation of the thrust bearing and its securing to the hull;
- f. effective means are to be provided to prevent loosening of bolts and nuts of the parts due to vibration;
- g. the flooring in places of operation and the engine room ladders are to be of the nonslip type;
- h. vertical or inclined ladders and service platforms, side of engines and equipment and passageways are to be protected by railings / handrails / guardrails;
- i. normal and emergency passages, service locations and devices are to be illuminated by the main lighting and emergency lighting systems;
- j. relief valves, fire fighting system valves, fire fighting piping, emergency bilge pipes and valves, are to be painted so that they can readily be identified by the operator.

### **D3. TRANSMISSION OF ORDERS**

#### **100. Internal communication**

101. The engine room and wheelhouse are to be connected by at least one system for transmission of service orders in both directions, and are to have more than one mode of communication with the control stations, one of which shall not use ship's electric energy. See Part II, Title 11, Section 8, subsection E4 of the Rules.

### **D4. IDENTIFICATION OF MACHINERY**

#### **100. Plates and colours**

101. The equipment, pipe fittings and pipe lines shall be easily identified by a colour system, in order to indicate and warn about the actual risks, according to National (ABNT, for Brazilian flag vessels) or International standards.

102. Identification plates are to be posted in each equipment or accessory and piping and fittings.

## **CHAPTER F OTHER MACHINERY**

### **CHAPTER CONTENTS**

#### **F1. AUXILIARY MACHINERY**

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#### **F1. AUXILIARY MACHINERY**

##### **100. Auxiliary machinery installations**

101. The auxiliary machinery installations are to be certified under the RBNA supervision of and be in compliance with the relevant Rules requirements.

##### **200. Steam boilers and boiler feed systems**

201. Every steam boiler and every unfired steam generator shall be provided with not less than two safety valves of adequate capacity. However, the RBNA 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.

202. 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.

203. 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.

204. 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.

205. 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.

## CHAPTER L OTHER MACHINERY

### CHAPTER CONTENTS

#### L1. PERIODICALLY UNATTENDED MACHINERY SPACES FOR ALL TYPES OF UNITS

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### L1. PERIODICALLY UNATTENDED MACHINERY SPACES FOR ALL TYPES OF UNITS

#### 100. General

101. The provisions of this chapter are additional to those of the chapters of this section and to Part II, Title MODU, Section 3, Chapter E 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.

#### 200. Application

201. The provisions of L1.300 to L1.900 apply to units which are designed to undertake self-propelled passages without external assistance.

202. 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 L1.300, L1.400, L1.700, L1.800 and L1.900.

203. Where in any unit machinery spaces of category A for drilling purposes are intended to be periodically unattended the application of L1.200 and L1.900 to machinery spaces of category A shall be considered by the RBNA, due consideration being given to the characteristics of the machinery concerned and to the supervision envisaged to ensure safety.

204. Measures shall be taken to the satisfaction of the RBNA 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.

205. Every unit shall be provided with documentary evidence, to the satisfaction of the RBNA, of its fitness to operate with periodically unattended machinery spaces.

### 300. Fire protection

#### *Fire prevention*

301. 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.

302. 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.

303. 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*

304. 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.

305. The fire detection system shall comply with the following.

- a. 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 specially 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 L1.701.
- b. After installation the system shall be tested under varying conditions of engine operation and ventilation.
- c. 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.

306. Means shall be provided in case of fire:

- a. in boiler air supply casings and exhausts (uptakes); and
- b. in scavenging air belts of propulsion machinery, to detect fires and give alarms at an early stage, unless the RBNA considers this to be unnecessary in a particular case.

307. 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*

308. An approved fixed fire-extinguishing system shall be provided in units that are not required to have this provision by Part II, Titl MODU, Section 3, Chapter E, E8.100.

309. 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:

- a. 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
- b. by permanent pressurization of the fire main system, either
  - i. by one of the main fire pumps; or
  - ii. by a dedicated pump for the purpose with automatic starting of one of the main fire pumps on reduction of the pressure.

310. The RBNA 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.

#### **400. Protection against flooding - Bilge-water level detection**

401. 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 L1.701.

402. 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.

403. Where the bilge pumps are capable of being started automatically, means shall be provided to indicate at the locations determined in accordance with L1.701 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.

#### **500. Bridge control of propulsion machinery**

501. 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.

502. 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.

503. 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 L1.5022.

504. 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.

505. 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.

506. 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.

507. 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 RBNA considers it impracticable, the pre-set speed and direction of thrust of the propeller shall be maintained until local control is in operation.

508. Indicators shall be fitted on the navigating bridge for:

- a. propeller speed and direction of rotation in the case of fixed-pitch propellers; or
- b. propeller speed and pitch position in the case of controllable-pitch propellers.

509. 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.

## 600. Communication

601. 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.

## 700. Alarm system

701. 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:

- a. activate an audible and visual alarm at another normally manned control station;
- b. activate the engineers' alarm or an equivalent alarm acceptable to the RBNA, if an alarm function has not received attention locally within a limited time;
- c. as far as is practicable be designed on the fail-to-safety principle; and
- d. 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.

702. 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.

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

704. 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.

705. Acceptance at the position mentioned in L1.701 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.

## 800. Special provisions for machinery, boiler and electrical installations

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

### *Change-over function*

802. 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*

803. 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.

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

805. An alarm system complying with section 8.7 shall be provided for all important pressures, temperatures and fluid levels and other essential parameters.

## 900. Safety systems

901. 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 L1.701. 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.

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