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AUSTRALIAN NAVAL CLASSIFICATION AUTHORITY MANUAL (VOLUME 2)

DIVISION 3: SHIP RULES

CHAPTER 02: STRUCTURE

PART 2: SOLUTIONS TO THE ANC RULES

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

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Division 3: Ship Rules, Chapter 02: Structure, Part 2: Solutions to the ANC Rules, May 2024 Edition

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3 https://www.legislation.gov.au/Series/C2004A03712

4 http://drnet/AssociateSecretary/security/policy/Pages/dspf.aspx

AUSTRALIAN NAVAL CLASSIFICATION RULES

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Division 3: Ship Rules
Part 2: Solutions to the ANC Rules

Chapter 02: Structure

Contents

Solutions to the ANC Rules

Rule 0. Goal

0.1 Goal for this Chapter is contained in Part 1.

Rule 1. General

1.1 The Naval Vessel Operator (NVO) shall present and justify a solution for demonstrating compliance to Part 1 of the ANC Rules. All decisions that affect compliance with the requirements of this chapter shall be recorded throughout the Capability Life Cycle (CLC) and these records shall be maintained throughout the life of the ship.

Solution

1.2 The rulesets of a single Classification Society shall be used for designing, constructing and maintaining the structure of ships.

1.3 The Classification Society issuing the ruleset required by paragraph 1.2 must be recognised as a Competent Organisation by the ANC Authority.

1.4 The requirements prescribed in Part 1 shall be met through the application of the appropriate class notations of the ship's Classification Society, supplemented by additional standards, or justified solutions where necessary to meet the Operating and Support Intent (OSI).

1.5 All Rules, Regulations, Codes and Standards used shall be the latest versions as amended at the time of drafting the ANC Basis unless a specific version date is specified in the text.

Rule 2. Not Used

Rule 3. Structural Design

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.

Solution

Design for manufacture, inspection and repair

3.2 The ship shall be designed for manufacture, inspection and repair.

3.2.1 The design shall ensure that shipyards, their suppliers and their subcontractors shall comply with:

3.2.1.1 the material and construction standards specified in the rules of the ship's Classification Society; and

3.2.1.2 the preservation system standards required by Rule 6.

3.3 The ship's structure shall be constructed and repaired under a ship structure quality assurance system agreed by the NVO and the ANC Authority and shall be certified with the relevant construction marks or symbols assigned by the ship's Classification Society.

Design assessment – General

3.4 The ship structure shall be assessed for the design load cases derived from the OSI, which causes maximum stresses in the structure, and considering minimum operating conditions to maximum scantling draught conditions with and without end-of-life growth margin.

3.5 The assessments shall consider the capacity of the structure to withstand longitudinal, transverse and, when applicable, torsional loads imposed by the operational demands.

Note: Torsional loading effects will normally only be required to be considered for ships with large deck openings, multi-hulls, and vessels with unusual hull forms, or structural configuration. When the torsional effects need to be considered, the resulting shear stresses are to be within acceptable limits, as appropriate to the calculation method employed.

3.6 The intact ship's structure shall be assessed for fatigue life to demonstrate the durability of the structural design for the design life of the ship, and operating environment specified in the OSI. The assessment shall also consider any local cyclic loads of sufficient magnitude, and frequency, to potentially cause damage. The ship shall be certified with the associated fatigue assessment class notation assigned by the ship's Classification Society.

3.7 Ship's masts shall be confirmed to provide the stiffness and have the strength and natural frequency of vibration to meet the requirements of mission critical equipment installed on or in the mast, for both normal operations and applicable damage scenarios.

Design assessment – Normal Operations – natural environment

3.8 The ship's structure shall be designed, constructed and maintained to the structural rule set of the ship's Classification Society applicable to the area(s) of operation defined in the OSI, and shall be certified with the relevant character/construction symbols, or marks, assigned by that society.

Design assessment – Normal Operations – built and man-made environment

3.9 The ship's structure shall be designed, constructed and maintained, to the structural rule set of the ship's Classification Society applicable to the ship operations, and load conditions defined in the OSI, and shall be certified with the associated class notation(s) assigned by that society.

Design assessment – Normal Operations – demands limited by structural capacity

3.10 The ship's structure shall be designed, constructed and maintained to remain within the elastic range during normal operations defined in the OSI. Any locations where, during normal operations, demands could unintentionally be applied beyond the elastic range of the structure, shall be assessed to define the serviceability limit state and measures imposed to prevent reaching this state.

3.10.1 Such locations may include, but are not limited to, cargo decks, flight decks, and towing arrangements.

3.10.2 Measures may include, but are not limited to, stress gauges and alarm systems, quick release systems, signage, and operational procedures.

Design assessment – Normal Operations – unquantifiable demands

3.11 The ship's structure shall be designed, constructed and maintained to the structural rule set of the ship's classification society applicable to the conditions defined in the OSI, and shall be certified with the associated class notation assigned by that society.

3.12 Corrosion margins employed in the design of the structure are to be clearly identified in design documentation.

Design Assessment – Normal Operations – access, layout and arrangement

3.13 The ship's structure shall be designed, constructed and maintained to the structural rule set of the ship's classification society and shall provide access so the ship can be inspected and surveyed in service to maintain the certification of the ship's classification society throughout the ship's life.

3.14 All ships shall comply with the principles of:

3.14.1 SOLAS Chapter II-1 Regulation 3-6 *Access to and within spaces in, and forward of, the cargo area of oil tankers and bulk carriers*.

3.14.2 SOLAS Chapter II-1 Regulation 3-9 *Means of embarkation on and disembarkation from ships*.

3.15 Ships without under-deck access to the forward mooring and towing positions shall comply with the principles of SOLAS Chapter II-1 Regulation 3-3 *Safe access to tanker bows*.

Design assessment – Normal Operations – Disregarded demands and disregarded capacity

3.16 Where the demands on the structure are below those demanded by the structural standard selected, the structural capacity may be assumed without justification and no solution is required.

Design assessment – Damage Scenarios – Foreseeable Damage

3.17 The ship's structure shall be designed, constructed, and maintained to the structural rule set of the ship's Classification Society applicable to maintain the post damage capability, derived from Chapter 01 *Integrated Platform Survivability*.

3.18 Post damage structural analysis shall demonstrate the residual strength of the ship against the damaged hull girder ultimate strength and shall be certified with the associated class notation(s) assigned by that society.

Design assessment – Damage Scenarios – Extreme Threat Damage

3.19 The ship's structure shall be designed, constructed and maintained to the structural rule set of the ship's Classification Society applicable, to maintain the post damage capability derived from the OSI, and Chapter 01 *Integrated Platform Survivability*.

3.20 The shock and whipping loads on the hull structure, and appendages, are to be assessed against hull girder ultimate strength, and the design methodology used to minimise the damage to the hull structure from shock, and whipping effects, shall be described.

3.21 Structural capacity to survive demands from internal, and external blast loads, are to be assessed against the standards specified in the solution to Chapter 01 *Integrated Platform Survivability*.

3.22 Post damage structural analysis shall demonstrate the residual strength of the ship against the damaged hull girder ultimate strength and shall be certified with the associated class notation(s) assigned by that society.

3.23 The ship is required to have a 95 per cent probability of surviving for 96 hours, after sustaining structural damage as a consequence of military action, collision or grounding, in wave conditions that have a probability of occurring for 80 per cent of the time.

Design assessment – All Damage Scenarios – access, layout and arrangement

3.24 The ship's structure shall be designed, constructed and maintained to the structural rule set of the ship's Classification Society applicable, to maintain the post damage capability derived from the OSI and Chapter 01 *Integrated Platform Survivability*.

Design assessment – All Damage Scenarios – Disregarded demands and disregarded capacity

3.25 Where a demand can be disregarded without affecting the risk level for critical damage to the ship, the disregarded demand need not be quantified in the design assessment. The relationship of disregarded demands to hazards covered in the ship's Safety Case should be documented in terms of scope, credibility or assumptions.

Rule 4. Construction

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.

Solution

4.2 The ship's structure shall be constructed and repaired under survey of the ship's Classification Society's Surveyors, and shall be certified with the relevant construction marks, symbols, and/or notations assigned by that Society.

4.3 The ship's structure shall be constructed and repaired under a ship structure quality assurance system agreed by the NVO and the ANC Authority.

Note: Standards to be applied for preservation systems are given in Rule 6.

Rule 5. Ships in Service

5.1 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.

Solution

5.2 The ship's structure shall be modified and/or repaired in accordance with the Rules of the ship's Classification Society, such that the ship maintains the class, including supplementary class notations, issued by the Classification Society.

5.3 The ship's structure shall be regularly surveyed by the Classification Society's Surveyors in accordance with the rules of the Classification Society.

5.4 The ship's structure is to be inspected and maintained by the NVO to assure the ship structure is always in a state of compliance to the rules of the ship's Classification Society. The NVO shall adopt a program of periodic inspection and reporting to find, report, maintain and repair deficiencies related to hull structure.

Rule 6. Preservation Systems

6.1 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.

Solution

6.2 Protective coatings shall be selected, applied and maintained to ensure the ship's service life, taking into account maintenance philosophy, accessibility for application and maintenance, expected service environment including contact media (such as in tanks), use and abuse (volume of traffic, impact damage etc.) and parallel systems and stresses (such as Cathodic Protection).

6.2.1 Coating products shall be selected, applied and maintained in accordance with the coating manufacturers' specifications.

6.2.2 Protective coatings shall be selected and applied in accordance with a coating plan. For each specific service area, the coating plan shall specify:

6.2.2.1 The intended coating durability and corrosivity;

6.2.2.2 Along with any special performance requirements required by this or other Chapters of these Rules (e.g., smoke and toxicity characteristics, low flame spread characteristics, coefficient of friction for non-slip and flight decks, solar absorption characteristics, colour stability).

6.2.2.3 The full paint scheme including number and types of coats and nominal dry film thicknesses (NDFT) for each coat, including justification of how this meets paragraph 6.2.2.1;

6.2.2.4 The surface area to be coated and associated coating weight estimation;

6.2.2.5 Schemes for specific challenging areas such as bolted connections;

6.2.2.6 Items that are to be left uncoated;

6.2.2.7 Acceptable minimum standards covering:

a. Surface cleanliness,

b. Substrate profile height and character/roughness,

c. Allowable residual levels of dust and water soluble contaminants,

d. Preparation grades of edges and welds and other surface imperfections,

e. Environmental conditions for preparation, application and cure,

f. Maximum and minimum deviations from the NDFT,

g. Application methods,

h. Overcoat intervals at typical temperatures,

i. Touch dry, hard dry and full cure times at typical temperatures.

Note: See Chapter 01 *Integrated Ship Survivability* for requirements related to external colour for susceptibility.

Note: See Chapter 03 *Buoyancy and Stability* for requirements relating to non-slip deck coatings.

Note: See Chapter 04 *Engineering Systems* for requirements for coatings for fuel tanks and fresh water tanks.

Note: See Chapter 06 *Fire Safety* for the requirements relating to fire properties of internal paint and deck coverings.

Note: See Chapter 10 *Dangerous Goods* for requirements related to coatings in Magazines and EO Stowage and Handling Areas.

Note: See Chapter 11 *Aviation Systems* for requirements relating to coefficient of friction for flight deck coatings.

Note: See Chapter 14 *Environmental Protection* for the requirements relating to Anti-fouling system coatings.

6.3 Coatings for the protection of structure shall be certified by the Australian Paint Approval Scheme (APAS) to the specification matching the intended environment, and purpose, of the coating.

Note: Certification of coatings to alternative quality assurance regimes may be considered where suitably justified.

6.4 Shop primers, where used, shall:

6.4.1 Comply with the requirements of the ship's Classification Society; and

6.4.2 Be compatible with the subsequent coating layer or shall be removed to the standard required by the coating manufacturer prior to the application of the subsequent coating layer.

6.5 All dedicated seawater ballast tanks and void spaces shall be coated during construction in accordance with IMO MSC.215(82) *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-Side Skin Spaces of Bulk Carriers*.

6.6 Coatings shall be applied by recognised Painting Contractor Certification Program (PCCP) contractors, certified to the applicable PCCP classes, and subclasses, for the component being coated.

6.7 Coating systems applied in areas that cathodic protection is acting shall be capable of exposure to the highest protected potentials that can reasonably be foreseen, without any detrimental effect on the functional performance of the coating.

6.8 Cathodic protection (CP) systems, where fitted, shall be designed, constructed and maintained to the hull structural rules of the ship's Classification Society and, for steel hulled ships, ISO 20313 *Ships and marine technology — Cathodic protection of ships*.

Note: Typically steel hull ships should be provided with Impressed Current Cathodic Protection (ICCP) for the external hull and galvanic anode CP for localised external CP, sea chests, ballast tanks and bilges. Typically, aluminium hull ships should be provided only with galvanic anode CP; however, ICCP for the external hull may be specially considered for an aluminium hull with appropriate verification data and justification for the system.

6.8.1 Any applicable guidance or recommended practices for cathodic protection systems issued by the ship's Classification Society and, for steel hulled ships, given in ISO 20313 including the annexes, shall also be followed.

6.8.2 CP systems shall:

6.8.2.1 Be capable of polarising the most active protected metal surface to a potential 0.2V, or 0.1V for aluminium alloys, more negative than its free corrosion potential in seawater, to the point at which all significant metal corrosion processes have ceased. These potentials are measured relative to a silver/silver chloride (Ag/AgCl) electrode in seawater and apply to all metals used in constructing the hull or underwater metal parts electrically bonded to the hull;

6.8.2.2 Be capable of maintaining such a potential within the limits specified in ISO 20313 Table 1 on all seawater immersed structure for a minimum of at least a planned docking cycle, at operational conditions given in the OSI including maximum speed, minimum temperature and maximum salinity of intended operational waters, size of bare metal surface areas and, where applicable, a percentage of protective coating break down of 15%;

6.8.2.3 Provide a smooth distribution of electrical potential across the protected structure;

6.8.2.4 Be designed to prevent detrimental effects including, but not limited to: cathodic disbonding, hydrogen embrittlement, hydrogen accumulation, over protection of amphoteric metals, excessive calcareous deposits;

6.8.2.5 Not be utilised in potable water tanks, or systems involved in the production of potable water (such as the particular sea chest sea water is drawn from to produce potable water).

6.8.3 Where ICCP systems are fitted:

6.8.3.1 ICCP anodes shall be designed to remain effective over the life of the vessel.

6.8.3.2 ICCP anode (dielectric) shields shall isolate anodes from hull coatings. The shield shall be designed to the geometry of the anode to ensure the potential at the edge of the shield is less than the maximum allowable potential for the hull.

Note: It is recommended that the hull be protected within 0.8m of any ICCP anode by a suitable dielectric shield material or coating.

6.8.3.3 Hull penetration cofferdams shall be provided for the cables to each anode and reference cell.

6.8.3.4 Ships over 1000 tonnes full load displacement shall be divided into CP zones. Each CP zone shall be protected by a dedicated system of power supply, anodes and reference electrode. A multi-zone control system shall be provided where necessary to adapt and optimise the current distribution.

6.8.3.5 ICCP systems shall be provided with a monitoring and alarm system with continuous data logging for automatic recording of anode current, reference electrode values and seawater conductivity and temperature.

6.8.4 Where galvanic anodes are fitted, they shall conform to AS 2239 *Galvanic (sacrificial) anodes for cathodic protection*.

6.8.4.1 Anodes shall be cast or extruded forms for flush mounting, stand-off, direct (bolt) mounting or bracelet types.

6.8.4.2 External hull anodes shall be flush mounted and arranged to reduce hydrodynamic drag.

6.8.4.3 Anodes shall not be fitted in locations where there is increased risk of them causing structural damage, such as the flat bottom or highly stressed structure.

6.8.4.4 Anodes shall have a connection with low electrical resistance to the protected structure.

6.8.4.5 Magnesium alloy anodes shall not be fitted.

6.8.4.6 The anode distribution in seawater ballast tanks shall include pit-guard anodes in the un-pumpable area below the tank suction.

6.8.5 Vessels fitted only with galvanic anodes shall be fitted with a CP monitoring and alarm system that comprises a hull-mounted reference electrode and a display/monitor system with high and low set points. The monitor system shall alarm to a continuously manned control station when the hull potential falls outside the allowable range.

Note: The risk of damaging hull potential changes is increased when the vessel is berthed alongside wharves, piers or other vessels, bonded to shore ICCP systems, on shore power, or when welding activity is undertaken.

6.8.6 All reference electrodes shall be calibrated against a standard reference cell to within 2mV or less. The reference electrode readings should ensure sufficient current is supplied to protect the whole hull.

6.8.6.1 A shielded Ag/AgCl electrode in saturated potassium chloride (KCl) shall be used for control systems and calibration of all reference electrodes used.

6.8.7 Electrical continuity, capable of handling 150% of the maximum CP current, shall be provided between the hull and appendages such as propellers and shafts, rudders, trim tabs and stabilisers unless the ship design specifically requires that these items are isolated.

6.8.8 In ships with non-conductive hulls, all metallic appendages and hull penetrations, such as seawater system inlets/outlets, shall be provided with low resistance internal electrical connections to ensure continuity with the installed CP system. The continuity of such internal attachments shall be monitored in service to prevent inadvertent isolation of hull penetrations from the CP system.

6.8.8.1 Alternatively, individual metallic hull fittings may be cathodically protected with their own externally mounted sacrificial anodes. In all cases, these anodes shall be fitted as close to the protected attachment as possible, and electrically bonded to it. All metallic hull appendages that are individually cathodically protected shall be electrically isolated from one another and the vessel's earthing system and grounding plates.

6.8.9 Cathodic protection systems shall be compatible with the Solution to the signature Rules of Chapter 01 *Integrated Platform Survivability*. Considerations may be, for example, noise or drag from turbulent flow or cavitation, or detection from electromagnetic effects of the system.

6.8.10 Cathodic protection systems shall be compatible with the Solution to the combat system Rules of Chapter 13 *Combat Systems*. Considerations may be, for example, noise or electromagnetic effects disturbing detectors.

6.8.11 An Operation and Maintenance Manual for the cathodic protection system(s) shall be provided, including:

6.8.11.1 Operating instructions for the safe operation, maintenance, inspection and test of the CP system;

6.8.11.2 Risks to personnel, including divers, of the CP system and their mitigation measures;

6.8.11.3 Risks to the structure of the vessel, particularly internal spaces, of CP system operation and their mitigation measures; and

6.8.11.4 Risks to onboard electrical systems while the CP system is operating and their mitigation measures; and

6.8.11.5 Maintenance, inspection and test procedures and schedule.

Rule 7. Additional Requirements for Ships with the Special Function of Bulk Fuel Carriage

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.

Solution

7.2 Ships with the Special Function of Bulk Fuel Carriage shall be subject to an enhanced programme of survey in accordance with, or equivalent to, the IMO International Code on the Enhanced Programme of Inspections During Surveys of Bulk Carriers and Oil Tankers, 2011 (2011 ESP Code) or the International Association of Classification Societies (IACS) Unified Requirements Z10.1 'Hull Surveys of Oil Tankers' or Z10.4 'Hull Surveys of Double Hull Oil Tankers', as appropriate.

Rule 8. Provision of Operational Information

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.

Solution

8.2 The ship shall be provided with the structural loading and operation manuals and as-built construction drawings required by the ship's Classification Society to maintain certification with the relevant construction marks, symbols or notations assigned by that Society.

8.3 Where a residual strength assessment has been conducted, the residual strength assessment manual shall be provided indicating ship survivability following realisation of the defined threat damage assessed in Rule 3 *Structural Design*.

8.4 Operation and maintenance manuals shall be provided for the ship's coatings and cathodic protection systems.

8.5 Loading computers, where fitted, shall:

8.5.1 Have hardware approved by the ship's Classification Society.

8.5.2 Have software approved by the ship's Classification Society against the approved Loading Manual.

8.5.3 Also calculate intact and damage stability in accordance with Chapter 03 *Buoyancy and Stability* Rule 8 *Provision of Operational Information*.

Rule 9. Military Features

9.1 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.

Solution

9.2 The military features of the ship's structure shall be designed, constructed, and maintained, to the structural rules of the ship's Classification Society applicable to the features and

performance levels defined in the OSI, and shall be certified with the relevant class notations assigned by that society.

9.3 The NVO and the ANC Authority shall agree an independent assurance program for construction of any ANC Rule requirements which are not in the scope of the Classification Society's certification.

9.4 The Master Reference Plane shall be installed in a sheltered, accessible position in the vicinity of maximum hull stiffness and where minimum hull deformations are anticipated through the ship's life.

9.5 The Master Reference Plane shall be installed to:

9.5.1 Be parallel to the ship-base plane;

9.5.2 Be perpendicular to the centreline reference plane;

9.5.3 Have a surface that is level and flat to the precision required by the combat system equipment; and

9.5.4 Be secured against inadvertent movement or adjustment.

Rule 10. Hull Marks

10.1 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.

Solution

10.2 All hull marks shall be painted either white, or black, to contrast with the colour of the hull. Typical form and size of hull marks are given in Part 3 Guidance.

Note: Draught mark requirements are given in Chapter 03 *Buoyancy and Stability* Rule 3.

10.3 A Naval Vessel shall display appropriate symbol marks to warn of any danger to other vessels operating in the near vicinity, such as overhanging propellers, overhanging stabiliser fins, side thrusters, bulbous bows, and any other protrusion, or vulnerable area, that may be damaged by tug and berthing operations.

10.4 Push point symbol marks shall be located on the area designed for tug pushing, usually in line with a transverse bulkhead.

10.5 Symbol marks shall be located above the boot topping.

10.6 Hull marks shall be affixed permanently to, or painted on, the exterior of the hull. Where the position of hull marks could be lost due to abrasive cleaning or painting, reference marks are to be permanently fitted to identify the location of the hull marks.

10.7 Permanently fitted hull marks, including reference marks, shall be attached in accordance with the rules of the ship's Classification Society.

10.8 Permanently fitted hull marks, including reference marks, shall not be located where they could increase the susceptibility or vulnerability of the vessel, such as reducing the vessel's sonar capability or interfering with other sensitive equipment.