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**AUSTRALIAN NAVAL CLASSIFICATION AUTHORITY MANUAL
(VOLUME 2)**

DIVISION 3: SHIP RULES

CHAPTER 04: ENGINEERING SYSTEMS

PART 1: ANC RULES



This document is issued for use by Defence and Defence Industry personnel and is effective forthwith.

A handwritten signature in black ink, appearing to read 'CN Dagg'.

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AUSTRALIAN NAVAL CLASSIFICATION RULES

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Division 3: Ship Rules

Part 1: ANC Rules

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Australian Naval Classification Rules**Rule 0. Goal**

- 0.1 The engineering systems shall be designed, constructed, operated, and maintained to:
 - 0.1.1 enable their operation in all Foreseeable Operating Conditions
 - 0.1.2 minimise risks to embarked persons in all Foreseeable Operating Conditions So Far As Reasonably Practicable (SFARP)
 - 0.1.3 operate in a predictable manner with a level of integrity commensurate with operational requirements
 - 0.1.4 ensure the watertight and weathertight integrity of the hull, and meet the requirements of Chapter 03 *Buoyancy and Stability*
 - 0.1.5 enable the restarting of shut-down systems and equipment necessary to provide essential safety functions ("dead ship" starting) without external aid in all Foreseeable Operating Conditions
 - 0.1.6 minimise the risk of fire, explosion or contamination of the atmosphere
 - 0.1.7 provide support to the embarked persons and provide essential safety functions in the event of all foreseeable damage at least until the persons have reached a place of safety or the threat has receded
 - 0.1.8 enable the maintenance and repair in the ship's maintenance plan.
- 0.2 Additional systems or equipment not directly covered by this Chapter, shall not impact on the ship's Engineering or Safety Systems.

Rule 1. General**Functional Objective**

- 1.1 The purpose of this Rule is to outline the principles and framework of Chapter 04 *Engineering Systems* and its application.

Scope

- 1.2 The scope of this Chapter is to describe the Goal, Functional Objectives and Performance Requirements for engineering systems on ships. It includes general elements including but not limited to the provision of information, essential safety functions, control, safety, systems integration etc. as well as individual systems such as propulsion, piping, electrical generation & distribution etc.
- 1.3 Division 2 *Core Design Rules* Chapter 01 *General Requirements* and Chapter 01 *Integrated Platform Survivability* applies to all Chapters of the Australian Naval Classification (ANC) Rules, as applicable to the design, and therefore in order to meet the Chapter 04 *Engineering Systems* goal, the requirements of both this Chapter, Chapter 01 *Integrated Platform Survivability* and Division 2 *Core Design Rules* Chapter 01 *General Requirements* shall be met.

- 1.4 Where the requirements of other Chapters, such as Chapter 06 Fire Safety, Chapter 07 Escape, Evacuation and Rescue, Chapter 14 Environmental Protection etc., impact on the considerations of the items described in this Chapter, then the over-riding requirements shall be derived in order to meet the relevant Functional Objectives and Goals for both Chapters. Specifically, on the interface with Chapter 10 Dangerous Goods (Explosive Ordnance), Chapter 04 Engineering Systems contains the overarching requirements for Engineering Systems which apply to the carriage, and use of Dangerous Goods (Class 1-9) and Chapter 10 Dangerous Goods (Explosive Ordnance) supplements Chapter 04 Engineering Systems by providing additional requirements applicable to Class 1 Dangerous Goods (Explosives).

Application

- 1.5 In addition to the requirements contained elsewhere in the present Rules, ships shall be designed, constructed and maintained in accordance with the structural, mechanical and electrical requirements of a classification society whose rules and procedures are recognised and validated by the Australian Naval Classification Authority (ANCA), or through alternative standards prescribed by the ANCA which provide an equivalent level of safety.
- 1.6 Chapter 04 Engineering Systems is written in a goal-based format that specifies high-level objectives and relies upon verification against an agreed standard for compliance.
- 1.7 For certain ship types, novel craft or for operational reasons the compliance in full with the requirements of this Chapter may not be required subject to justification and acceptance by the ANCA.

Rule 2. Not Used**Rule 3. Provision of Operational Information****Functional Objective**

- 3.1 Operators shall be provided with adequate information and instructions for the safe operation and maintenance of all machinery and systems.

Performance Requirements

- 3.2 Information and instructions shall be supplied to the operator to ensure the safe operation, fault finding and maintenance of machinery, under all Foreseeable Operating Conditions. For essential safety functions, clear system diagrams and instructions shall be provided detailing the changeover procedures and the actions to be completed in the event of machinery breakdown.
- 3.3 Instructions shall define the safe operating limits and make it clear that operation outside these limits is unsafe and can damage equipment and systems.
- 3.4 Instructions shall be presented in English and in a format that can be understood by the operator in the context in which it is required.

Note: See Division 2 Core Design Rules Chapter 01 General Requirements Rule 11 Documentation for the requirements relating to Information and instructions to support safe operation and maintenance during the full lifecycle of the Naval Vessel.

Rule 4. Propulsion**Functional Objective**

- 4.1 The propulsion machinery shall enable the ship to manoeuvre as and when required by the Command but still remain within the designed or imposed limitations as and when required by the Command but still remain within the designed or imposed limitations.

Performance Requirements

- 4.2 To enable the ship to manoeuvre, this Rule shall be applied in conjunction with Rule 5, *Manoeuvring Equipment*.
- 4.3 Redundancy of propulsion equipment shall be provided as per the Integrated Platform Survivability (IPS) levels specified in the Operating and Support Intent (OSI).

Note: See Chapter 01 *Integrated Platform Survivability* for the requirements relating to post damage capability, zoning, separation, redundancy, and signature reduction.

- 4.4 The ANCA shall give consideration to the reliability of single essential propulsion components on application.
- 4.5 The requirements for manoeuvrability shall apply in addition to these requirements.

Note: See Chapter 09 *Navigation Rule 11 Collision Avoidance* and Rule 12 *Controllability* for the requirements relating to navigation manoeuvrability.

- 4.6 Effective means of communicating orders from the normal and emergency conning positions to any position from which the speed and direction of thrust of the propellers can be controlled shall be provided.

Note: See Chapter 08 *Safety Communications Rule 6 Internal Communications* for the requirements relating to main internal communications system to support machinery control, Replenishment at Sea (RAS), and other engineering operations.

- 4.7 Means shall be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative.
- 4.8 Means shall be provided to ensure that the propulsion machinery can be brought into operation from the dead ship condition without external aid.
- 4.9 Fuel supply arrangements from internal storage tanks shall be such that a reserve of fuel is available to provide continuous running for a period specified by the OSI without continuous transfer of fuel, and that means are provided to ensure that the quality of the fuel shall not cause damage to the propulsion equipment.
- 4.10 Machinery spaces and exhaust systems shall be designed to attenuate noise and vibration from engines and turbines.

Note: See Division 2 *Core Design Rules Chapter 01 General Requirements Rule 7 Hazardous Areas* and Rule 14 *Platform and Equipment Vibrations* for the requirements relating to noise and vibration.

Rule 5. Manoeuvring Equipment**Functional Objective**

- 5.1 The manoeuvring equipment shall enable the ship to manoeuvre as and when required by Command whilst remaining within the design or imposed limitations.

Performance Requirements

5.2 The requirements for manoeuvrability shall apply in addition to these requirements.

Note: See Chapter 09 *Navigation* Rule 11 *Collision Avoidance* and Rule 12 *Controllability* for the requirements relating to navigation manoeuvrability.

Note: Consideration should be given to the effects of the failure of stabilisers (if fitted) and use of steering gear for roll compensation. See Rule 7 *Ship Stabilising Systems* of this Chapter for the requirements relating to stabilisers.

5.3 The manoeuvring equipment system shall exhibit sufficient redundancy to cope with single failures without the loss of manoeuvring capability.

5.4 Operation of the manoeuvring equipment shall be possible from a number of locations.

5.5 The operational status of the manoeuvring equipment shall be clearly visible at each control station.

Note: See Chapter 09 *Navigation* Rule 3 *Bridge Workstations* and Rule 7 *Operation & Control Systems* for the requirements relating to operational status.

5.6 The manoeuvring equipment control system shall exhibit sufficient redundancy to cope with single failures of components and electrical supply.

5.7 Effective means of communicating orders from the normal and emergency conning positions to any position from which the speed and direction of thrust of propulsors can be controlled shall be provided.

5.8 The motive power supply shall exhibit a level of redundancy, diversity, and capacity to ensure that the manoeuvring equipment remains operational and shall exhibit a level of continuity to ensure continuous operation.

Note: This is to include provision of supplies and control in the event of damage to the Naval Vessel.

5.9 The manoeuvring equipment shall fail-safe and exhibit alternative modes of operation to fulfil the manoeuvring requirements during a failure.

Rule 6. Pressure and Piping Systems

Functional Objective

6.1 Pressure vessels and pressure piping systems, including valves, fittings and pumps necessary for the operation of installed machinery and equipment, as well as the safe carriage of cargo, shall be of a design and construction adequate to safely contain media, taking account of the anticipated pressure and temperature profiles and the service for which they are intended.

Notes: See Rule 24 *Sea Water Systems* for the requirements relating to sea water systems.

See Rule 25 *Fresh Water Systems* for the requirements relating fresh water systems.

See Rule 26 *Fuel Oil and Lube Oil Systems* for the requirements relating to fuel and lube oil systems.

See Rule 27 *Hydraulic Systems* for the requirements relating to hydraulic systems.

See Rule 28 *Compressed Air Systems* for the requirements relating to compressed air systems.

See Rule 29 *Compressed Gas Systems* for the requirements relating to compressed gas.

See Rule 30 *Wastewater and Oily Bilge Water Transfer Systems* for the requirements relating to wastewater and oily bilge transfer systems.

See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 15 *Registered Plant* for the requirements relating to pressure vessels.

Performance Requirements

- 6.2 The system shall be designed and constructed to operate safely in static and transient conditions.
- 6.3 Surface temperatures of pipes shall not pose a danger to embarked persons or become a source of ignition in case of flammable fluid leaks.

Notes: See Chapter 06 *Fire Safety* Rule 3 *Risk of Ignition* for the requirements relating to the prevention of ignition of flammable substances.

See Chapter 12 *Habitability* Rule 4 *Naval Vessel Configuration* for the requirements relating to insulation of piping in living and working areas.

- 6.4 Provision shall be made to reduce to a minimum the entry of contaminants into pressure systems and to provide drainage points for systems as required.
- 6.5 Where media quality is required to be maintained, system materials and system operation shall be compatible with the media. Means of testing and treatment shall be provided.
- 6.6 Valves associated with maintaining watertight integrity shall be operable from a position.

Note: See Chapter 03 *Buoyancy and Stability* Rule 2 *Watertight Integrity* for the requirements relating to watertight integrity.

- 6.7 Precautions against the build-up of electrostatic charges shall be provided.
- 6.8 Pressure relief arrangements shall be fitted to prevent overpressure in excess of the design pressure in any part of a pressure system. The relief setting, quantity, location and flow capacity of the pressure relief devices installed shall mitigate the consequences of excessive overpressure.
- 6.9 Pressure relief arrangements shall not pose a danger to embarked persons, the environment or any other ship system. Where the media contained poses a safety hazard to embarked persons or the environment, arrangements shall be put in place to minimise the risk following release.
- 6.10 Failure of a joining arrangement shall not pose a further risk (e.g., due to atomisation of hydrocarbons, leakage of water onto electrical equipment etc.).
- 6.11 The design of piping systems, including supports, couplings and valves, shall be made of fire-resistant and corrosion-resistant materials.
- 6.12 Each pipe and valve shall be clearly marked, identifying the system it serves. The system identification method used shall be consistent throughout the Naval Vessel.
- 6.13 Pipe fittings shall be readily accessible for maintenance purposes.
- 6.14 Piping systems shall not obstruct passageways, working and recreation areas, or accesses for maintenance of equipment or structure.

Note: See Chapter 12 *Habitability* Rule 4 *Naval Vessel Configuration* for the requirements relating to piping in living and working areas.

Rule 7. Ship Stabilising Systems**Functional Objective**

- 7.1 Where fitted, motion control systems shall stabilise the ship to motion limits compatible with embarked person's endurance and OSI sea-keeping requirements under all load conditions.

Performance Requirements

- 7.2 The requirements for manoeuvrability shall apply in addition to these requirements.

Note: See Chapter 09 *Navigation* Rule 12 *Controllability* for the requirements relating to navigation manoeuvrability.

- 7.3 The requirements for watertight integrity and stability shall apply in addition to these requirements.

Note: See Chapter 03 *Buoyancy and Stability* Rule 2 *Watertight Integrity* and Rule 4 *Reserve of Stability* for the requirements relating to watertight integrity and stability.

- 7.4 Ship stabilising systems shall not impede the operation of survival and rescue craft.
- 7.5 The ships stability requirements shall not be reliant on ship stabilising systems.
- 7.6 Control systems shall be in accordance with Rule 16 *Machinery Control*.
- 7.7 Alerts and indicators shall be in accordance with Rule 17 *Alerts and Safety Systems*.
- 7.8 It shall be possible to lock the stabiliser fins in a known position. Mechanical locking due to a single failure shall be considered and accommodated.
- 7.9 The operation of ship stabilising systems, or failure of any part of the stabiliser unit or its control system shall not result in an unsafe condition which will have detrimental effect on the ship's operating, sea-keeping capability or safety of embarked persons.

Rule 8. Not Used**Rule 9. Other Essential Safety Functions****Functional Objective**

- 9.1 The ship's machinery outfit shall provide services for essential safety functions not described elsewhere in the ANC Rules.

Performance Requirements

- 9.2 Arrangements for the continuous supply of energy to essential machinery and services shall be provided.

Note: See Rule 10 *Electrical Generation and Power Supplies* for the requirements relating to the main and emergency sources of electrical power.

- 9.3 A fire main system shall be available which is capable of providing essential safety functions.

Note: See Chapter 06 *Fire Safety* Rule 9 *Fire Fighting*.

- 9.4 Where a ship is expected to receive low flash point fuels, a suitable system is required for its storage, use or safe disposal.

Note: See Chapter 06 Fire Safety Rule 14, Carriage of Low Flash Point Fuels for the requirements relating to carriage of low flash point fuels.

- 9.5 Normal and emergency bilge pumping and piping arrangements shall be provided.

Notes: See Rule 30 Wastewater and Oily Bilge Water Transfer Systems for the requirements relating to bilge pumping arrangement.

See Chapter 03 Buoyancy and Stability Rule 2 Watertight Integrity for the requirements relating to watertight integrity.

See Chapter 01 Integrated Platform Survivability Rule 11 Incident Response for the requirements relating to emergency dewatering/flood control.

- 9.6 Where operation of essential safety functions is reliant on the continuous removal of heat, they shall be provided with appropriate redundancy or an alternative method of cooling.
- 9.7 Where a watertight bulkhead extending from the keel to the weather deck is used to protect the remainder of the Naval Vessel from the consequences of collisions, any emergency systems or installations which are essential for the safety of the Naval Vessel, shall not be installed forward of this bulkhead, unless sufficient redundancy is provided elsewhere in the Naval Vessel.

Rule 10. Electrical Generation and Power Supplies

Functional Objective

- 10.1 Sufficient electrical power shall be provided to supply the required services and habitability requirements during all operational conditions without recourse to the emergency electrical supply.
- 10.2 Sufficient electrical power shall be provided to supply services for essential safety systems for the duration of the emergency conditions.
- 10.3 Transitional power supplies shall be provided where no interruption of the electrical supply to essential safety systems is required.

Performance Requirements

- 10.4 Electrical generation and distribution arrangements shall supply electricity to consumers in all operating and environmental conditions defined in the OSI.
- 10.5 The Quality of Power Supply (QPS) shall account for the following:
- 10.5.1 all operational and environmental conditions as defined in the OSI
 - 10.5.2 without any requirement to use emergency supplies
 - 10.5.3 electromagnetic Interference from ship's equipment and/or external environmental conditions.
- 10.6 The electrical power generation and power supplies shall be designed and arranged with a high level of integrity and availability.

- 10.7 Redundancy arrangements shall be provided to supply essential safety functions and, where specified, mission-critical functions in the event of the loss or unavailability of any one generator.

Note: See Chapter 01 *Integrated Platform Survivability* for the requirements relating to post damage capability, zoning, separation and redundancy.

- 10.8 Protection measures shall be provided.

Note: See Rule 15 *Electrical Protection Arrangements* for the requirements relating to electrical protection measures.

- 10.9 Consumer equipment shall be safeguarded from excessive power from electrical generation and supply equipment to minimise damage to equipment or impacts to essential safety functions.
- 10.10 Where required by the OSI, the ship shall have the facilities to safely connect shore side electrical power.
- 10.11 Facilities shall be provided to regain sufficient power to restore essential safety functions from a dead ship condition.
- 10.12 Arrangements for the safe installation and use and maintenance of energy storage devices shall be provided.

Note: See Rule 15 *Electrical Protection Arrangements* for the requirements relating to energy storage devices.

- 10.13 In the event of failure of the main electrical supply, a means to supply sufficient electricity to service the essential safety and mission critical functions shall be provided.
- 10.14 Where a main generator is used in lieu of the emergency generator, subject to complying with necessary requirements, the requirements of the emergency source of power shall be applied to the main source of power.
- 10.15 For essential safety functions, and, where specified, mission critical functions for which an interruption to supply is unacceptable, transitional electrical supplies with sufficient capacity and duration to ensure continuous operation shall be provided.
- 10.16 The power supply to escape, evacuation and rescue systems shall be provided.

Note: See Chapter 07 *Escape, Evacuation and Rescue* Rule 14 *Power Supply to Escape, Evacuation and Rescue Systems* for the requirements relating to providing electrical power for escape, evacuation and rescue systems.

- 10.17 Electrical power generation and energy storage capacity shall be sized and designed to include a growth margin.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 12 *Margins Management* for the requirements relating to margins management.

Rule 11. Not Used**Rule 12. Not Used****Rule 13. Electrical Distribution and Equipment****Functional Objective**

13.1 Electrical power shall be distributed safely to consumers.

Performance Requirements

- 13.2 Electrical equipment shall meet the requirements of *Rule 10 Electrical Generation and Power Supplies*, paragraph 10.5, in terms of suitability for the QPS.
- 13.3 Electrical equipment and distribution systems shall meet the requirements of *Rule 15 Electrical Protection Arrangements*.
- 13.4 The electrical system voltages and frequencies shall ensure safe provision of electrical power to systems and to minimise the risk of exposure to embarked persons.
- 13.5 The design of the type and configuration of the distribution system, including earthing arrangements as necessary, shall minimise the risk to embarked persons and equipment under normal and foreseeable abnormal conditions.
- 13.6 The number, size, installation and arrangement of electrical switchboards and distribution centres shall be suitable for the functional requirements of the vessel.
- 13.7 The distribution system shall be designed and arranged with a high level of Integrity and availability.
- 13.8 Cables shall be installed such that risk of injury to embarked persons or damage to the system is minimised when equipment is operating in foreseeable or under fault conditions.
- 13.9 Main and emergency supplies, where required for a single consumer, shall be separated as widely as possible.
- 13.10 The continuity of supply to essential safety functions and, where specified mission critical functions shall be ensured.
- 13.11 Arrangements for the isolation and switching of distribution circuits shall be provided.
- 13.12 Installation of cables shall not cause mutual interference between systems. Also, electrical and electronic equipment shall not be impaired in its function by electromagnetic energy.

Note: See Division 2 Core Design Rules Chapter 01 General Requirements Rule 6 Equipment Selection for the requirements relating to Electromagnetic Compatibility (EMC) applicable to all electronic, electrical, and electromechanical equipment.

- 13.13 Suitable protection arrangements for the use of portable or temporary electrical equipment shall be provided.
- 13.14 Effective means of communication shall be provided between all switchboards.

Note: See Chapter 08 *Safety Communications* Rule 6 *Internal Communications* for the requirements relating to main internal communications system.

- 13.15 Where a damage control emergency distribution system is installed, it shall not introduce additional risk of harm to embarked persons, equipment or the *Naval Vessel*.
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Note: See Chapter 01 *Integrated Platform Survivability* Rule 12 *Post Damage Recovery* for the requirements relating to damage control emergency distribution systems.

- 13.16 Electrical distribution system shall be sized and designed to include a growth margin.
-

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 12 *Margins Management* for the requirements relating to margins management.

- 13.17 Electrical distribution equipment and consumers shall be clearly marked and uniquely identifiable for the end user and/or maintenance embarked persons as appropriate.
- 13.18 An electrical distribution system for Australian portable electrical equipment shall be provided that meets the Australian Standard for interface compatibility.
- 13.19 Electrical equipment and cables in sensitive compartments shall be selected, designed, and installed to meet the emanation security requirements.
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Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 18 *Emanation Security* for the requirements relating to emanation security.

- 13.20 All electrical conductors and cables shall be clearly distinguishable visually and identified to indicate their intended function.
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Rule 14. Lighting

Functional Objective

- 14.1 Illumination shall be provided appropriate for location and operational requirements in both normal and emergency conditions.

Definitions

- 14.2 For the purpose of this *Rule* the following descriptions of lighting systems have been used to provide a common vocabulary (Reproduced from *Division 1 Annex A Definitions and Abbreviations*):
- 14.2.1 Primary lighting: Fixed lighting provided for safe access around the ship and those compartments accessed during normal operations. Carrying out operations at control stations
- 14.2.2 Secondary lighting: Fixed replacement lighting in event of primary lighting failure. This may be at a lower illumination level
- 14.2.3 Tertiary lighting: Fixed independent lighting system to provide a minimum level of illumination on failure of primary and secondary lighting
- 14.2.4 Transitional lighting: Fixed lighting provided upon loss of primary lighting and prior to the operation of the secondary lighting, where a level of continuous illumination must be maintained for operational purposes

- 14.2.5 Escape, evacuation and rescue lighting: A combination of secondary and tertiary lighting specifically arranged to enable escape, evacuation and rescue
- 14.2.6 Operational lighting: Fixed lighting as required for special purposes with different levels of illumination from primary and secondary lighting
- 14.2.7 Portable lighting: non-fixed, portable lighting which may be used to support other lighting systems
- 14.2.8 Dark adaption lighting: Lighting in designated areas designed to preserve night vision for embarked persons
- 14.2.9 Safety lighting: Illumination that ensures the safe movement of both duty and non-duty embarked persons during darkened and non-darkened ship conditions while maintaining the night vision of those adapted to darkness.

Performance Requirements

- 14.3 The light fittings selected for a particular space shall be appropriate for the hazardous zone classification of the space.

Notes: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 7 *Hazardous Areas* for the requirements relating to lighting fittings in non-Explosive Ordnance (EO) hazardous areas.

See Chapter 10 *Dangerous Goods (Explosive Ordnance)* Rule 5 *Electrical Fittings* for the requirements relating to lighting fittings in EO hazardous areas.

- 14.4 Illumination levels shall be appropriate for all foreseeable operating conditions.
- 14.5 Lighting systems shall permit the ship to be operated in accordance with the OSI.
- 14.6 Primary lighting systems shall provide a suitable level of illumination:
 - 14.6.1 to allow safe access to areas of the ship that require it for normal operations
 - 14.6.2 to allow operation and control of the ship.
- 14.7 The lighting system shall be arranged such that a single failure will not cause total loss of illumination in any compartment or control location.
- 14.8 In the event of loss of primary lighting, at locations where a level of illumination must be maintained for operational control and damage control purposes, transitional lighting shall be provided until the secondary lighting is operational.
- 14.9 Operational lighting shall be provided in areas where there is an operational requirement for different levels of illumination from that provided by the primary system.
- 14.10 To meet operational requirements, lighting levels shall be controllable locally.
- 14.11 Siting of light fittings shall consider the transfer of heat to adjacent surfaces.
- 14.12 Lighting required for escape, evacuation and rescue shall be provided.

Note: See Chapter 07 *Escape, Evacuation and Rescue* Rule 15 *Lighting During Escape, Evacuation and Rescue Emergencies* and Rule 18 *Way Finding System* for the requirements relating to lighting used in escape, evacuation and rescue routes.

- 14.13 Navigation lights shall be provided.

Note: See Chapter 09 *Navigation* Rule 11 *Collision Avoidance* for the requirements relating to navigation lighting.

- 14.14 Where provided, lighting systems including portable lighting shall be appropriate for the hazardous zone classification of the compartment in which it will be used.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 7 *Hazardous Areas*.

- 14.15 If specified by the OSI, the lighting system and ship arrangement shall enable a darkened ship scenario in which the ship can continue operations at night with no light being visible at any time from outside the ship.
- 14.16 The lighting system arrangement shall allow any embarked persons requiring night vision to carry out their duties and move between specified compartments with minimal loss of their night vision.
- 14.17 If specified by the OSI, all externally visible lighting systems on the ship shall be designed to support aviation operations at night.

Note: See Chapter 11 *Aviation Systems* Rule 3 *Ship External Lighting* for the requirements relating to ship external lightings, Night Vision Imaging System (NVIS) compatibility or any device that can be a light source during night aviation operations.

- 14.18 Lighting systems in health facilities shall be provided.

Note: See Chapter 15 *Health Facilities* for the requirements relating to lighting system arrangement for health facilities.

Rule 15. Electrical Protection Arrangements

Functional Objective

- 15.1 All electrical equipment shall be suitably protected against damage to itself under normal, reasonably foreseeable abnormal and fault conditions and to prevent injury to embarked persons or damage to other equipment.

Performance Requirements

- 15.2 Exposed conductive parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live shall be earthed or arrangements provided to protect embarked persons.
- 15.3 A means to automatically detect, locate and alert of insulation breakdown with respect to earth within equipment and the ungrounded electrical power system shall be provided without requiring isolation of essential safety or mission critical consumers.
- 15.4 Arrangements shall be provided to minimise the effects and likelihood of arc flash on embarked persons and provide protection for embarked persons and equipment against arc flash, during operation or while undergoing maintenance.
- 15.5 Suitable protection arrangements from the ingress of solids, liquids and gases shall be provided for all electrical equipment and distribution systems.
- 15.6 Efficient means, suitably located, shall be provided for protecting from excess of current every part of a system as may be necessary to prevent danger.
- 15.7 Suitable arrangements for the protection of mechanically connected equipment due to the effects of electrical overloads shall be provided.

- 15.8 Suitable arrangements for the protection of electrical equipment due to the effects of mechanical overloads shall be provided.
- 15.9 Essential safety functions and, where specified mission critical functions shall be supplied using fire-resistant cable.
- 15.10 Electrical equipment and distribution systems shall be suitably protected from mechanical damage.
- 15.11 Suitable security arrangements to prevent unauthorised access to live electrical connections and electrical control shall be provided.
- 15.12 Suitable protection arrangements for lightning strikes shall be provided.
- 15.13 Alternative arrangements for cooling of essential machinery, systems and their electrical power supply in the event of a primary cooling system failure shall be provided.
- 15.14 Suitable arrangements shall be provided to minimise the effects of radiation hazards to embarked persons.
- 15.15 Suitable protection shall be provided for protecting embarked persons from earth leakage electric shock.
- 15.16 Capacitance on ungrounded distribution systems shall be protected from hazardous touch voltage to endure safety of embarked persons.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 7 *Hazardous Areas* for the requirements relating to protection against static electricity.

- 15.17 Design of grounded distribution systems shall limit the magnitude of harmful circulating current in ship structure under fault conditions.

Note: See Rule 13 *Electrical Distribution and Equipment* for the requirements relating to earthing and bonding.

- 15.18 All electrical equipment shall be fitted with suitable electrical warning signage to mitigate the risk of electric shock.
- 15.19 Protection system shall ensure the continuous availability of systems that provides essential safety functions and, where specified, mission critical functions under fault conditions.

Rule 16. Machinery Control

Functional Objective

- 16.1 Main and auxiliary machinery and systems essential for the safety of the ship and embarked persons shall be provided with effective means for its operation and control during all operational conditions defined in the OSI.

Performance Requirements

- 16.2 The requirements for control stations shall be applied in addition to these requirements.

Notes: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 10 *Control Stations* for the transverse requirements relating to control stations and their relationships.

See Rule 31 *Integrated Control System* for the requirements relating to control and monitoring functions of ship machinery and systems.

- 16.3 The control system shall operate essential machinery **and** systems in a safe, controlled and stable manner throughout the machinery's/systems defined operational limits and shall recover automatically in a safe manner after a loss of power supply.
- 16.4 **Audible and visual** indications of impending slow-down/shut-down of essential machinery and systems shall be provided at applicable locations with provision to take alternative actions if approved.
- 16.5 Automated control systems which utilise stored energy to start essential machinery shall be configured not to exhaust the stored energy completely and to provide an alert when the stored energy is below a critical limit.
- 16.6 The monitoring system for system parameters shall have integrity appropriate for its intended purpose. Where it is not considered practical to have the normal machinery control system with sufficiently high integrity to provide the required level of safety, sufficient direct reading gauges shall be provided to enable potentially hazardous fault conditions or abnormal conditions to be identified and to allow the machinery to be operated safely.
- 16.7 For unattended machinery spaces, a machinery control and alarm position shall be provided.
- 16.8 The control system shall fail-safe. The fail-safe conditions are to be derived and documented.
- 16.9 Operators shall have an independent, high integrity method to disconnect all energy sources that shall put machinery for essential safety functions into a known safe state.
- 16.10 **Machinery control systems with automation shall include provisions for manually overriding the automatic controls. Failure of any part of the system shall not prevent the use of the manual override.**

Rule 17. Alerts and Safety Systems

Functional Objective

- 17.1 The alert system shall inform operators **SFARP** of deviations from normal operation of machinery and systems during all ship operations.
- 17.2 A safety system shall be installed to ensure that any serious malfunctions of machinery or system which present an immediate danger shall initiate a corrective action where appropriate to remove the risk of danger.

Performance Requirements

- 17.3 An alert system shall be arranged with necessary panels at **all control stations**.
- 17.4 The design, construction and operation of the alert and safety systems shall consider human element requirements.

Note: See Division 2 Core Design Rules Chapter 01 General Requirements Rule 8 Human Factors Engineering for the requirements relating to design for human elements.

- 17.5 **Alert systems shall include the following characteristics:**
- 17.5.1 the operational status of the computer based system shall be easily recognisable
- 17.5.2 alerts shall be visually and audibly presented with priority over other information in every operating mode of the system and shall be clearly distinguishable from other information

- 17.5.3 when using general purpose graphical user interfaces, only functions necessary for the respective process shall be available.
- 17.6 The alert and safety system shall be provided with a continuous supply of power.
- 17.7 The alert and safety systems shall prevent unauthorised changes being made to system's parameters.
- 17.8 The status of an alert shall be clearly visible and a means to accept it from all appropriate locations shall be provided. Visual indication of the alarm shall remain until the fault is cleared.
- 17.9 Machinery and Systems shut-down by the safety system shall be reset by operator action before allowing a restart.
- 17.10 Where the function of a safety system may lead to a greater hazard than the loss of the equipment, an override feature may be acceptable to the ANCA.
- 17.11 The status of operating and standby machinery and systems shall be indicated at appropriate control stations.
- 17.12 SFARP, the alert and safety systems shall be designed to fail to a safe state.

Rule 18. Systems Integration

Functional Objective

- 18.1 Essential safety functions shall be designed such that risks of harm to embarked persons, damage to the Naval Vessel or the environment are eliminated or minimised SFARP, both in normal operation and under fault conditions. Functions shall be designed to fail safe.

Performance Requirements

- 18.2 The integrity of essential safety systems and, where specified mission critical systems, during normal operation and fault conditions shall be demonstrated.
- 18.3 Any imposed equipment limitations shall be reflected in system design.
- 18.4 Systems shall be designed such that they will not unduly affect any other system (even under failure conditions).
- 18.5 Failure of one part of the integrated system shall not affect the functionality of other parts except for those functions directly dependant on the defective part.

Note: See Rule 31 *Integrated Control System* for the requirements relating to system integration of ship machinery and systems.

Rule 19. Heating, Ventilation and Air Conditioning

Functional Objective

- 19.1 Internal ambient conditions shall be controlled to suit machinery requirements.
- 19.2 Internal ambient conditions shall be controlled for crew habitability.
- 19.3 Ventilation shall be provided for hazardous areas.

Performance Requirements

19.4 Suitable **internal** ambient conditions in spaces containing machinery or equipment shall be maintained.

19.5 Suitable **internal** ambient conditions shall be maintained in all living and working spaces.

Notes: See Chapter 09 *Navigation Rule 2 Bridge Working Environment* for additional requirements of HVAC servicing the Naval Vessel's bridge.

See Chapter 12 *Habitability* for additional requirements of Heating, Ventilation and Air Conditioning (HVAC) servicing living and working spaces.

See Chapter 13 *Combat Systems* for additional requirements of HVAC servicing work spaces with elements of the combat system.

See Chapter 15 *Medical Facilities* additional requirements of HVAC servicing Medical Facilities.

19.6 HVAC Systems shall ensure the integrity of the of the following Naval Vessel's boundaries:

19.6.1 Fire Zones

19.6.2 Watertight Zones

19.6.3 Gastight Zones

19.6.4 Chemical, Biological, Radiological and Nuclear Defence (CBRN-D) Zones.

Notes: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 17 *Physical Security* for the requirements relating to vents, ducts, barriers and penetrations.

See Chapter 06 *Fire Safety* for fire zones, Chapter 03 *Buoyancy and Stability* for watertight zones and Chapter 01 *Integrated Platform Survivability* for gastight and CBRN-D zones.

19.7 Hazardous areas and areas where noxious odours may regularly occur shall be provided with appropriate ventilation systems.

Notes: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 7 *Hazardous Areas* for the requirements relating to detection requirements for toxic gases.

See Chapter 06 *Fire Safety* Rule 3 *Risk of Ignition* for the requirements relating to ventilation to prevent accumulation of Gas/Vapour and the storage of flammable gases, Rule 13 *Special Carriage of Dangerous Goods*, Rule 14 *Carriage of Low Flash Point Fuels*, and Rule 15 *Special Requirements for Vehicle, Well dock and Ro-ro spaces and Small craft bays*.

See Chapter 10 *Dangerous Goods (Explosive Ordnance)* Rule 2 *Layout and Services* for the requirements relating to HVAC servicing EO stowages.

See Chapter 11 *Aviation Systems* Rule 7 *Aviation System Storage Area* for the requirements relating to HVAC servicing aviation hangars.

19.8 For remote controlled ventilation machinery and systems, appropriate indication, monitoring, alerts and protection shall be provided.

Notes: See Rule 16 *Machinery Control* for the requirements relating to control systems of all machineries and Rule 17 *Alert and Safety Systems* for the requirements relating to alarms and safety systems for all machineries.

See Chapter 06 *Fire Safety* Rule 8 *Containment of Fire* for the requirements relating to the HVAC control system.

- 19.9 Continuity of operation of essential safety functions in the event of a ventilation failure shall be provided.

Note: See Rule 9 *Other Essential Safety Functions* for the requirements where HVAC provides cooling to support/service systems that provides essential safety functions.

- 19.10 The routing of ventilation systems for spaces with hazardous atmospheres shall not pose a risk to other spaces.

Note: See Chapter 06 *Fire Safety* Rule 8 *Containment of Fire* for the requirements relating to ducting arrangements in the Naval Vessel.

- 19.11 Where the OSI specifies CBRN Defence capability, the HVAC requirements for this capability apply.

Note: See Chapter 01 *Integrated Platform Survivability* Rule 10 *Chemical, Biological, Radiological and Nuclear (CBRN) Defence* for the requirements relating to CBRN.

- 19.12 HVAC systems redundancy shall be provided as per the Integrated Platform Survivability (IPS) level specified in the OSI.

Note: See Chapter 01 *Integrated Platform Survivability* for the requirements relating to zoning, separation, redundancy and post damage capability.

Rule 20. Tanks

Functional Objective

- 20.1 Bulk fluids, required for machinery systems and crew habitability, shall be safely stored.

Performance Requirements

- 20.2 Suitable arrangements to safely determine the level of fluid in a tank shall be provided.

Note: Chapter 06 *Fire Safety* Rule 3 *Risk of Ignition* for the requirements relating to tank gauges.

- 20.3 Tanks shall be provided with suitable arrangements to prevent overpressure and under pressure during all operational evolutions.

Note: See Chapter 03 *Buoyancy and Stability* Rule 2 *Watertight Integrity* for the requirements relating to ventilators.

- 20.4 Vent pipes for oil fuel service, settling and lube oil tanks shall be located or protected to minimise the risk of damage and subsequent ingress of seawater or rainwater.

- 20.5 The loading or discharge connections and vent pipes/overflows associated with fuel oils, lubricating oils, hydraulic oils and other oils shall be fitted with drip trays of suitable capacity so as not to cause a hazard to the environment or adjacent equipment.

Note: Chapter 14 *Environmental Protection* Rule 2 *Oil Pollution Prevention* for the requirements relating to drip trays.

- 20.6 Suitable arrangements to prevent the ignition of vapours in a tank shall be provided.

Note: See Chapter 06 *Fire Safety* Rule 3 *Risk of Ignition* for the requirements relating to tanks containing flammable liquids.

- 20.7 Arrangements to prevent contamination of fluids in tanks shall be provided.

Rule 21. Not Used**Rule 22. Not Used****Rule 23. Refrigeration Systems****Functional Objective**

- 23.1 Refrigeration systems shall provide safe and efficient cooling to the temperature ranges required by the equipment, stores or activities in a space and efficiently maintain those temperatures.

Performance Requirements

- 23.2 Refrigeration systems shall be designed and constructed to cool and maintain refrigerated spaces or equipment at a set temperature.
- 23.3 Refrigeration systems shall be provided with redundant machinery in order to provide continuous cooling of the spaces or equipment in case of failure of one piece of machinery.
- 23.4 Refrigerants and materials used in refrigeration systems shall meet the environmental requirements.

Note: See Chapter 14 *Environmental Protection* Rule 5 *Emissions from Ozone Depleting Substances and Synthetic Greenhouse Gases* and Rule 11 *Ship Recycling* for the requirements relating to refrigerants and materials.

- 23.5 A refrigerant gas detection and alarm system shall be provided in any compartments in which refrigerant gas is stored, used or piped through. The detection and alarm system shall be connected to the integrated control system and sound at a manned location.
- 23.6 Refrigerated spaces shall be arranged so that no person can be trapped inside and walk-in refrigerated spaces shall be fitted with an alarm button inside to alert a manned space in case of entrapment.
- 23.7 Refrigerating system machinery spaces shall be well ventilated.
- 23.8 Refrigeration systems shall be arranged with suitable means of isolation so that maintenance, servicing or repair work may be conducted, minimising the release of the refrigerant into the atmosphere.

Rule 24. Sea Water Systems**Functional Objective**

- 24.1 Sea water systems shall be designed to consistently deliver the required pumping and delivery capacities, and pressures throughout the vessel in all operating conditions specified by the OSI.

Performance Requirements

- 24.2 For ships exposed to extreme threat conditions, the design of seawater inlets, discharges and pump location and characteristics shall meet the requirements of IPS levels specified in the OSI.

Note: See Chapter 01 *Integrated Platform Survivability* for the requirements relating to IPS levels.

- 24.3 Sea water inlets shall not be located where they may lose suction during the ship's most extreme normal manoeuvres (e.g. hard turns, hard astern).
- 24.4 Sea water discharges shall not be located where they may interfere with operations such as small boat operations, embarkation, pilot ladders or diving.

Note: See Chapter 05 *Seamanship Systems* Rule 14 *Diving Operations* for the requirements relating to diving.

- 24.5 Sea water systems shall provide seawater at the quality required by the equipment it serves.
- 24.6 Layout of spaces, equipment and pipework shall allow for ease of access for cleaning of seawater filters, strainers and coolers.
- 24.7 Sea water systems shall be designed to prevent biofouling of the system.

Note: See Chapter 14 *Environmental Protection* Rule 10 *Biofouling Management* for the requirements relating to Marine Growth Prevention System (MGPS) where installed.

- 24.8 The requirements for High-Pressure Sea Water System shall apply in addition to these requirements.

Note: See Chapter 06 *Fire Safety* for the requirements relating to fire fighting.

- 24.9 The requirements for ballasting and de-ballasting systems shall apply in addition to these requirements.

Note: See Chapter 14 *Environmental Protection* Rule 9 *Ballast Water Management* for the requirements relating to ballasting and de-ballasting.

- 24.10 Provision shall be made to maintain a supply of seawater to the ship while alongside or docked.

Note: See Chapter 06 *Fire Safety* Rule 9 *Fire Fighting* for the requirements relating to international shore connection.

- 24.11 Where the OSI requires the vessel to navigate in cold climates and may be exposed to low temperatures that may cause equipment and liquid within systems to freeze, the sea water system shall be winterised accordingly.
- 24.12 Sea water inlets and discharges shall not be located where they may reduce the effectiveness of the ship's underwater sensors.

Rule 25. Fresh Water Systems

Functional Objective

- 25.1 Fresh water systems shall consistently provide fresh water at the required quality, temperature and pressure in all operational conditions and environments.

Performance Requirements

- 25.2 Fresh water systems shall provide potable cold and hot water and technical water at the quality required by the purpose it serves.
- 25.3 There shall be separate potable water and technical water storage and distribution systems. Technical water may be made from water taken from potable water tanks.
- 25.4 Fresh water storage tanks shall be kept secure from tampering.
- 25.5 Fresh water sampling points shall be located at the storage tanks and other appropriate locations throughout the water generation and distribution system in order to monitor water quality and locate any source of contamination.
- 25.6 Provision shall be made to receive fresh water from external sources.

Note: See Chapter 05 *Seamanship Systems* Rule 11 *Replenishment at Sea* for the requirements relating to RAS compliant Naval Vessels.

Rule 26. Fuel and Lube Oil Systems**Functional Objective**

- 26.1 Fuel and lube oil systems shall safely and efficiently provide oil to equipment at the required quality, temperature, pressure and flow rate in all operational conditions and environments.

Performance Requirements

- 26.2 Materials and equipment for fuel and lube oil systems shall be selected for safety and compatibility with all foreseeable grades of fuel and lube oil to be used in the systems.
- 26.3 Engine fuel systems shall be designed to safely accommodate the high-pressure pulses which are generated by the fuel injection pumps.
- 26.4 Fuel and lube oil treatment systems shall be provided where necessary to supply oil at the quality, temperature, pressure and flow rate required by the equipment it serves.
- 26.5 Oil, fuel and lubricating oil pressure pipe joints shall be shielded or otherwise suitably protected to avoid, SFARP, oil spray or leakages onto hot surfaces, electrical equipment or into machinery air intakes.

Note: See Chapter 06 *Fire Safety* Rule 3 *Risk of Ignition* for the requirements relating to control of leaks.

Rule 27. Hydraulic Systems**Functional Objective**

- 27.1 Hydraulic systems shall safely and efficiently provide fluid to actuation equipment at the required pressure and flow in all operational conditions and environments.

Note: See Division 2 *Core Design Rules* Rule 15 *Registered Plant* for the requirements relating to pressure vessels.

Performance Requirements

- 27.2 Materials and equipment for hydraulic systems shall be selected for safety and compatibility with all foreseeable grades of hydraulic fluid to be used in the systems.

- 27.3 Hydraulic oil treatment systems shall be provided where necessary to supply oil at the quality, temperature, pressure and flow rate required by the equipment it serves.
- 27.4 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 malfunctioning of the hydraulic means for control in main propulsion machinery including controllable pitch propellers.
- 27.5 Hydraulic systems shall be provided with appropriate safety devices, alarms and indicators.
- 27.6 Hydraulic systems shall reliably deliver hydraulic fluid under pressure for the actuation of hydraulically driven machinery and for the operation of remote-controlled equipment.

Rule 28. Compressed Air Systems

Functional Objective

- 28.1 Compressed Air Systems shall safely and efficiently provide air to equipment and systems at the required purity and pressure in all operational conditions and environments.

Note: See Division 2 *Core Design Rules* Rule 15 *Registered Plant* for the requirements relating to pressure vessels.

Performance Requirements

- 28.2 Electrically powered air compressors for recharging breathing apparatus air cylinders shall be designed, manufactured and installed to be powered by the main and emergency electrical power sources.

Note: See Chapter 05 *Seamanship Systems* Rule 14 *Diving Operations* for the requirements relating to diving.

- 28.3 Materials and equipment for compressed air systems shall be selected for safety and compatibility with the air temperatures and pressures found in the systems.
- 28.4 The air supply system for air compressors shall be designed to prevent contaminants from entering the compressor.
- 28.5 Compressed air systems shall supply air at the purity, pressure and temperature required by the equipment it serves.
- 28.6 Ship's general service low pressure air systems shall be provided with facilities to receive low-pressure air from shore.
- 28.7 Compressed air systems shall be provided with drains at appropriate locations in the system.
- 28.8 Compressed air systems shall be provided with relief valves or fusible plugs at appropriate locations in the system to prevent the system from exceeding maximum design pressures. Discharging air from the relief systems shall be directed to a safe location.

Rule 29. Compressed Gas Systems

Functional Objective

- 29.1 Compressed gas systems, including steam boilers, non-acetylene gases, and dissolved acetylene, shall be safely and efficiently provide the required compressed gases to equipment and systems at the specified pressure and quality.

Notes: See Chapter 06 *Fire Safety* for the requirements relating to fire extinguishers.

See Chapter 15 *Medical Facilities* for the requirements relating to medical oxygen.

See Division 2 *Core Design Rules* Rule 15 *Registered Plant* for the requirements relating to pressure vessels.

Performance Requirements

- 29.2 Pressure vessels used in compressed gas systems shall be designed, constructed and certified to operate safely in all operating conditions.
- 29.3 Compressed gas storage locations and facilities shall be designed to minimise potential hazards to the ship, taking into account the specific properties of the stored gases.

Rule 30. Wastewater and Oily Bilge Water Transfer Systems

Functional Objective

- 30.1 Wastewater and oily bilge water transfer systems shall safely and efficiently provide collection, treatment and removal at the required level of treatment in all operational conditions and environments.

Performance Requirements

- 30.2 Failure of any part of wastewater and oily bilge water transfer systems or its control systems shall not result in an unsafe condition that will have a detrimental effect on the environment or safety of embarked persons.
- 30.3 Wastewater and oily bilge water transfer systems shall comply with the environmental requirements.

Note: See Chapter 14 *Environmental Protection* Rule 2 *Oil Pollution Prevention* and Rule 3 *Wastewater Pollution Prevention* for the requirements relating to environmental regulations.

- 30.4 Wastewater and oily bilge water transfer systems shall not compromise watertight boundaries and be designed to prevent progressive flooding.

Note: See Chapter 03 *Buoyancy and Stability* Rule 2 *Watertight Integrity* for the requirements relating to drainage.

- 30.5 Wastewater and oily bilge water transfer systems shall comply with hazardous areas requirements.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 7 *Hazardous Areas* for the requirements relating to hazardous areas.

- 30.6 Wastewater and oily bilge water transfer systems shall be suitably sized and meet the endurance requirements specified in the OSI.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 13 *Range and Endurance* for the requirements relating to range and endurance.

- 30.7 Wastewater, oily bilge water and oil residue (sludge) systems shall be provided for the safe collection and transfer to/from any fitted treatment, holding tanks or discharge points.

Note: See Chapter 14 *Environmental Protection* Rule 2 *Oil Pollution Prevention* and Rule 3 *Wastewater Pollution Prevention* for the requirements relating to collection and transfer, holding tanks and discharge connections.

- 30.8 Wastewater piping systems shall be designed to be able to be cleaned.
- 30.9 Means of access to wastewater and oily bilge water transfer piping systems shall be provided to allow inspection and cleaning.
- 30.10 Wastewater and oily bilge water transfer systems discharges and vents shall be located to minimise the risk of toxic gases being drawn back into the ship and shall not pose a danger to other vessels alongside.
- 30.11 Dedicated oily bilge water systems shall be provided in machinery spaces where both sea/fresh water and oil systems are located.

Note: See Chapter 14 *Environmental Protection* Rule 2 *Oil Pollution Prevention* for the requirements relating to oil filtering equipment.

- 30.12 The oily bilge water system shall not serve as the emergency dewatering system required to meet the flood control requirements.

Note: See Chapter 01 *Integrated Platform Survivability* Rule 11 *Incident Response* for the requirements relating to emergency dewatering/flood control.

Rule 31. Integrated Control System

Functional Objective

- 31.1 The Naval Vessel's Integrated Control System (ICS) shall provide fault tolerant control and monitoring functions of ship machinery and systems whilst maintaining the overall safety of the ship and protection of embarked persons.

Performance Requirements

- 31.2 The ICS shall provide control and monitoring to all essential services and safety systems, and where specified, mission critical functions and provide operational status of each connected system, at all control stations.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 10 *Control Stations* for the transverse requirements relating to control stations and their relationships.

- 31.3 The ICS shall control the machinery and systems to operate in a safe, controlled and stable manner throughout the defined operational limits.
- 31.4 Failure of the ICS shall not cause the loss of control to systems that could impact on the safety of embarked persons and seaworthiness of the ship.
- 31.5 The ICS shall allow for the disabling of automatic or remote control operation of machinery, equipment and systems from the ship's ICS enabling safe inspection, maintenance, and damage control operations.
- 31.6 The design, construction and installation of the ICS shall incorporate the ergonomics requirements.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 8 *Human Factors Engineering* for the requirements relating to design for anthropometrics data.

- 31.7 A continuous electrical power supply for the ICS shall be provided in the event of failure of primary power supplies.

Note: See Rule 10 *Electrical Generation and Power Supplies* and Rule 13 *Electrical Distribution and Equipment* for the requirements relating to uninterruptible power system (UPS).

31.8 Audible and visual alerts shall be available locally at all ICS.

Note: See Rule 17 *Alerts and Safety Systems* for the requirements relating to audible and visual alerts.

31.9 The ICS shall recover automatically from failure conditions and return to a predetermined safe state.

31.10 The ICS connectivity's and data storage capacity shall be sized and designed to include a growth margin.

Note: See Division 2 *Core Design Rules* Chapter 01 *General Requirements* Rule 12 *Margins Management* for the requirements relating to margins management.

31.11 The onboard ICS and the ICS' remote pier-side monitoring system (if specified by the OSI) shall meet the cyber resilience requirements.

31.12 Where specified by the OSI, the ICS shall provide the facilities to conduct onboard training of the ICS operations and functions using a fully simulated environment of the ship's systems.