

# **Australian Government**

Defence

# AUSTRALIAN NAVAL CLASSIFICATION AUTHORITY MANUAL (VOLUME 2)

# **DIVISION 2: CORE DESIGN RULES**

# **CHAPTER 01: GENERAL REQUIREMENTS**

PART 2: SOLUTIONS TO THE ANC RULES



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

**CN Dagg, CSC** Assistant Secretary Australian Naval Classification Authority Department of Defence CANBERRA ACT 2600 May 2024 Edition

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## ANCA Manual (Volume 2)

Division 2: Core Design Rules, Chapter 01: General Requirements, Part 2: Solutions to the ANC Rules

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# AUSTRALIAN NAVAL CLASSIFICATION RULES

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# AMENDMENTS

Proposals for amendments to the ANCA Manual (Volume 2) may be sent to:

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# Division 2: Core Design Rules Part 2: Solutions to the ANC Rules

# **Chapter 01: General Requirements**

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#### Solutions to the ANC Rules

#### Rule 0. Goal

0.1 The Goal for this Chapter is contained in Part 1.

#### Rule 1. General

- 1.1 Solutions for the rules of this Chapter are integral to the Solutions contained in the Chapters of Divisions 3 to 7 and supplemented by the Solutions of this Chapter.
- 1.2 Compliance with the rules of this Chapter shall be demonstrated within the Solutions of each of the Chapters in Divisions 3 to 7.
- 1.3 All Rules, Regulations, Codes and Standards used shall be the latest versions as amended at the time of drafting the Australian Naval Classification (ANC) Basis unless a specific version date is specified in the text.

#### Rule 2. Not Used

#### Rule 3. System Safety

3.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

#### Solutions

- 3.2 System safety shall meet the requirements of MIL-STD-882 *System Safety*; however, the following supplementary requirements are to take precedence, and any conflicts shall be documented.
- 3.3 The system safety approach shall be documented including:
- 3.3.1 the integration of risk management with the systems engineering process

Note: System safety relies on a coordinated approach within a systems engineering process to consider the hazards of all functional disciplines. Where the Solutions to Divisions 3 to 7 require specialist assessments such as software assessment, fire safety analysis or threat hazard assessments, they should be integrated within the System Safety Program.

- 3.3.2 the identification of prescribed and derived system requirements, including legislation and Defence policy, and their documentation and allocation within the system and stakeholders
- 3.3.3 the process for review of the So Far As is Reasonably Practicable (SFARP) argument including approval of the risk control strategy, acknowledgement of the residual risk, authorisation of risk control measures and communication
- 3.3.4 the management of hazards, risks and risk control measures including their verification, maintenance and documentation in a Hazard Log or Hazard Tracking System.

- 3.4 Reasonably foreseeable hazards shall be identified and documented for subsequent hazard analysis including:
- 3.4.1 a preliminary hazard analysis which identifies hazards with initial risk assessments and potential control measures
- 3.4.2 a system requirements hazard analysis which determines system design requirements, including legislation, policies and standards, to eliminate or minimise risks SFARP.

Note: System safety relies on a coordinated approach with human factors engineering to incorporate the hazards associated with the human interface. Each hazard identification and analysis activity includes the effects of human error and their potential to contribute to a failure mode.

- 3.5 Hazard analyses shall include risk assessments of identified reasonably foreseeable hazards, using Defence's safety and environment matrix format including at minimum:
- 3.5.1 functional hazards identified relating to systems' inputs, outputs, interfaces and consequences of functional failure
- 3.5.2 health hazards such as chemical, physical (noise, vibration, motion, temperature, blast shrapnel), biological, ergonomic and radiation
- 3.5.3 system-of-systems hazards related to the Naval Vessel's interaction with or effect on other independent systems

Note: In the context of this rule, the Naval Vessel is a system, whereas a system-of-systems includes its interaction with independent systems such as aircraft, ships, watercraft and command and control elements.

- 3.5.4 environmental hazards with the potential for adverse effect to the environment
- 3.5.5 operating and support hazards associated with on board processes, equipment and facilities
- 3.5.6 subsystem hazards in components and equipment
- 3.5.7 system hazards identified as part of subsystem integration and interfaces.

Note: Hazard analysis activities rely on a coordinated approach with software design and development to incorporate associated hazards. Where software assessments, considering the degree of software control and criticality are undertaken, they should be integrated within the System Safety Program.

- 3.6 Risk control measures shall be identified within the hazard analyses to protect the embarked persons, the public and the environment from:
- 3.6.1 the effects of the external environment
- 3.6.2 the effects of workplace hazards
- 3.6.3 physical and cognitive stressors resulting from system use
- 3.6.4 the effects of harmful substances, effluents, aquatic organisms and pathogens.
- 3.7 Risk control measures shall be documented according to the hierarchy of controls to meet the requirements of legislation and Defence policy for selection and approval of the risk control strategy.

- 3.8 A Safety Case shall be developed to provide a comprehensive and structured body of evidence that demonstrates, by reasoned argument, that the Naval Vessel is safe to operate as intended in the defined operating conditions including:
- 3.8.1 a summary of hazards with their risk levels and recommendations to address residual risks where reasonably practicable
- 3.8.2 demonstration of compliance with legislation and Defence policy and derived safety requirements
- 3.8.3 a summary of the SFARP arguments, their supporting evidence, records of consultation and the status of associated risk acknowledgement
- 3.8.4 definition of assumptions, constraints, system boundaries, interfaces and associated System Safety Programs.
- 3.9 The NVO shall update and maintain system safety records throughout the Naval Vessel's lifecycle for:
- 3.9.1 the status of hazards, risks, risk control strategy approvals and the implementation, verification and validation of risk control measures
- 3.9.2 the periodic update of reports relating to the Safety Case and associated evidence.

#### Rule 4. Systems Architecture

4.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 4.2 The system architecture shall be defined, described and evaluated to meet the requirements of:
- 4.2.1 ISO/IEC/IEEE 15288 Systems and software engineering System life cycle processes
- 4.2.2 ANSI/EIA-632 Processes for Engineering a System.
- 4.3 The system architecture shall be derived from the system requirements considering at a minimum:
- 4.3.1 states and modes of the Naval Vessel
- 4.3.2 environmental conditions
- 4.3.3 reliability and availability characteristics of Safety Functions
- 4.3.4 availability of Essential Safety Functions after a single error or failure
- 4.3.5 integrity characteristics.
- 4.4 The system architecture shall incorporate constraints and objectives considering at a minimum:
- 4.4.1 accessibility requirements

- 4.4.2 maintenance strategy
- 4.4.3 operating strategy
- 4.4.4 system contingency operations (such as operation in degraded mode, with component failures or as a reconfigurable system).

#### Rule 5. Material Selection

5.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules.

#### Solutions

5.2 Solutions to this rule are integral to the Solutions contained in all Chapters of Divisions 3 to 7. Compliance with this rule shall be demonstrated within the Solutions of each of the Chapters in Divisions 3 to 7.

#### Rule 6. Equipment Selection

6.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules.

#### Solutions

6.2 Solutions to this rule are integral to the Solutions contained in all Chapters of Divisions 3 to 7. Compliance with this rule shall be demonstrated within the Solutions of each of the Chapters in Divisions 3 to 7.

#### Electromagnetic Compatibility (EMC)

- 6.3 All electronic and electrical equipment shall meet the requirements of:
- 6.3.1 the relevant Australian Communications and Media Authority (ACMA) mandated EMC standards
- 6.3.2 for Metallic Hull Naval Vessel: IEC 60533 *Electrical and electronic installations in ships -Electromagnetic compatibility (EMC)*
- 6.3.3 for Non-metallic Hull Naval Vessel: IEC 62742 *Electrical and electronic installations in ships* - *Electromagnetic compatibility (EMC)*
- 6.3.4 SOLAS Chapter V Regulation 17 *Electromagnetic Compatibility*.
- 6.4 Where the OSI requires an Integrated Platform Survivability (IPS) Level A or B, electronic and electrical equipment for systems that provide Essential Safety Functions and where specified, Mission Critical Functions shall also meet the relevant requirements of:
- 6.4.1 MIL-STD-461 Electromagnetic Interference Characteristics Requirements for Equipment
- 6.4.2 MIL-STD-464 Electromagnetic Environmental Effects Requirements for Systems paragraph 5.2 Intra-system electromagnetic compatibility (EMC)
- 6.4.3 MIL-STD-464 *Electromagnetic Environmental Effects Requirements for Systems* paragraph 5.3 *External RF EME*.

Note: Where external sources of radio frequency defined within MIL-STD-464 paragraph 5.3 are less than those required by Rule 7 *Hazardous Areas*, the Rule 7 limits take precedence.

- 6.5 Where the Naval Vessel has a magnetic signature treatment system; electronic and electrical equipment that provide Essential Safety Functions and where specified, Mission Critical Functions, shall meet the requirements of MIL-STD-464 *Electromagnetic Environmental Effects Requirements for Systems* paragraph 5.7.3. *DC Magnetic Environment*.
- 6.6 EMC margins for electronic and electrical equipment that provide Essential Safety Functions and where specified, Mission Critical Functions shall meet the requirements of MIL-STD-464 *Electromagnetic Environmental Effects Requirements for Systems* paragraph 5.1 *Margins*.

#### Rule 7. Hazardous Areas

7.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 7.2 Hazardous Areas shall be identified and documented including:
- 7.2.1 Areas in which a flammable atmosphere and/or dust atmosphere is or may be expected to be present, shall be classified into zones to meet the requirements of AS/NZS IEC 60079.10: *Explosive Atmospheres: Classification of Areas*.
- 7.2.2 Confined spaces shall meet the requirements of AS 2865 *Confined Spaces*.
- 7.2.3 General hazards shall be identified during preliminary hazard analysis within the System Safety Program as required in Rule 3 *System Safety*, including areas:
- 7.2.3.1 that contain electrical and electronic equipment with access which could lead to electric shock
- 7.2.3.2 with equipment that may move unexpectedly
- 7.2.3.3 where Dangerous Goods and explosive ordnance are stowed, handled, maintained or used
- 7.2.3.4 where there is a risk of falling.
- 7.2.4 Health hazards shall be identified within the System Safety Program as required in Rule 3 *System Safety*, including areas:
- 7.2.4.1 where chemicals are generated, stowed, handled, maintained or used (such as gases, refrigerants, cleaning products)
- 7.2.4.2 where environmental factors could lead to physical harm to embarked persons (such as temperature, acoustic energy, pressure)
- 7.2.4.3 with radiation hazards (RADHAZ).
- 7.3 Identified Hazardous Areas shall be provided with risk control measures as required in Rule 3 *System Safety*, including:
- 7.3.1 Gas detection systems and associated alerts shall be designed, constructed and maintained to detect flammable and/or toxic atmospheres to meet the rules of the Classification Society.

- 7.3.2 Safety signs to indicate Hazardous Areas, associated equipment and access restrictions shall meet the requirements of:
- 7.3.2.1 AS 1319 Safety Signs for the Occupational Environment
- 7.3.2.2 Defence Safety Manual.
- 7.4 Equipment and systems in Hazardous Area zones shall be designed, constructed and maintained to meet the relevant requirements of the AS/NZS IEC 60079 Series: *Explosive Atmospheres*.
- 7.5 Access arrangements to Hazardous Areas shall be designed, constructed and maintained to:
- 7.5.1 secure against unauthorised access
- 7.5.2 entry and exit openings shall be of sufficient size to allow for the passage of persons wearing personal protective equipment
- 7.5.3 allow escape from within secured compartments by either of:
- 7.5.3.1 through openings without the use of keys, codes or similar security to unlock them
- 7.5.3.2 secondary means of escape.
- 7.6 Electrically conductive or partially conductive equipment on the Upper Deck shall be bonded to meet the requirements of MIL-STD-1310 *Shipboard Bonding, Grounding, and other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse (EMP) Mitigation, and Safety.*
- 7.7 Fall protection arrangements and equipment shall be designed, constructed and maintained to meet the requirements of the AS/NZS 1891 *Industrial fall-arrest systems and devices* series including:
- 7.7.1 work positioning systems, including:
- 7.7.1.1 anchorage points
- 7.7.1.2 horizontal lifeline systems
- 7.7.1.3 horizontal life rail systems.
- 7.7.2 or where work positioning systems are not suitable, a fall-arrest system.
- 7.8 Hazards involving noise shall be assessed, controlled, integrated and documented within the System Safety Program as required in Rule 3 *System Safety*.

Note: See Divisions 3 to 7 for Chapters on *Habitability* including the Solutions for: the minimisation of, protection from, and warnings of noise onboard the Naval Vessel.

Electromagnetic Radiation Hazards

- 7.9 Hazards involving radiation shall be assessed, controlled, integrated and documented within the System Safety Program as required in Rule 3 *System Safety* supplemented by the following:
- 7.9.1 **Electric and Magnetic Field (EMF).** The power flux densities and field strength reference limits shall meet the requirements of the following International Commission on Non-Ionizing Radiation Protection (ICNIRP) documents:

- 7.9.1.1 Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz 100 kHz)
- 7.9.1.2 Guidelines on Limits of Exposure to Static Magnetic Fields.
- 7.9.2 **Radio Frequencies (RF).** The power flux densities and field strength reference limits shall meet the requirements of Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Radiation Protection Series (RPS) S-1: *Standard for Limiting Exposure to Radiofrequency Fields 100 kHz to 300 GHz.*
- 7.9.3 **Laser frequencies.** Laser radiation safety requirements, classification and labelling shall meet the requirements of:
- 7.9.3.1 AS/NZS IEC 60825.1 Safety of Laser Products Part 1: Equipment Classification and Requirements
- 7.9.3.2 AS/NZS IEC 60825.14 Safety of Laser Products Part 14: A User Guide.
- 7.9.4 **Incoherent optical frequencies.** The irradiance reference limits shall meet the requirements for:
- 7.9.4.1 Ultraviolet (UV) frequencies: ARPANSA RPS 12 Occupational Exposure to Ultraviolet Radiation
- 7.9.4.2 Infrared (IR) and/or visible frequencies: AS/NZS IEC 62471 *Photobiological Safety of Lamps and Lamp Systems*.
- 7.9.5 **Ionising RADHAZ**. Equipment emitting ionising RADHAZ shall be designed and managed to control undue risks As Low As Reasonably Achievable (ALARA) including to meet the relevant requirements of:
- 7.9.5.1 ARPANSA RPS C-1 Code for Radiation Protection in Planned Exposures Situations
- 7.9.5.2 ARPANSA RPS F-1 Protection Against Ionising Radiation
- 7.9.5.3 ARPANSA RPS 10 Code of Practice & Safety Guide Radiation Protection in Dentistry
- 7.9.5.4 ARPANSA RPS 11 Security of Radioactive Sources.
- 7.9.6 **RADHAZ to Ordnance.** Electrically Initiated Devices (EIDs) shall be located and used in areas where the power flux densities and field strengths do not exceed the limits prescribed in the online Explosive Ordnance Technical Publications Library (EOTP Library).
- 7.9.7 **RADHAZ to Fuel.** Power flux densities and field strengths capable of producing an ignition hazard to a flammable atmosphere shall not exceed the limits prescribed in PD CLC/TR 50427 Assessment of Inadvertent Ignition of Flammable Atmospheres by Radio-Frequency Radiation.

#### **RADHAZ Controls**

- 7.9.8 Radiation measurements shall be recorded and reported to meet the relevant requirements of:
- 7.9.8.1 AS/NZS 61786.2 Measurement of DC magnetic, AC magnetic and AC electric fields from 1 Hz to 100 kHz with regard to exposure of human beings
- 7.9.8.2 AS/NZS 2772.2 Radiofrequency fields, Part 2: Principles and methods of measurement and computation 3 kHz to 300 GHz.

Note: RF emitter characteristics and transmission parameters are to be documented to allow computation of the theoretical minimum separation distance prior to conducting RF radiation measurements.

- 7.9.9 Equipment capable of emitting hazardous levels of RADHAZ shall be equipped with the means to enable or inhibit radiation emissions (using ON state and OFF state respectively), including either of:
- 7.9.9.1 physical Safe-to-Transmit (STT) devices that can be locked in the OFF state and prevent removal of the device while in the ON state
- 7.9.9.2 software STT function provided with access control through user/role-based log-in only.
- 7.9.10 Rotating emitters shall be equipped with a Safe-To-Rotate (STR) function with the means to enable or inhibit rotation (using ON state and OFF state respectively), including either of:
- 7.9.10.1 physical STR keys to lock the equipment in the OFF state and prevent removal of the key while in the ON state
- 7.9.10.2 software STR function provided with access control through user/role-based log-in only.
- 7.9.11 A lockable RADHAZ key control system shall be provided for the visual representation of the STT and STR keys and their state.
- 7.9.12 Where the radiation measurements indicate power flux densities and field strengths exceeding the defined limits, exclusion zones shall be defined including:
- 7.9.12.1 deck markings
- 7.9.12.2 warning signs.
- 7.9.13 The Naval Vessel shall be provided with the following RADHAZ documentation to meet the requirements of the *Defence Radiation Safety Manual* (DRSM):
- 7.9.13.1 Radiation Safety Plan
- 7.9.13.2 Radiation Safety Notice.
- 7.9.14 Equipment defined by ARPANSA as a Controlled Apparatus shall be entered into the Defence Radiation Source and Facility Inventory (DRSFI) database.

#### Rule 8. Human Factors Engineering

8.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 8.2 The Human Factors Engineering (HFE) approach to the design of effective human interfaces shall be documented including the integration of HFE and risk management within the System Safety Program.
- 8.3 The Naval Vessel's design shall meet the HFE requirements of MIL-STD-1472 *Human Engineering* section 5 *Detailed Requirements* except:
- 8.3.1 Section 5.7 *Warnings, hazards and safety* shall be replaced by the following paragraph 8.7.

- 8.3.2 Section 5.8.4.2.2 *Anthropometric databases* shall be replaced by the following paragraph 8.6.
- 8.3.3 Section 5.15 *Habitability* shall be replaced by the requirements of Divisions 3 to 7 for Chapters on *Habitability*.
- 8.3.4 Section 5.16 *Cybersecurity* shall be replaced by the requirements of Chapter 02 *Cyberworthiness*.
- 8.3.5 Section 5.18 *Ship bridge design* shall be replaced by the requirements of Divisions 3 to 7 for Chapters on *Navigation*.
- 8.3.6 Where sections are considered not applicable, this shall be justified and documented for requirements such as:
- 8.3.6.1 Section 5.6 *Ground Vehicles*
- 8.3.6.2 Section 5.12 Virtual environments, remotely handled systems, automated systems, telepresence, teleoperations, and telemedicine
- 8.3.6.3 Section 5.13 Individual, crew-served, ground and air weapons systems, and optics.

Note: For all references in this Rule to MIL-STD-1472, where the document uses a reference to "see 6.2", it should be read to mean "in the OSI". Where coverage in the OSI is not provided, clarification is to be sought from the NVO.

- 8.4 **Human machine interface.** In addition to MIL-STD-1472 sections 5.1 *Controls*, 5.2 *Visual displays* and 5.3 *Speech and audio systems*, the requirements of ISO 11064 *Ergonomic design of control centres* shall be considered for Control Stations.
- 8.5 In addition to the MIL-STD-1472 requirements of paragraph 8.3, the following supplementary requirements are to take precedence, and any conflicts shall be documented including:
- 8.5.1 **Physical environment design**. In addition to MIL-STD-1472 section 5.11, requirements for the following from Divisions 3 to 7 Chapters on:
- 8.5.1.1 *Escape, Evacuation and Rescue* including the requirements for access passages, entrances and exits
- 8.5.1.2 *Buoyancy and Stability* including the requirements for deck surfaces, platforms, stairs, ramps, and ladders
- 8.5.1.3 *Buoyancy and Stability* including and the requirements for handholds, seatbelts or other restraints
- 8.5.1.4 *Seamanship Systems* including the requirements for elevators.
- 8.5.2 **Information systems**. In addition to MIL-STD-1472 section 5.17, requirements for Chapter 03 *Software Systems*.
- 8.6 **Anthropometric databases.** Spaces, systems and workstations shall be designed to meet the requirements of persons defined in Defence Science and Technology Group (DST Group), DST-Group-TR3564 *Revised Anthropometry Guidance for the Royal Australian Navy* or its successor databases, utilising:
- 8.6.1 anthropometric dimensions, three-dimensional body scan and physical characteristics data
- 8.6.2 operational clothing, equipment worn and personal protective equipment (PPE).

- 8.7 HFE hazards shall be assessed, controlled, integrated and documented within the System Safety Program as required in Rule 3 *System Safety*, including:
- 8.7.1 **Environment**. In addition to MIL-STD-1472 section 5.5, the Naval Vessel shall protect embarked persons from the effects of the surrounding environment by the provision of:
- 8.7.1.1 illumination levels in Divisions 3 to 7 Chapters on *Engineering Systems*
- 8.7.1.2 heating, ventilation and air conditioning (HVAC) in Divisions 3 to 7 Chapters on *Engineering Systems*
- 8.7.1.3 an acoustic environment in Divisions 3 to 7 Chapters on Habitability
- 8.7.1.4 controlled exposure to vibration (including whole-body) in Divisions 3 to 7 Chapters on *Habitability* and *Buoyancy and Stability*.
- 8.7.2 **Hazardous manual tasks.** In addition to MIL-STD-1472 section 5.20 *Strength and handling*, the Naval Vessels' spaces and systems shall be designed to protect embarked persons from the physical stressors of handling its equipment and defined cargo.

#### Rule 9. Not Used

#### Rule 10. Control Stations

10.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules.

#### Solutions

- 10.2 Solutions to this rule are integral to the Solutions contained in all Chapters of Divisions 3 to 7. Compliance with this rule shall be demonstrated within the Solutions of each of the Chapters in Divisions 3 to 7.
- 10.3 Human machine interfaces of control stations shall be designed, constructed and maintained as required by Rule 8 *Human Factors Engineering*.
- 10.4 Functional hazards of control stations shall be assessed, controlled, integrated and documented within the System Safety Program as required in Rule 3 *System Safety*.
- 10.5 Operating and support hazards of control stations shall be assessed, controlled, integrated and documented within the System Safety Program as required in Rule 3 *System Safety*.

#### Rule 11. Documentation

11.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

#### Solutions

11.2 Solutions to this rule are integral to the Solutions contained in all Chapters of Divisions 3 to 7. Compliance with this rule shall be demonstrated within the Solutions of each of the Chapters in Divisions 3 to 7.

- 11.3 The NVO shall ensure that the operational and maintenance information and guidance:
- 11.3.1 defines the as-designed operating limits of the system
- 11.3.2 is published in a structure and format allowing readers to easily move between guidance documents while being presented with the required information
- 11.3.3 is written in English and the agreed format (such as digital, paper or Interactive Electronic Technical Manual (IETM)).
- 11.4 The Naval Vessel shall be provided with the documentation and as-built drawings:
- 11.4.1 required by the Classification Society to establish and maintain certification with the relevant construction marks, symbols or notations assigned by that Society
- 11.4.2 required for configuration management of the system by the NVO.

#### Rule 12. Margins Management

12.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 12.2 The margins management approach shall be documented including the:
- 12.2.1 integration of margins management within the design and construction program, including a schedule for reporting the margin status
- 12.2.2 identification of prescribed and derived margins requirements, including analyses of potential areas of growth, and their documentation and allocation within the system
- 12.2.3 process for use of margins including the authorisation and approval of their consumption
- 12.2.4 management of margins including their consumption, status reporting, maintenance and documentation throughout the Naval Vessel's lifecycle.
- 12.3 The NVO shall ensure margins are identified for management throughout the Naval Vessel's lifecycle including the following types:
- 12.3.1 design and build margins which are set and controlled within the design and construction program
- 12.3.2 growth margins allocated to systems critical to the capability and performance of the inservice Naval Vessel
- 12.3.3 capability upgrade margins determined for both design and construction and in-service consumption.
- 12.4 Margins budgets shall be defined to allow for uncertainty and growth throughout the Naval Vessel's lifecycle considering at a minimum the following categories:
- 12.4.1 space
- 12.4.2 weight

Note: See Divisions 3 to 7 for Chapters on *Structure* and *Buoyancy and Stability* relating to specific requirements for structural design, weight and moment control which are integral parts of margins management.

- 12.4.3 centres of gravity (VCG, TCG, LCG)
- 12.4.4 electrical power generation and distribution
- 12.4.5 electronics equipment, data storage and distribution
- 12.4.6 HVAC heating and cooling load
- 12.4.7 chilled water
- 12.4.8 refrigeration
- 12.4.9 boat lifting appliances
- 12.4.10 environmental protection systems.
- 12.5 The NVO shall update and maintain margins records throughout the Naval Vessel's lifecycle for:
- 12.5.1 the status of margin types, categories, their consumption and the implementation, verification and validation records
- 12.5.2 periodic impact assessment updates to performance aspects including:
- 12.5.2.1 speed
- 12.5.2.2 stability
- 12.5.2.3 hull girder strength
- 12.5.2.4 electrical load analysis
- 12.5.2.5 range.

#### Rule 13. Range and Endurance

13.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 13.2 The Naval Vessel shall have fuel storage capacity to achieve the range specified in the OSI considering at a minimum the following parameters:
- 13.2.1 speed profile
- 13.2.2 minimum fuel reserves remaining
- 13.2.3 propulsion and power generation configuration
- 13.2.4 loading condition
- 13.2.5 environmental conditions.
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13.3 The Naval Vessel shall have storage capacity to achieve the endurance specified in the OSI, calculated using the following equations with grossing factors, space requirements and masses given in Table 1.1.

$$V = GF \times SR \times N \times E$$

and

$$TM = M \times N \times E$$

Where:

V = Total volume of storage (m<sup>3</sup>)

GF = Grossing Factor (Table 1.1)

SR = Space Requirement (Table 1.1)

N = Number of persons or items (refer Table 1.1)

E = Endurance (days – refer OSI)

TM = Total Mass (kg)

M = Mass of persons or items (Table 1.1)

#### Table 1.1: Acceptable Grossing Factors, Space Requirements and Masses

Description of Space / Item	Grossing Factor	Space Requirement (m³/Embarked Person/day) [unless otherwise noted]	Mass (kg/Embarked Person/day) [unless otherwise noted]	Comments
<b>Provisions Store</b>	rooms			
Cold room(s) (freezer)	9/4	0.00157	0.580	<ul> <li>This includes:</li> <li>Meat product group – beef, lamb, veal, pork, poultry, seafood</li> <li>Frozen product group – prepared foods, quick frozen vegetables.</li> </ul>
Cool room(s) (refrigeration)	5/3	0.00366	1.200	<ul> <li>This includes:</li> <li>Butter, margarine, small goods</li> <li>Fresh fruit and vegetables (endurance 30 days)</li> <li>Cheese, cream, eggs, milk, yoghurt</li> <li>Potatoes, onion, pumpkin (endurance 30 days).</li> </ul>
Dry provision storeroom(s)	9/5	0.00283	1.100	<ul><li>This includes:</li><li>General grocery items</li><li>Flour and flour products.</li></ul>
Thawing space	9/4	0.00105	0.400	Frozen produce (meat - beef, lamb, veal, pork, poultry, seafood)
Waste Storage				
Grey water		0.170		170 L based on fresh water domestic use

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Description of	Greening	Space	Maga	Commonts
Space / Item	Grossing Factor	Space Requirement (m³/Embarked Person/day) [unless	Mass (kg/Embarked Person/day) [unless	Comments
		otherwise noted]	otherwise noted]	
Sewage (vacuum flush toilets)		0.012		12 L if vacuum flush toilets are used
Sewage (gravity flush toilets)		0.070		70 L if gravity flush toilets are used
Garbage	5/2	0.0077	1.800	Includes contaminated packaging – not compacted
Fresh Water				
Potable water		0.170	170	
Fresh water (vacuum flush toilets)		0.012	12	12 L if vacuum flush toilets are used
Fresh water (gravity flush toilets)		0.070	70	70 L if gravity flush toilets are used
Technical Water		[m³/item/day]	[kg/item/day]	
Aviation wash down for air system with a hangar		0.455	455	per air system
Aviation wash down for air system without a hangar		2.275	2275	per air system
Distilled and/or demineralised water for aviation wash down for engines		0.040	40	per engine
Distilled and/or demineralised water for Naval Vessel propulsion gas turbine wash down		0.180	180	per gas turbine
Officers Storerooms		[m³/Officer/day]	[kg/Officer/day]	
Officer's storeroom	9/5	0.0075	1.500	<ul><li>This includes:</li><li>Non-service provisions</li><li>Drinks.</li></ul>
Officers reserve mess gear	1	0.283	11.3400	
Crew Storerooms		[m³/crew member*/day]	[kg/crew member*/day]	* not including Officers
Canteen	9/5	0.00236	0.0819	

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Description of Space / Item	Grossing Factor	Space Requirement	Mass	Comments	
		(m³/Embarked Person/day) [unless otherwise noted]	(kg/Embarked Person/day) [unless otherwise noted]		
Drinks storeroom	8/5	0.0030	1.400		
Other Storerooms					
Accommodation Store	1	0.11	15.278		

#### Rule 14. Platform and Equipment Vibrations

14.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

#### Solutions

- 14.2 Vibration prediction analysis shall be carried out for the Naval Vessel.
- 14.3 Equipment and machinery shall be selected to avoid resonance with the Naval Vessel considering the following:
- 14.3.1 the predicted vibration
- 14.3.2 any subsequent vibration measurements.
- 14.4 All equipment onboard the Naval Vessel shall meet the requirements of either:
- 14.4.1 ISO 10055 Mechanical vibration Vibration testing requirements for shipboard equipment and machinery components
- 14.4.2 MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment.
- 14.5 Foundations and connections to the structure supporting the equipment shall meet the requirements defined by the manufacturer.
- 14.6 All reciprocating and propulsion machinery shall meet the rules of the Classification Society for acceptable vibration levels.
- 14.7 Hazards involving whole body vibrations shall be assessed, controlled, integrated and documented within the System Safety Program as required in Rule 3 *System Safety*.

#### Rule 15. Registered Plant

15.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

#### Solutions

- 15.2 Registered Plant shall be designed, constructed and maintained to meet the requirements of legislation and Defence policy, throughout the Naval Vessel's lifecycle, supplemented by the following.
- 15.3 Items of plant that require registration shall be identified and documented, including for pressure equipment, the relevant hazard level assessments defined in AS 4343 *Pressure* equipment hazard levels.
- 15.4 Plant identified as requiring design registration by the *WHS Regulations* shall be granted a plant design registration and issued with a design registration number by the WHS regulator.
- 15.5 An item of plant identified as requiring registration by the *WHS Regulations* shall be issued with a plant registration number by the regulator.
- 15.6 Registered Plant shall be permanently and clearly marked with the registration numbers on or adjacent to the physical plant.
- 15.7 Clearly defined precautions, limitations and equipment requirements for the safe operation, handling and stowage of Registered Plant shall be provided to the operators, which include:
- 15.7.1 guidance derived from the technical documentation provided by the original equipment manufacturer
- 15.7.2 the level of qualification and experience required by operators of the plant
- 15.7.3 the appropriate licence required to operate the plant.
- 15.8 The maintenance of Registered Plant shall be documented within the Naval Vessel's maintenance management system, including the NVO's reporting systems.
- 15.9 The NVO shall maintain records for the period the Registered Plant is in use for:
- 15.9.1 registration of plant designs and items of plant
- 15.9.2 the design and any modifications.

#### Rule 16. Temporarily Installed Sub-systems

16.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 16.2 The approach to the temporary installation of sub-systems shall be documented within the Naval Vessel's configuration management program.
- 16.3 The NVO shall provide justification for a temporarily installed sub-system that demonstrates all risks have been eliminated or minimised SFARP.
- 16.4 The justification shall assess the temporarily installed sub-system's integration, interfaces and effect to the approved ANC Basis.

#### Rule 17. Physical Security

17.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

#### Solutions

17.2 The physical security arrangement, equipment and fittings shall be designed, constructed and maintained to meet the material requirements of the Navy *Physical Security Standards - HMA Ships, Submarines & Watercraft*.

#### Rule 18. Emanation Security

18.1 The NVO shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. In the presentation and justification of a solution, the following shall be considered.

- 18.2 Naval Vessels fitted with systems that store, process, or otherwise handle classified information at SECRET or above, shall meet the requirements of ACSI 71 *Emanation Security Manual*.
- 18.3 In the presentation of a solution, this Rule shall be supplemented by the requirements provided by Volume 3 *ANC Design Notes*, Division 2 *Core Design Rules*, Design Note 01 *Emanation Security Installation and Certification Requirements*.