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DIVISION 5: REMOTE AND AUTONOMOUS SYSTEMS

SECTION 4: LARGE UNCREWED SURFACE VESSELS

CHAPTER 04: ENGINEERING SYSTEMS

PART 1: ANC RULES

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

389

CN Dagg, CSC Assistant Secretary Australian Naval Classification Authority Department of Defence CANBERRA ACT 2600 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 5: Remote and Autonomous Systems (RAS) Rules Section 4: Large Uncrewed Surface Vessel (L-USV) Part 1: ANC Rules

Chapter 04: Engineering Systems

Contents	
Rule 0.	Goal
Rule 1.	General
Rule 2.	Not Used4
Rule 3.	Provision of Operational Information4
Rule 4.	Propulsion4
Rule 5.	Manoeuvring5
Rule 6.	Pressure and Piping systems5
Rule 7.	Ship Stabilising Systems
Rule 8.	Not Used6
Rule 9.	Other Essential Safety Functions
Rule 10.	Electrical Generation and Power Supplies
Rule 11.	Not Used6
Rule 12.	Not Used6
Rule 13.	Electrical Distribution and Equipment
Rule 14.	Lighting7
Rule 15.	Electrical Protection Arrangements
Rule 16.	Machinery Control
Rule 17.	Alerts and Safety Systems
Rule 18.	Systems Integration
Rule 19.	Heating, Ventilation and Air Conditioning (HVAC)8
Rule 20.	Tanks9
Rule 21.	Not Used9
Rule 22.	Not Used9
Rule 23.	Refrigeration Systems
Rule 24.	Sea Water Systems
Rule 25.	Fresh Water Systems
Rule 26.	Fuel and Lube Oil Systems
Rule 27.	Hydraulic Systems
Rule 28.	Compressed Air Systems
Rule 29.	Other Compressed Gas Systems
Rule 30.	Not Used
Rule 31.	Ships Integrated Control System (ICS)10
Rule 32.	Remote Monitoring

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Rule 33. Remote Control 11 Rule 34. Autonomy 11

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 Not used.
- 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) from the Remote Command Unit (RCU) as required by the Operating and Support Intent (OSI);
- 0.1.6 Minimise the risk of fire, explosion, or contamination of the atmosphere;
- 0.1.7 Provide essential safety functions in the event of all foreseeable damage; and
- 0.1.8 Enable the maintenance and repair in the L-USV's maintenance plan.
- 0.2 Additional systems or equipment not directly covered by this Chapter, shall not impact on the L-USV'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 whole L-USV. 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 ANC Rules, as applicable to the design, and therefore to meet the Chapter 04 Engineering Systems goal, the requirements of both this chapter and Division 2 Core Design Rules Chapter 01 General Requirements and Chapter 01 Integrated Platform Survivability shall be met.
- 1.3.1 Division 3 *Ship Rules* Chapter 04 *Engineering Systems* goal applies to all Naval Vessels greater than 24m length overall that carry persons. Therefore, to meet the Chapter 04 *Engineering Systems* goal, a L-USV that requires embarked persons, shall meet the requirements of both this chapter and the requirements of Division 3 *Ship Rules* Chapter 04 *Engineering Systems* as applicable to the design.

Division 5, Section 4, Chapter 04, Part 1

- 1.3.2 The Rules listed in this Chapter are based on those in the corresponding Chapter within Division 3 *Ship Rules* and have been adapted for L-USV. When referring to Division 2 or 3, the following terms may be interchanged:
- 1.3.2.1 'Ship' as ' L-USV';
- 1.3.2.2 'Crew' or 'Operator' or 'Embarked Persons' as 'End User';
- 1.3.2.3 'Primary, Main or Damage Control Station' as 'Remote Command Unit (RCU)';
- 1.3.2.4 'Bridge' or 'conning position' as RCU; and
- 1.3.2.5 'Signature Reduction' as 'Signature Management'.
- 1.4 The Engineering Systems of the L-USV shall match its RAS Maturity Level to allow End Users to safely operate the L-USV to achieve missions listed in the OSI.
- 1.5 Where the requirements of other chapters, such as Chapter 06 Fire Safety, Chapter 07 Escape, Evacuation & 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 to meet the relevant Functional Objectives and Goals for both Chapters. Specifically, on the interface with Chapter 10 Dangerous Goods, Chapter 04 Engineering Systems contains the overarching requirements for Engineering Systems that apply to the carriage and use of Dangerous Goods (Class 1-9), Chapter 10 Dangerous Goods supplements Chapter 04 Engineering Systems by providing additional requirements applicable to Class 1 Dangerous Goods (Explosives).

Application

- 1.6 In addition to the requirements contained elsewhere in the present rules, L-USV's 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 ANC Authority, or through alternative standards prescribed by the ANC Authority which provide an equivalent level of safety.
- 1.7 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.
- 1.8 For certain L-USV types 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 ANC Authority.

Rule 2. Not Used

Rule 3. Provision of Operational Information

3.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 3 *Provision of Operational Information.*

Rule 4. Propulsion

4.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 4 *Propulsion* as amended in Table 1.1 below:

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Table 1.1: Division 3 Chapter 04 Rule 4 Amendments

Rule Number	Amendment
4.1	The propulsion machinery shall enable the L-USV to manoeuvre as and when required by the End User but still remain within the designed or imposed limitations.
4.5	Not used.
4.10	Machinery spaces and exhaust systems shall be designed to attenuate noise and vibration from engines and turbines to meet the requirements of Division 02 Rules Chapter 01 Rule 07 <i>Hazardous Areas</i> and Rule 14 <i>Platform and Equipment Vibrations</i> .

Rule 5. Manoeuvring

5.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 5 *Manoeuvring* as amended in Table 1.2 below:

Table 1.2: Division 3 Chapter 04 Rule 5 Amendments

Rule Number	Amendment
5.4	Operation of the manoeuvring equipment shall be possible from a number of locations in the RCU.
5.7	Not used.

Rule 6. Pressure and Piping systems

6.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 6 *Pressure and Piping systems* as amended in Table 1.3 below:

Table 1.3: Division 3 Chapter 04 Rule 6 Amendments

Rule Number	Amendment
6.3	Surface temperature of pipes shall not become a source of ignition in case of flammable fluid leaks.
6.6	Valves associated with maintaining watertight integrity shall be operable by the End User from the RCU as required by the RAS Maturity level of the L-USV.
6.9	Pressure relief arrangements shall not pose a danger to the environment or any other L-USV's system. Where the media contained poses a safety hazard to the environment, arrangements shall be put in place to minimise the risk following release.
6.14	Piping systems shall not obstruct access for maintenance of equipment or structure.

Rule 7. Ship Stabilising Systems

7.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 7 *Ship Stabilising Systems* as amended in Table 1.4 below:

Table 1.4: Division 3 Chapter 04 Rule 7 Amendments

Rule Number	Amendment
7.1	Where fitted, Motion Control Systems shall stabilise the L-USV to motion limits compatible with the OSI sea-keeping requirements under all load conditions.
7.4	Not used.

Rule Number	Amendment
7.6	The operation of the L-USV's stabilising systems shall not result in an unsafe condition for the vessel or equipment.
7.10	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 L-USV operating or sea-keeping capability.

Rule 8. Not Used

Rule 9. Other Essential Safety Functions

9.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 9 *Other Essential Safety Functions*.

Rule 10. Electrical Generation and Power Supplies

10.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 10 *Electrical Generation and Power Supplies* as amended in Table 1.5 below:

Table 1.5: Division 3 Chapter 04 Rule 10 Amendments

Rule Number	Amendment
10.1	Electrical power shall be provided to supply the required services during all operational conditions without recourse to the emergency electrical supply.
10.16	Not used.

Rule 11. Not Used

Rule 12. Not Used

Rule 13. Electrical Distribution and Equipment

13.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 13 *Electrical Distribution Equipment* as amended in Table 1.6 below:

Rule Number	Amendment
13.4	The electrical system voltages and frequencies shall ensure safe provision of electrical power to systems and shall minimise the risk of exposure to End Users.
13.5	The design of the type and configuration of the distribution system, including earthing arrangements as necessary, shall minimise the risk to equipment, to End Users, equipment, or Platform under normal and foreseeable abnormal conditions.

Table 1.6: Division 3 Chapter 04 Rule 13 Amendments

Rule Number	Amendment
13.8	Cables shall be installed such that risk of damage to the system is minimised when equipment is operating in foreseeable or under fault conditions.
13.11	Arrangements for the isolation and switching of distribution circuits shall be provided depending on the RAS Maturity Level of the L-USV and the requirements of the OSI.
13.13	Not used.
13.14	Not used.
13.15	Where a damage control emergency distribution system is installed, it shall not introduce additional risk of harm to equipment or the platform.

Rule 14. Lighting

14.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 14 *Lighting* as amended in Table 1.7 below:

Table 1.7: Division 3 Chapter 04 Rule 14 Amendments

Rule Number	Amendment
14.2.5	Not used.
14.2.7	Not used.
14.2.8	Not used.
14.10	Not used.
14.12	Not used.
14.16	Not used.

Rule 15. Electrical Protection Arrangements

15.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 15 *Electrical Protection Arrangements* as amended in Table 1.8 below:

Rule Number	Amendment
15.1	All electrical equipment shall be suitably protected against damage to itself under normal, reasonably foreseeable abnormal and fault conditions and to prevent or damage to other equipment.
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 End Users.
15.4	Arrangements shall be provided to minimise the effects and likelihood of arc flash on equipment, and provide protection for equipment against arc flash, during operation or while undergoing maintenance.
15.14	Suitable arrangements shall be provided to minimise the effects of radiation hazards to End Users.
15.15	Efficient protection shall be provided for protecting End Users from electric shock and earth leakage in accordance with relevant Commonwealth and State Legislation.
15.19	Arrangements of administrative signage to minimise the risk of electric shock shall be provided in accordance with the Australian Legislation to minimise risk of injury to End Users.

Table 1.8: Division 3 Chapter 04 Rule 15 Amendments

Rule 16. Machinery Control

16.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 16 *Machinery Control* as amended in Table 1.9 below:

Table 1.9: Division 3 Chapter 04 Rule 16 Amendments

Rule Number	Amendment
16.1	Main and Auxiliary Machinery & Systems essential for the safety of the L-USV shall be provided with effective means for its operation and control during all operational conditions defined in the OSI.
16.7	For unattended machinery spaces, a machinery control and alarm position shall be provided, at the RCU in accordance with the RAS maturity level specified in the OSI.
16.9	End Users 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.

Rule 17. Alerts and Safety Systems

17.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 17 *Alerts and Safety Systems* as amended in Table 1.10 below:

Table 1.10: Division 3 Chapter 04 Rule 17 Amendments

Rule Number	Amendment
17.1	The alert system shall inform End Users at the RCU as soon as reasonably practicable of deviations from normal operation of machinery and systems during all L-USV operations.

Rule 18. Systems Integration

18.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 18 *Systems Integration.*

Rule 19. Heating, Ventilation and Air Conditioning (HVAC)

19.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 19 *Heating, Ventilation and Air Conditioning (HVAC)* as amended in Table 1.11 below:

Table 1.11: Division 3 Chapter 04 Rule 19 Amendments

Rule Number	Amendment
19.2	Not used.
19.5	Not used.
19.6	The ventilation requirements of Division 5 Section 4 Chapter 06 <i>Fire Safety</i> and Division 5 Section 4 Chapter 09 <i>Navigation</i> Rule 2 <i>Bridge Working Environment</i> shall be met. Ventilation arrangements shall comply with the requirements of Division 5 Section 4 Chapter 01 <i>Integrated Platform Survivability</i> Rule 2 <i>Post Damage Capability</i> .
19.8	Provisions to 'Crash Stop' ventilation in case of fire shall be provided to the End User located at the RCU if required by the OSI.

Rule 20. Tanks

20.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 20 *Tanks* as amended in Table 1.12 below:

Table 1.12: Division 3 Chapter 04 Rule 20 Amendments

Rule Number	Amendment
20.1	Bulk fluids, required for machinery systems shall be safely stored.
20.2	Suitable arrangements to safely determine the level of fluid in a tank shall be provided, in accordance with the RAS Maturity Level of the L-USV as specified in the OSI.

Rule 21. Not Used

Rule 22. Not Used

Rule 23. Refrigeration Systems

23.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 23 *Refrigeration Systems* as amended in Table 1.13 below:

Table 1.13: Division 3 Chapter 04 Rule 23 Amendments

Rule Number	Amendment
23.7	Not used.

Rule 24. Sea Water Systems

24.1 The L-USV shall comply with Division 3 Chapter 04 Rule 24 Sea Water Systems.

Rule 25. Fresh Water Systems

25.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 25 *Fresh Water Systems* as amended in Table 1.14 below:

Table 1.14: Division 3 Chapter 04 Rule 25 Amendments

Rule Number	Amendment
25.4	Not used.

Rule 26. Fuel and Lube Oil Systems

26.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 26 *Fuel and Lube Oil Systems*.

Rule 27. Hydraulic Systems

27.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 27 *Hydraulic Systems*.

Rule 28. Compressed Air Systems

28.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 28 *Compressed Air Systems* as amended in Table 1.15 below:

Table 1.15: Division 3 Chapter 04 Rule 28 Amendments

Rule Number	Amendment
28.3	Not used.

Rule 29. Other Compressed Gas Systems

29.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 29 *Other Compressed Gas Systems*.

Rule 30. Not Used

Rule 31. Ships Integrated Control System (ICS)

31.1 The L-USV shall comply with Division 3 *Ship Rules* Chapter 04 *Engineering Systems* Rule 31 *Ships Integrated Control System (ICS)* as amended in Table 1.16 below:

Table 1.16: Division 3 Chapter 04 Rule 31 Amendments

Rule Number	Amendment
31.1	The L-USV ICS shall provide fault tolerant control and monitoring functions of ship machinery and systems while maintaining the overall safety of the L-USV and protection of equipment.
31.3	The L-USV's ICS shall operate machinery and systems in a safe, controlled and stable manner throughout the defined operational limits. Failure of the L-USV's ICS shall not cause the loss of control to systems that could impact on the seaworthiness of the L-USV.
31.11	The onboard L-USV's ICS and the ICS's remote pier-side monitoring system, if specified by the OSI, shall comply with the cyber-worthiness requirements in Division 2 <i>Core Design Rules</i> Chapter 02 <i>Cyber-worthiness</i> .
31.12	The L-USV's ICS shall provide the facilities to conduct training of the ICS operations and functions using a fully simulated environment of the L-USV's systems, if specified by the OSI.

Rule 32. Remote Monitoring

Functional Objective

32.1 The L-USV shall have remote monitoring capabilities to ensure monitoring of engineering systems.

Scope

32.2 This rule is applicable for L-USV with a Remote Monitoring level of RM1 or greater.

Performance Requirements

- 32.3 L-USV systems with a Remote Monitoring level of RM1 shall have the capability to remotely monitor engineering systems data critical for operation.
- 32.4 L-USV systems with a Remote Monitoring level of RM2 or greater shall have the capability to monitor engineering systems data as far as reasonably practical to achieve the OSI requirements.

Rule 33. Remote Control

Functional Objective

33.1 The L-USV shall have Remote Control capabilities to ensure effective Engineering Systems.

Scope

33.2 This rule is applicable for L-USV with a Remote Control level of RC1 or greater.

Performance Requirements

- 33.3 L-USV systems with a Remote Control level of RC1 shall be able to control critical systems when required in the OSI.
- 33.4 L-USV systems with a Remote Control level of RC2 or greater shall be able to control systems required for safe operation IAW with OSI.
- 33.5 L-USV systems with a Remote Control level of RC3 or greater shall have the capability to control systems essential to maintaining operations to achieve the system OSI.
- 33.6 L-USV systems with a Remote Control level of RC4 shall be able to control all systems typically operated by onboard operators.

Rule 34. Autonomy

Functional Objective

34.1 The L-USV shall have autonomy control and decision-making capabilities to ensure control of engineering systems.

Scope

34.2 This rule is applicable for L-USV with an Autonomy level of A1 or greater.

Performance Requirements

34.3 L-USV systems with an Autonomy level of A1 or greater shall be able to autonomously control defined systems and subsystems IAW the OSI.

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