Australian Transport Council

National Standard

for

Commercial Vessels

PART C

DESIGN AND CONSTRUCTION

SECTION 5

ENGINEERING

SUBSECTION 5B

ELECTRICAL

Edition 2

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FOREWORD

Edition 1 of this subsection of the National Standard for Commercial Vessels was developed following a review of the Uniform Shipping Laws Code (USL) Code Section 9: Engineering, and replaced part 4: Electrical of that Section.

Public consultation was carried out in 2000 and 2001 with Edition 1 of this subsection being endorsed by the Australian Transport Council (ATC) in July 2002, and published on CD in August 2002. Edition 1 of this subsection had not been adopted through legislation.

Following publication of Edition 1 of this subsection, a number of concerns were raised regarding the fact that the standard followed class society rules, rather than Australian standards.

In 2003 NMSC commenced a revision of this subsection. The revised version was reviewed by a reference group comprising government and industry prior to release for public comment in December 2004.

Public comment was reviewed by a reference group comprising industry and government in April 2005, with the recommendations of the group being accepted by NMSC in July 2005. The final draft of this subsection was approved by NMSC in August 2005, and endorsed by ATC on 18 November 2005.

The Regulatory Impact Statement was prepared in accordance with COAG guidelines, and the final draft of the RIS was accepted by the Office of Regulatory Review (ORR).

The major change between Edition 1 and 2 of this subsection is a requirement for vessels to comply with AS/NZS 3000: *Electrical installations* (known as the Australian/New Zealand Wiring Rules). Compliance with AS/NZS 3000 has meant a large number of prescriptive requirements have been deleted. Those remaining are specific requirements needed to meet the special conditions found on vessels and in the marine environment.

This edition supersedes the first edition.

This Subsection of the National Standard for Commercial Vessels is intended to be read in conjunction with Part A—Safety Obligations, and Part B—General Requirements.

The following documents were consulted during the development of this subsection of the NSCV:

IEC 60092—*Electrical installations in ships*

ISO 10133—*Small craft – Electrical systems – Extra-low-voltage d.c. installations*

ISO 13297—*Small craft - Electrical systems - Alternating current installations*

AS 1852—*International electrotechnical vocabulary*

These documents may provide assistance to users of this Subsection.

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CHAPTER 1 PRELIMINARY

1.1 SCOPE

This Subsection of the NSCV specifies the following:

a) Common requirements for all electrical systems (Chapter 2).

b) Specific requirements for extra-low voltage systems (Chapter 3).

c) Specific requirements for low voltage systems (Chapter 4).

d) Emergency electrical installations (Chapter 5).

This Subsection of the NSCV shall be read in conjunction with Part B—General Requirements of the NSCV.

1.2 APPLICATION

1.2.1 Vessels of measured length 35 metres or more

The electrical installations on vessels of measured length 35 m or more shall—

a) meet the requirements of, and be assessed under, the rules of a Classification Society; and

b) comply with the requirements of Clauses 2.2 to 2.9 of this Subsection.

NOTE: Classification Society is defined in NSCV Part B.

In addition, electrical installations on the following vessels of measured length 35 m or more shall also comply with the following:

i) Class 1A vessels shall comply with the requirements specified in Marine Orders Part 12 for SOLAS passenger vessels.

ii) Class 2A and 3A vessels of 500 GT and over shall comply with the requirements specified in Marine Orders Part 12 for SOLAS cargo vessels.

1.2.2 Vessels of measured length less than 35 metres

The electrical installations on vessels of measured length less than 35 m shall comply with this Subsection of the NSCV.

Class 1A vessels of measured length less than 35 m shall also comply with the requirements for electrical installations specified in Marine Orders Part 12 for SOLAS passenger vessels.

1.2.3 Exceptions

This subsection does not apply to Special Vessels provided for in Part F of this standard, unless Part F specifies otherwise.

NOTE: Such vessels include fast craft, hire and drive vessels and novel vessels.

1.3 OBJECTIVE

The objective of this Subsection is to provide vessel designers and builders with specifications on how to design, install and repair the

electrical system so that, when used with reasonable care and under normal conditions, the system will—

a) perform reliably; and

b) minimise the risk of hazards such as fire and personal injury.

1.4 REQUIRED OUTCOMES

In this Subsection of the NSCV, Chapter 2 specifies the required outcomes for the electrical system and installation as a whole. Where necessary, subsequent Chapters specify additional required outcomes for the part of the electrical system dealt with in that Chapter. The required outcomes are mandatory to the extent that they are applicable to a particular vessel. The required outcomes within each Chapter are followed by solutions that are "deemed-to-satisfy" these required outcomes. Compliance with required outcomes may also be achieved through the application of the equivalent solutions that comply with the principles set out in Part B of this National Standard.

When developing an equivalent solution, it is a requirement of this National Standard that the overall system safety is maintained.

NOTE: A proposed solution that satisfies one or more required outcomes in isolation but has negative effects on compliance with other required outcomes would not be considered an equivalent solution under Part B of this National Standard.

1.5 REFERENCED DOCUMENTS

The following documents are referenced in this Subsection of the NSCV. Any referenced document shall be considered to be the latest revision of the document, including amendments and supplements.

NATIONAL MARINE SAFETY COMMITTEE

National Standard for Commercial Vessels

Part B—General Requirements

Part C—Design and Construction

Section 4: Fire Safety

Section 5: Engineering

Subsection 5A-Machinery

Section 7: Equipment

Subsection 7A—Safety Equipment

Subsection 7B—Communication Equipment

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

AS/NZS 1125—*Conductors in insulated electric cables and flexible cords*

AS/NZS 1768—*Lightning protection*

AS 2676.1—*Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings - Vented cells*

AS 2676.2—*Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings - Sealed cells*

AS/NZS 3000—*Electrical installations* (known as the Australian/New Zealand Wiring Rules)

AS/NZS 3004—*Electrical installations – Marinas and pleasure craft at low voltage*

AS/NZS 3008.1.1—*Electrical installations – Selection of cables – cables for alternating voltages up to and including 0.6/1 KV – Typical Australian installation conditions*

AS 3011.1—*Electrical installations - Secondary batteries installed in buildings - Vented cells*

AS 3011.2—*Electrical installations - Secondary batteries installed in buildings - Sealed cells*

AS/NZS 3017—*Electrical installations - Testing and inspection guidelines*

AS/NZS 3112—*Approval and test specification – Plugs and socket-outlets*

AS/NZS 3123—*Approval and test specification - Plugs, socket-outlets and couplers for general industrial application*

AS/NZS 3187—*Approval and test specification - Mineral-insulated metal-sheathed cables*

AS/NZS 3191—*Electric flexible cords*

AS/NZS 5000.1—*Electric cables - Polymeric insulated – for working voltages up to and including 0.6/1 kV*

AS 60529—*Degrees of protection provided by enclosures (IP Code)*

AS/NZS 61558.2.16.2—*Safety of power transformers, power supply units and similar – Part 2.16.2: Particular requirements for portable inverters*

AUSTRALIAN MARITIME SAFETY AUTHORITY

Marine Orders Part 12 *Construction – Subdivision & Stability, Machinery and Electrical Installations*

1.6 DEFINITIONS

For the purposes of this Subsection of the NSCV—

a) the definitions provided in Part B of the NSCV, in addition to those in this Clause, shall apply; and

b) the definitions in AS/NZS 3000 shall apply.

Where there is any duplication in the terms defined in this subsection and the definitions in AS/NZS 3000 or the definitions in Part B of the NSCV, the definitions in this Clause shall apply.

battery compartment—
a room, locker or space used solely for the storage of batteries.

earth—

the conductive mass of earth, whose electric potential at any point is conventionally taken as equal to zero.

NOTE: A vessel's earth is established by a conducting connection (intentional or accidental) with the earth, including any conductive part of the wetted surface of a hull.

earth electrode—

all earth connections, including a main earth connection, to the hull of a metal hulled vessel and the connection(s) to the earth plate of a vessel with a non conductive hull. Earth electrodes include hull or earth plate connections for protective earthing, equipotential bonding, lightning protection, and/or communication systems.

emergency switch board (ESB)—

a switchboard supplied by the emergency source of power and from which the emergency electrical installation can be supplied.

essential services—

those services essential for safety of persons and safe navigation.

NOTE: This may include auxiliaries necessary for propulsion and power generation, steering gear, watertight doors, bilge and fire pumps, engine room ventilation, navigation lights, emergency lighting, communication equipment, navigation aids, and alarm systems.

inverter—

a device that uses semi-conductor devices to transfer power between a d.c. source or load and an a.c. source or load.

isolated earth system—

a system of distribution in which no point is normally connected to earth.

licensed electrician—

a person licensed or authorised by a state or territory electrical licensing authority to carry out electrical work in that state or territory.

main switch board (MSB)—

a switchboard directly supplied by the main source of electrical power and from which the whole electrical installation can be supplied.

shore supply—

a supply of electrical energy located onshore or at any other source external to the vessel.

voltage—

the difference in potential between conductors and between conductors and earth as follows:

a) **extra-low voltage (ELV) –** not exceeding 50 V a.c. or 120 V d.c.

b) **low voltage (LV) –** exceeding extra-low voltage but not exceeding 1000 V a.c. or 1500 V d.c.

c) **high voltage (HV) –** exceeding low voltage.

NOTE: From AS/NZS 3000.

1.7 ABBREVIATIONS

ELV—

Extra-low voltage

ESB—
emergency switchboard

LV—
Low voltage

HV—
High voltage

MEN—
multiple earthed neutral

MSB—
main switchboard

RCD—
residual current device

CHAPTER 2 COMMON REQUIREMENTS FOR ALL ELECTRICAL SYSTEMS

2.1 SCOPE

This Chapter sets out the requirements for electrical equipment and electrical installations that are common to all electrical systems used in vessels.

REQUIRED OUTCOMES

2.2 SAFETY PROTECTION

Protection must be provided to prevent inadvertent contact by personnel and passengers with parts of the electrical installation that are live in normal service and those that may become live during fault conditions. Electrical equipment and installations must minimise the risk of fire, damage and physical injury when a vessel's electrical equipment is used with reasonable care. Minimisation must include overcurrent protection, appropriate insulation, appropriate construction, fault indication, safety trips, and effective operational and maintenance procedures.

2.3 FUNCTIONALITY AND RELIABILITY

A vessel's electrical installation must be designed, and electrical equipment selected and installed, so as to maintain the functionality and reliability of the installation under operating conditions expected in the marine environment. The functionality and reliability of systems and equipment necessary for the safe operation of the vessel must be maintained during normal and emergency operations (e.g. avoidance of electromagnetic interference with navigation equipment). The vessel's electrical installation must be of a quality and standard that will limit the degradation of the installation from the extreme conditions expected in the marine environment (e.g. electrochemical corrosion).

2.4 PROTECTION AGAINST OVERCURRENT

Protection must be provided against damage due to excessive temperature rise or electromechanical stresses caused by over-currents that may arise in conductors.

2.5 WATERTIGHT AND FIRE INTEGRITY

Where a wiring system passes through a deck or bulkhead that is required to be of watertight or fire-rated construction the integrity of the construction must be maintained. Where the routing of a wiring system requires the penetration of solid surfaces such as bulkheads or decks, the wiring system must be effectively protected from mechanical damage.

2.6 ISOLATION

Electrical installations, and parts of installations, must be provided with isolation devices to prevent or remove hazards associated with abnormal

operation (e.g. faults such as short circuits) and to allow maintenance of electrical equipment.

2.7 EMERGENCY SUPPLY

Electrical services essential for personal safety, the safety of the vessel and the safety of navigation must remain operational under emergency conditions.

2.8 OPERATION AND MAINTENANCE

The electrical system of a vessel must be designed and installed to facilitate its identification, safe use, inspection and maintenance.

2.9 BATTERIES

Battery installations must be designed and installed to eliminate or minimise risks associated with the emission of gases, corrosive fluids, electrochemical corrosion, movement, mechanical damage, and exposed terminals.

DEEMED-TO-SATISFY SOLUTIONS

2.10 COMPLIANCE

For the purpose of this National Standard, the common requirements for an electrical installation shall be deemed-to-satisfy the required outcomes in Clauses 2.2 to 2.9 if they comply with—

a) AS/NZS 3000 Electrical installations; and

c) Clauses 2.11 to 2.22 of this Chapter.

Where there is any conflict in the requirements in this Subsection and the requirements in AS/NZS 3000 *Electrical installations* the requirements in this Subsection shall apply.

2.11 ISOLATION

Isolation devices must operate in all active conductors but must not interrupt a neutral conductor unless allowed for in AS/NZS 3000 or in this standard.

Isolation devices must not interrupt an earthing conductor.

2.12 RADIOS

The electrical power supply for radios shall comply with the relevant requirements of Part C Subsection 7B Communication Equipment of the NSCV.

2.13 EARTHING AND BONDING

2.13.1 Earthing

2.13.1.1 General

Earthing arrangements shall comply with AS/NZS 3000 and the provisions in Clauses 2.13.1.2 to 2.13.1.4 of this Chapter.

2.13.1.2 Earthing systems

2.13.1.2.1 Method of earthing

The method of earthing for a.c. systems at voltages greater than 50 V shall be—

a) a multiple earthed neutral (MEN) system; or

b) an isolated earth system.

The method of earthing for d.c. systems shall be—

i) a negative earth; or

ii) an isolated earth.

NOTES:

1. AS/NZS 3000 provides guidance for earthing of ELV systems.
2. An installation may include mixed methods of earthing. Earthing systems should be mixed only after consideration of the possible fault currents in each system.

2.13.1.2.2 Main earth connection

In a vessel with a hull constructed wholly of metal, the main earth conductor shall be taken from the earth terminal, bar, or link at the main switchboard to an earth electrode solidly connected to the hull.

In a vessel with a hull not constructed wholly of metal, the main earth conductor shall be taken from the earth terminal, bar, or link at the main switchboard to an earth electrode solidly connected to an earth plate

The main earth conductor shall run in as direct a manner as practicable and shall not be connected to any other appliance.

2.13.1.2.3 MEN earth systems

In an MEN earthing system the neutral to earth bond should be made at each generator.

NOTE: This avoids tripping of shore based RCDs. The MEN bond is switched out of the system because the shore power/vessel supply changer over switch operates in all live conductors.

2.13.1.2.4 Isolated earthing systems

An electrical system isolated from earth shall employ an earth fault monitor or insulation resistance monitor.

Where earth lamps are used for this function, the lamps shall—

a) be of a filament type;

b) not exceed 30 W;

c) be of the same colour;

d) be placed not more than 125 mm apart; and

e) have a lamp test capability.

Each generator in an isolated earth system shall have an earth fault monitor or insulation resistance monitor.

2.13.1.3 Earthing and bonding electrodes

All connections to the vessel's hull or earth plate shall—

a) be accessible for inspection;

b) be secured by means of a screw or stud used for this purpose only with a diameter suited to the size of the earth conductor but not less than 6 mm;

c) be protected against corrosion; and

d) remain unpainted.

NOTE: Care should be taken to ensure bright metallic surfaces at the contact areas immediately before the nut or screw is tightened. The use of washers of a type that bite into the metal is recommended. To protect against electrolytic corrosion, care must be taken in the choice of metals and methods used to make the connection. Where necessary the joint should be protected with anti-oxidation grease.

Earth electrodes used for the connection of lightning protection to a vessel's hull or earth plate shall not be used for connection of protective earthing, equipotential bonding or communication equipment earthing.

2.13.1.4 Earth plates

All electrical installations on vessels of non-metal hull construction shall incorporate an earth plate that complies with the following:

a) The earth plate shall be—

   i) manufactured from copper or other material of equivalent mechanical and electrical properties; and

   ii) securely attached with non-corrodible fastenings to the hull of the vessel.

b) The earth plate shall be positioned so that it is immersed at all times during operation of the vessel.

c) The earth plate shall have an area of at least 0.25 m2, and shall be at least 3.2 mm thick.

d) Connections to the earth plate shall comply with Clause 2.13.1.3.

If more than one earth plate is used, all earth plates shall be equipotentially bonded (see Clause 2.13.2).

The same earth plate may be used for protective earthing, functional earthing of communications equipment, and lightning protection. Main earth (protective earth), functional earthing and lightning down conductors shall be run separately to the earth plate(s) and connected by separate electrodes to the earth plate(s).

2.13.2 Bonding

Equipotential bonding shall—

a) have a resistance to earth of less than 0.5 ohm; and

a) in non metallic vessels, be provided between all engine bedplates, generator frames, metallic elements of the fuel system, fixed metal objects with a surface area in excess of 0.4m^2, and the earth plate.

To help dissipate possible static build up and to minimise the effects of electrolytic corrosion it is recommended that metallic fittings, particularly those in contact with the sea, are bonded to the main earth system.

NOTE: For electrical bonding requirements relating to preventing static charges on fuel tanks and fuel systems see NSCV Part C Subsection 5A.

2.14 NAVIGATION LIGHTS AND NAVIGATION EQUIPMENT

2.14.1 General

The provision of navigation lights, navigation equipment and their sources of power shall comply with the provisions of NSCV Part C Section 7 and Clauses 2.14.2 to 2.14.4 of this Subsection.

2.14.2 Navigation lights

Each light shall be wired by a separate circuit to a—

a) discrete section of a distribution board; or

b) panel dedicated to navigation lights.

The use of junction boxes in navigation light circuits shall be limited to those needed to connect the navigation lights to fixed wiring. Navigation light circuits shall not share wiring enclosures or junction boxes with other circuits.

Each light shall be—

i) individually controlled; and

ii) protected in each insulated pole by a fuse or a circuit breaker, mounted on the navigation light distribution board or panel.

2.14.3 Navigation light distribution board

The navigation light distribution board or panel shall only be used for supplying power to the navigation lights. The board or panel shall be connected either directly, or through a transformer, to the main switchboard (MSB) and /or the emergency switchboard (ESB).

If a separate emergency supply is used then there shall be two separate supplies to the navigation light distribution board or panel, one from the MSB and one from the ESB.

Any alternate supply change over (i.e. from the main to the emergency supply), and any change over for alternate navigation lights, shall be operable from the wheel house or the helm position, and shall be easily accessible to the watchkeeper.

2.14.4 Indicators and alarms

If the navigation lights are not visible from the vessel's deck then the lights shall be provided with an automatic indicator to give an audible or visual

indication of lamp failure. The indicators shall be in the wheel house or at the helm position and placed to gain the attention of the watchkeeper.

If a visual indicator is connected in series with the navigation lamp then a means shall be provided to prevent failure of the navigation lamp in the case of failure of the indicator.

If an audible indicator is used, it shall be connected to a separate source of supply, and provision shall be made for testing this supply.

2.15 CABLES AND WIRING SYSTEMS

2.15.1 Wiring systems

The following shall apply in addition to the wiring system requirements of AS/NZS 3000.

a) Wiring systems supplying steering machinery, navigation lights, navigation and communication equipment, wiring systems in machinery spaces and wiring systems nominated in the emergency systems provisions of AS/NZS 3000 shall be of a type that are capable of satisfying the AS/NZS 3000 wiring systems requirements for emergency systems.

   Note: further guidance regarding wiring system classification and the fire performance of cables may be found in:

   (i) The selection and installation of wiring systems and the emergency systems provisions of AS/NZS 3000;

   (ii) AS/NZS 3013 Electrical installations – Classification of the fire and mechanical performance of wiring systems; and

   (iii) AS/NZS 4507 Cables – Fire performance.

b) In machinery spaces and on exposed decks cable fixing (i.e. saddles, clips, clamps, ties and straps) shall be of non corrosive metal.

c) Wiring systems and equipment onboard a vessel shall be considered as 'likely to be disturbed'.

   NOTE: AS/NZS 3000 provides the requirements for ‘wiring systems likely to be disturbed’.

2.15.2 Stranded conductors

All conductors in cables, with the exception of mineral-insulated metal sheathed (MIMS) cables, shall be of stranded, annealed copper, constructed in accordance with AS/NZS 1125. MIMS cables shall meet the requirements of AS/NZS 3187.

NOTE: MIMS has limited application in the marine environment due to the risk of vibration and movement. Care should be taken to ensure that MIMS is used appropriately.

2.15.3 Connections

Cable connections and terminations shall be at fixed, enclosed terminals. All connections and terminations shall be accessible.

2.15.4 Penetration of bulkhead or deck

Where the routing of a cable requires the penetration of solid surfaces such as bulkheads or decks, the cable shall be effectively protected from mechanical damage.

Where the penetration is through a watertight or fire rated bulkhead or deck, the watertight and fire rated integrity of the bulkhead or deck shall be maintained.

Penetrations of refrigeration bulkheads or decks, or other insulated bulkheads or decks, shall be as close as practicable to perpendicular to the plane of the bulkhead or deck. Cable shall not be laid under thermal or sound insulation.

Glands and bushes used in bulkhead or deck penetrations shall be corrosion-resistant.

2.15.5 Duplicate supply

Where a duplicate or alternative supply is required (e.g. alternative supplies for the navigation light panel), the two cables shall be routed separately so as to avoid the risk of concurrent damage to both cables.

2.16 LIGHTNING PROTECTION

Vessels with non metallic hulls and/or non metallic structures shall be provided with lightning protection. The minimum level of protection shall be to the requirements for the protection of boats in AS/NZS 1768 *Lightning protection*.

NOTES:

1. Surge suppression devices should be used for the protection of individual circuits and equipment that may contain sensitive components.
2. Information concerning the safety of personnel in electrical storm conditions should be maintained in the vessel's documentation and also that information should be made available to personnel by way of safety signage.
3. Maintenance to the lightning protection system may be required, particularly after exposure to lightning.

2.17 UNACCEPTABLE COMPONENTS MATERIALS AND METHODS

The following components, materials and methods are not suited to the marine environment and shall not be used:

a) Re-wireable fuses.

b) Hull return, except for cathodic protection systems.

c) Aluminium conductors.

2.18 ENGINE ROOM AND CARGO SPACE VENTILATION

Each engine room and cargo space fan shall be supplied from a separate final sub-circuit. All ventilation systems shall be capable of being stopped from a readily accessible position outside the ventilated space.

NOTE: Refer to NSCV Part C Section 4 Fire Safety for requirements regarding remote stops for use in case of fire.

2.19 EQUIPMENT AND ACCESSORIES IN EXPOSED LOCATIONS

Electrically operated equipment and accessories with an IP Rating (International Protection Rating: see AS/NZS 60529) suitable for the location shall be used in exposed locations. No accessories shall be installed less than 0.3 m above the deck unless specifically made for the application, for example a foot switch windlass control.

2.20 OVER CURRENT PROTECTION OF ESSENTIAL SERVICES

Steering gear circuits shall have short circuit protection only and shall be equipped with overload and trip alarms at each helm position.

Other circuits deemed essential may have short circuit protection only, if equipped with an overload alarm.

2.21 COMMISSIONING—INSPECTION AND TESTING

2.21.1 Tests

At the conclusion of construction, modification, or repairs the electrical system, equipment or part shall be inspected and tested in accordance with AS/NZS 3000. The functioning of each RCD shall be verified.

NOTE: Further information on inspection and testing is also available in AS/NZS 3017.

Commissioning tests shall include, as a minimum, the correct operation (i.e. in accordance with manufacturers specifications and the objectives and requirements of this Subsection) of the following equipment where fitted—

a) generator operation including:
   i) engine governors;
   ii) parallel operation;
   iii) load sharing;
   iv) voltage regulator operation by instantaneous loading and unloading of generator; and
   v) safety devices, such as overspeed trips, reverse power trips, over current trips, load shedding, together with the associated controls and alarms.
b) load testing of motors;
c) overload alarm circuits of essential service motors;
d) main engine safety alarms and trips;
e) machinery and equipment that incorporates remote controls, remote stops and limit switches;
f) emergency stop circuits;
g) vessel's alarm systems; and
h) other systems and equipment installed in the vessel.

2.21.2 Test results

All test results shall be recorded and the test results shall remain with the vessel's documentation.

Test results should be dated, accurate, legible and retained for the life of the vessel.

2.22 DESIGN PARAMETERS

Unless otherwise specified, electrical equipment shall be designed for an ambient temperature of at least 45ºC.

CHAPTER 3 EXTRA-LOW VOLTAGE SYSTEMS AND BATTERIES

3.1 SCOPE

This Chapter sets out the requirements for electrical equipment and electrical installations for extra-low voltage systems.

NOTE: Extra-low voltage includes voltages up to 50 V a.c and 120 V d.c

3.2 APPLICATION

This Chapter applies to those parts of a vessel's electricity supply that do not exceed 50 V a.c and 120 V d.c.

NOTE: Requirements for the separation of ELV and LV electrical installations in vessels that have both are covered in AS/NZS 3000.

REQUIRED OUTCOMES

3.3 REQUIRED OUTCOMES

The required outcomes given in Clauses 2.2 to 2.9 of Chapter 2 shall apply to this Chapter.

DEEMED-TO-SATISFY SOLUTIONS

3.4 COMPLIANCE

For the purpose of this National Standard an extra-low voltage electrical installation shall be deemed to have satisfied the required outcomes in Clause 3.3 if it complies with Clauses 3.5 to 3.9 of this Chapter and the relevant Clauses of AS/NZS 3000.

3.5 PROVISIONS OF AS/NZS 3000 NOT TO APPLY

The following provisions of AS/NZS 3000 shall not apply:

a) The provision that states 'Protection against direct contact is not necessary for voltages of 25 V a.c. or 60 V d.c., or below, in dry indoor conditions'.

It is deemed that dry indoor conditions do not occur in the marine environment.

NOTE: This provision is in the NOTE to Clause 7.7.5 (ii) in the 2000 edition of AS/NZS 3000.

b) The provision that refers to 'electrical equipment used in dry locations'.

It is deemed that dry locations do not occur in the marine environment.

NOTE: This provision is in Clause 7.7.6 (b) in the 2000 edition of AS/NZS 3000.

c) The provisions for ELV that allow switches to 'operate in one less conductor than the number of conductors in the circuit'.

NOTES:

1. These provisions are in Clauses 7.7.8.2 (b) and 7.7.9 (b) in the 2000 edition of AS/NZS 3000.

2. As a result of Clause 3.5 c), in isolated systems switches and circuit protection are required to interrupt all active conductors (See Clause 3.7).

3.6 ENGINE STARTING CABLES

Engine starting cables shall—

a) be protected from mechanical damage;

b) have their terminals protected from mechanical damage and from contact with conductive materials;

c) be as short in length as is compatible with the stowage arrangements of the starter motor batteries;

d) either be routed to avoid the possibility of coming into contact with petroleum products or be enclosed or sheathed with a material resistant to the effects of petroleum products;

e) be of adequate size for the expected cranking current and to minimise voltage drop;

f) be connected directly to the starter via the starting relay contacts; and

g) be suitably sealed at terminals in such a manner as to reduce corrosion.

NOTE: Starter motor manufacturers specifications should be used for cable size.

The starting motor relay shall be mounted either directly on the starter or adjacent to it.

3.7 SWITCHES AND CIRCUIT PROTECTION

In isolated systems, switches and circuit protection shall interrupt all active conductors i.e. double pole switches are to be used.

3.8 BATTERIES AND BATTERY INSTALLATIONS

3.8.1 General

Batteries and their installations shall comply with this Subsection and the relevant requirements of Part C Subsection 5A, Part C Section 4, and Part C Subsection 7B of the NSCV.

NOTES:

1. Part C Subsection 5A (Machinery) specifies requirements for the capacity of batteries used for starting main engines (number of starts) and for alternative starting arrangements.
2. Part C Section 4: Fire Safety specifies requirements for the capacity of batteries used in fire-detection and fire-suppression systems.
3. Part C Subsection 7B (Communication Equipment) specifies requirements for batteries used in radios.
4. In addition to the battery provisions of AS/NZS 3000, guidance on batteries can be found in AS 2676 and AS 3011. These standards cover batteries with voltages in excess of 24 V. However, the guidance offered is sound for battery installations under 24 V.
5. Where specific parts of the NSCV are referenced but have not yet been published, refer to Part B Clause 1.5.

Clause 3.8, shall not apply to batteries integral to particular equipment when those batteries do not feed into a vessel's distribution system.

NOTE: These batteries may include those used in hand held and portable equipment, internal back up batteries for electronic navigation devices, fire detector back up batteries and batteries for stand alone emergency lighting units.

3.8.2 Isolation of batteries

All batteries shall be controlled by an isolation switch operating in all active conductors. Isolation switches shall be located as close as practicable to the battery, and cables between the battery and isolating switch shall be double insulated or installed in a wiring enclosure throughout their entire length.

Certain circuits may be required when the main distribution system is isolated (for example, automatic bilge pumps and solar battery charging circuits). These circuits shall be fitted with individual isolation switches and protection devices located as close as practical to the battery.

3.8.3 Change over and paralleling switch

Systems involving multiple battery installations shall be provided with switching to allow the parallelling and/or change over of batteries used for engine starting. Where such arrangements are provided the isolation capability and overcurrent protection for each battery shall be maintained.

3.8.4 Location and mounting of batteries

3.8.4.1 Location of starting batteries

To limit voltage drop in cables, starting batteries should be located as close as practicable to the engines they serve while minimising the risk of hydrogen released by the battery being ignited by a spark from the starter motor.

3.8.4.2 Mechanical protection

Batteries shall be located and mounted in—

a) a suitably sized and well secured battery box with fitted lid and adequate ventilation that complies with Clause 3.8.4.3; or

b) a dedicated battery compartment or room that complies with Clause 3.8.4.4.

NOTE: This is to ensure a high level of protection against mechanical damage, exposure to moisture, and the possibility of short circuit caused by accidental contact with loose metal tools and other conductive articles.

3.8.4.3 Battery boxes

Battery boxes shall be—

a) of a chemically resistant material, capable of containing the whole volume of electrolyte; and

b) mounted and arranged to prevent movement of the battery due to the motion of the vessel.

3.8.4.4 Battery compartments

In dedicated battery compartments or rooms, batteries shall be mounted in drip trays or containers of a chemically resistant material that are capable of containing the total volume of electrolyte.

Mounting arrangements for the containers and the batteries within the containers shall prevent movement of the batteries due to the motion of the vessel.

3.8.4.5 Housing of batteries

Batteries, or sets of batteries, charged by chargers where the sum of all chargers is greater than 2 kW in total shall be housed in a compartment dedicated to batteries only. Battery compartments shall be well ventilated to the open deck (refer to Clause 3.9). Cable entries to battery compartments shall be gas tight.

Lead acid batteries and alkaline batteries shall not be housed in the same compartment or container, or in close vicinity to each other.

NOTE: Alkaline electrolytes and acids react violently and noxious fumes may be generated, even in sealed cells.

Batteries shall not be housed in accommodation spaces unless they are in a container sealed from the accommodation space and vented to the open deck.

3.8.4.6 Switches in battery compartments

Switches and other circuit interrupting devices shall not be housed in battery boxes, battery compartments or dedicated battery rooms. These devices shall be mounted as close as practicable, but external to, these housings.

3.8.5 Battery charging

Charging capacity shall be such that fully discharged batteries can be charged to 80 per cent of full charge within 10 hours while maintaining essential services and without exceeding a safe charge rate.

To avoid damage to batteries and their charging systems, battery chargers shall incorporate devices for—

a) regulation of charging current commensurate with the capacity of the battery and/or the manufacturers recommendations;

b) protection against overcharge, over voltage and reversal of charging current;

c) charge rate indication; and

d) circuit isolation and protection.

Battery charging systems shall incorporate regulators designed to suit the particular power input or inputs used (e.g. LV, engine driven generator, wind generator, solar power).

3.8.6 Battery protection

Battery terminals shall be protected from mechanical damage and from contact with conductive materials.

Batteries supplying essential services, excluding engine starting batteries, shall have short circuit protection as a minimum protection for overcurrent.

Engine starting batteries shall have either:

a) Short circuit protection; or

b) Mechanical protection of the starting cables.

For all other battery circuits, short circuit and overload protection shall be provided.

Short circuit and overload protection shall comply with the manufacturers specifications. If manufacturer's information on prospective short circuit currents and fault current capacity is not available, for the purposes of providing protective devices the prospective fault current at the terminals shall be considered to be—

i) for vented cells – 20 times the nominal battery capacity at the 3 hour rate; and

ii) for sealed cells – 35 times the nominal battery capacity at the 3 hour rate.

3.9 VENTILATION OF BATTERIES AND BATTERY COMPARTMENTS

3.9.1 General

To avoid the potential for an explosion or fire, battery compartments, rooms and boxes shall be well ventilated to free air so that hazardous gases cannot accumulate.

NOTE: This clause is based on AS 3011.1, AS 3011.2, AS 2676.1 and AS 2676.2. While these standards are for batteries with voltages above 24 V and most marine battery installations are 12 V or 24 V, the general provisions in the standards are applicable.

3.9.2 Minimum exhaust rate

The minimum exhaust ventilation rate required to maintain the concentration of hazardous gases below 2 per cent is calculated by the following formula:

$$q_v = 0.006\, n\, I$$

where

q_v = the minimum exhaust ventilation rate, in litres per second

n = the number of battery cells

I = the charging current, in amperes

3.9.3 Natural ventilation

For natural ventilation the minimum size of inlet and outlet vents is given by:

$$A = 100\, q_v$$

where

A = the minimum area of vent, in square centimetres

q_v = the minimum exhaust ventilation rate, in litres per second

With natural ventilation, an air velocity of at least 0.1 m/s is assumed.

NOTE: Based on the provisions of AS 2676 and AS 3011.

3.9.4 Mechanical ventilation

Where mechanical ventilation is used to meet the minimum exhaust rate (q_v) the following shall apply—

a) exhaust air shall be discharged outside the ship's structure;

b) fans shall not be located within a duct (i.e. best mounted at discharge end of duct);

c) exhaust ducting shall have a positive gradient over the full length of the duct and shall not connect to other ductwork;

d) non sparking material shall be used for fan blade and fan housing;

e) controls for the fan shall be external to the compartment being ventilated; and

f) air flow shall be monitored and an audio/visual flow alarm fitted.

CHAPTER 4 LOW VOLTAGE SYSTEMS

4.1 SCOPE

This Chapter sets out the requirements for electrical equipment and electrical installations specific to low voltage electrical systems.

NOTE: Low voltage exceeds 50 V a.c. and 120 V d.c but is less than 1000 V a.c. and 1500 V d.c.

4.2 APPLICATION

This Chapter applies to vessels having an electricity supply that exceeds 50 V a.c. and 120 V d.c but is less than 1000 V a.c. and 1500 V d.c.

NOTE:

1. Vessels with an LV system may also have an ELV supply.
2. AS/NZS 3000 contains provisions regarding the segregation of circuits of different voltage.

REQUIRED OUTCOMES

4.3 REQUIRED OUTCOMES

The required outcomes given in Clauses 2.2 to 2.9 of Chapter 2 apply to this Chapter.

DEEMED-TO-SATISFY SOLUTIONS

4.4 COMPLIANCE

For the purpose of this National Standard a low voltage electrical system shall be deemed-to-satisfy the required outcomes in Clause 4.3 if it complies with Clauses 4.5 to 4.9 of this Chapter and the relevant Clauses of AS/NZS 3000 relating to low voltage installations.

4.5 MULTIPLE EARTHED NEUTRAL (MEN) SYSTEM

Where the vessel uses a MEN system the vessel's MEN link shall be made at each generator.

NOTE: This avoids nuisance tripping of shore side RCDs. The vessel's MEN point is switched out of the circuit by the shore supply change over switch.

4.6 RESIDUAL CURRENT DEVICES

State and Territory Workplace Health and Safety legislation may have specific requirements for RCDs beyond the requirements of AS/NZS 3000. Designers, builders and surveyors are advised to check with their local authorities.

4.7 SHORE SUPPLY

4.7.1 General

Where electricity is to be supplied to a vessel from a shore supply the shipboard shore power facility shall include:

a) A circuit breaker operating in all live conductors of the supply, including neutral, fitted adjacent to the shore supply inlet on the vessel.

b) A test device, connected on the supply side of the vessel's shore supply circuit breaker to check, and visually indicate, the polarity of the shore supply in relation to the vessel's system

c) An interlocking circuit to ensure the shore power can not be connected unless the polarity is correct or a polarity reversal arrangement incorporating interlocking circuitry is installed.

d) In three phase supplies:

   i) a means of checking the phase sequence in relation to the vessel's system; and

   ii) appropriate switchgear to facilitate the reversal of phase sequence.

The polarity of plugs, socket outlets and couplers used for a vessel's shore power supply equipment shall be in accordance with AS/NZS 3112 and AS/NZS 3123

Note Where necessary, repairs may be required to correct the polarity of the shore supply connection. State or Territory electrical safety regulations may require that low voltage work be carried out by licensed electricians.

Fixed wiring shall be used between the shore connection circuit breaker and the change over switch.

At the main switchboard or adjacent to the changeover switch, there shall be a means of indicating for each phase when the shore supply is energised.

4.7.2 Shore supply cable

The vessel's shore supply connecting cable shall—

a) be a heavy duty flexible cord or flexible cable;

b) have a minimum current capacity of 15 A;

c) comply with AS/NZS 3191; AS/NZS 5000.1 and/or AS/NZS 3008.1.1 as applicable;

d) be arranged to allow for the movement of the vessel at the berth without imposing tension on the cable or connections, or exposing the cable to mechanical stress or damage; and

e) have a length that will ensure the voltage drop for the vessel's electrical installation is kept within the requirements of AS/NZS 3000 relating to voltage drop; i.e. the voltage drop at any point of the electrical installation shall not exceed 5 per cent of the nominal voltage.

4.7.3 Changeover switch

The changeover switch or device for the vessel supply/shore supply shall operate simultaneously in all live conductors and neutral. Except where the change over switch is direct acting (i.e. a mechanical switch), the control circuit of any change over arrangement shall include, in addition to

any mechanical interlocks, electrical interlocks on contactors, circuit breakers or other switching devices.

4.7.4 Earth

Earth continuity between the vessel's earth and the shore earth shall be maintained through the appropriate pin in a plug/socket shore power connection or by a dedicated earth terminal in a shore supply connection that uses terminals.

4.7.5 Notices

A notice containing the following information shall be provided at the shore connection facility on the vessel:

a) Supply voltage.

b) Frequency of the vessel's a.c. system.

c) The procedure for carrying out the connection.

4.7.6 Supply inlet plug

A means to prevent stress on terminal connections or the accidental removal of the supply inlet plug shall be provided on the shore connection facility on the vessel.

NOTE: Suitable arrangements include, but are not limited to, the screw cap of plug/socket units, or a lanyard between the cable and a stout attachment on the vessel to relieve stress on the 0.5 to 1.0 m of cable closest to the shore connection

4.7.7 Arrangement of shore connection

Guidance regarding possible configurations for the vessel's shore connection may be found in AS/NZS 3004.

4.8 GENERATORS—CONTROL AND INSTRUMENTATION

4.8.1 Control

4.8.1.1 Overcurrent

Overload and short circuit protection for each generator shall be provided by a circuit breaker. The generator manufacturer's specifications should be adhered to for circuit breaker ratings and time delay settings. If the manufacturer's specifications are unavailable, for the purpose of providing overload and short circuit protection the following settings shall apply:

a) 110 per cent of rated output current — 15 min

b) up to 150 per cent of rated output current — 2 min

c) 150 per cent or greater of rated output current — instantaneous

Consideration should be given to providing an alarm warning for overloads of less than 110 per cent of rated output current.

4.8.1.2 Load shedding

Where essential and non essential services are separated, consideration should be given to the provision of load shedding of non-essential services when one or more generators become overloaded.

4.8.2 Instruments

4.8.2.1 General

Instruments shall be provided that indicate the operational conditions of voltage, frequency and load and any variation from the limits of safe operation of the vessel's electrical system.

4.8.2.2 Minimum requirements

Each generator shall have as a minimum—

a) a voltmeter;

b) a means of detecting earth leakage;

c) either an ammeter in each phase, or an ammeter with a selection switch to enable the current in each phase to be measured;

d) for a.c. generators, a frequency meter located on the supply side of the main switch or main circuit breaker; and

e) for generators above 50 kW, a wattmeter.

4.8.2.3 Generators operated in parallel

For generators operated in parallel, in addition to the instruments specified under Clause 4.8.2.2 each generator shall have:

a) A wattmeter.

b) Reverse power protection, operating with time delay and in the range 2 per cent to 15 per cent of rated power. A 50 per cent fall of applied voltage shall not render the reverse power protection inoperative.

To facilitate the parallelling operation, the following instrumentation shall be the minimum provided:

i) Two voltmeters.

ii) Two frequency meters.

iii) A synchroscope, synchronising lamps, or an equivalent arrangement.

One voltmeter and one frequency meter shall be connected to the busbars, the other voltmeter and frequency meter may be either those dedicated to each generator or shall be switched to enable the voltage and frequency of any generator to be measured.

4.8.2.4 Range of instruments

4.8.2.4.1 Voltmeters

The upper limit of the range of a voltmeter shall be 120 ± 5 per cent of the nominal voltage of the circuit in which it is installed. The nominal voltage of the circuit shall be clearly indicated on the voltmeter.

4.8.2.4.2 Ammeters

The upper limit of the range of an ammeter shall be 130 ± 5 per cent of the rated full load current of the circuit in which it is installed. Rated full load current shall be clearly indicated on the ammeter.

4.8.2.4.3 Wattmeters

Wattmeters used on generators that may be operated in parallel shall be capable of indicating 15 per cent reverse power.

4.9 INVERTERS

4.9.1 General

Where applicable, inverters used on board vessels shall comply with AS/NZS 61558 Part 2.16.2.

4.9.2 Inverters with outputs isolated from other electrical systems

Inverters supplying individual or multiple outlets isolated from other supply systems shall comply with the provisions of AS/NZS 3000 relating to protection by electrical separation, including the provisions applying to protective earthing. Circuit protection for inverter output shall be double pole. Switching at outlets shall be double pole.

4.9.3 Inverters used to supply the vessel's power system

Inverters used to supply a vessel's LV system shall comply with the requirements for generators (Clause 4.8). Inverters shall have the capability to monitor, give alarm, and disconnect when 'out of specification' values of voltage, frequency and current are detected. Disconnection shall occur in all live conductors, including the neutral. There shall be enough output capacity to operate the required systems. Supply to the vessel's distribution system shall be controlled by an appropriate interlocking changeover switch, or equivalent device, operating in all live conductors including neutral.

NOTE: Inverters with variable output or unusual arrangements of metering and controls should meet safety and operational needs. Power and supply management systems are now in use and the technology in this field is advancing rapidly. Without restricting the progress of this technology, the basic tenets of electrical safety must be addressed before any other installation design elements are considered.

CHAPTER 5 EMERGENCY ELECTRICAL INSTALLATIONS

5.1 SCOPE

This Chapter specifies the requirements for the equipment and installation of a vessel's emergency electrical system.

5.2 OBJECTIVE

The objective of this Chapter is to provide vessel designers and builders with specifications for the design and installation of emergency electrical systems to ensure a source of power is available in the event of failure of the main electrical system.

5.3 APPLICATION

This Chapter applies to all vessels subject to this subsection of the NSCV.

REQUIRED OUTCOMES

5.4 GENERAL

The required outcomes given in Clauses 2.2 to 2.9 of Chapter 2 apply to this Chapter.

5.5 FUNCTION OF ESSENTIAL SERVICES TO BE MAINTAINED

The electrical system must be designed and installed so that, in the event of a failure in the main electrical system, power can be supplied and maintained to all services essential for safety.

5.6 PERIOD OF OPERATION

Essential services must be maintained during emergency situations for a period sufficient for the emergency to be overcome or for evacuation of the vessel to be completed.

5.7 EMERGENCY LIGHTING

In the event of a failure in the main electrical system, sufficient emergency lighting must be provided to facilitate the initiation, undertaking and completion of appropriate emergency responses.

DEEMED-TO-SATISFY SOLUTIONS

5.8 COMPLIANCE

For the purpose of this National Standard, an emergency electrical installation shall be deemed-to-satisfy the required outcomes in Clauses 5.4 to 5.7 if it complies with—

a) Clauses 5.9 to 5.14 of this Chapter;

b) the requirements of Chapters 2, 3 and 4 of this Subsection; and

c) the relevant clauses of AS/NZS 3000.

5.9 GENERAL

5.9.1 Design and location

An emergency source of electrical power shall be self-contained. Unless otherwise provided for in Clause 5.10.3, the emergency source of electrical power, including any fuel required to supply that source, shall comply with the following:

a) It shall not be located forward of the collision bulkhead.

b) It shall be located above the weathertight deck, or where there is no weathertight deck then above the water line, and shall be accessible from the open deck.

c) It shall be located so that a fire or other unplanned occurrence in the propulsion machinery space will not interfere with the supply or distribution of emergency power outside that space.

d) The space in which it is located shall be—

   i) protected from exposure to moisture; and

   ii) provided with ventilation sufficient to enable the emergency power source to operate at full power.

5.9.2 Operation

The emergency generator and its engine, and any emergency battery, shall be capable of operating at full power when the vessel is—

a) upright;

b) rolling up to an angle of 22.5° either way and simultaneously pitching 10° by bow or stern; or

c) in any combination of angles within those limits.

5.9.3 Duplication of main source of electrical power

Where a vessel is designed with two, non-contiguous machinery spaces having separate electrical installations with separate distribution systems, each installation may be considered as the emergency source of electrical power for the other.

5.10 POWER SOURCE

5.10.1 Type of power source

An emergency source of electrical power shall be:

a) a battery complying with Clause 5.10.2; or

b) a generator driven by a diesel engine complying with Clause 5.10.3.

5.10.2 Battery

The emergency battery shall be capable of carrying the total emergency load in accordance with Table 1.

Where a vessel in Category 1 or 2 (Vessel use) has an emergency source of power from a battery only, the emergency lighting system shall automatically come into operation upon failure of the main electrical supply.

The emergency source of electrical power for Category A and B (Operational area) vessels shall not be the normal starting batteries.

Category C, D and E (Operational area) vessels may use the normal starting batteries provided those batteries are located in accordance with Clause 5.9.1.

NOTES:

1. Part B, Table 2 and 3 describes vessel use and operational area categories.
2. Chapter 3 of this Subsection of the NSCV specifies requirements for the installation and ventilation of batteries and battery compartments.

5.10.3 Diesel engines

5.10.3.1 General

Where a generator driven by a diesel engine provides the emergency source of power, the engine shall be capable of being easily started in its cold condition at a temperature of 0°C.

5.10.3.2 Fuel

Fuel for an emergency generator engine shall have a flashpoint of not less than 60°C.

5.10.3.3 Starting arrangements

Where an engine is not designed to be started manually, the following requirements apply:

a) The starting equipment shall be capable of providing 3 consecutive starts.

NOTE: Starting methods can be electrical from batteries, compressed air, hydraulic, or other forms of stored energy.

b) A second source of energy capable of providing an additional 3 starts within a 30 minute period shall be provided.

c) Where compressed air is used as the sole means of starting an engine, a manually started, mechanically driven air compressor shall be provided.

d) Where an air receiver for an emergency generator is supplied from the main or auxiliary compressed air system, the air supply line shall be fitted with a non-return valve which shall be located in the emergency generator space.

e) Where a hydraulic starter is used it should have both an engine driven and a manual pump for charging the accumulator.

5.10.3.4 Location of starting arrangements

The starting arrangements specified in Clause 5.10.3.3 shall not be situated in any of the following locations:

a) Below the bulkhead deck in the case of a Category 1 vessel or below the weathertight deck in the case of a Category 2 vessel.

b) Forward of the collision bulkhead.

c) In the space containing the main source of electrical power.

d) In a space that would be rendered inaccessible or uninhabitable by a fire or other incident in the space containing the main source of electrical power.

5.10.4 Temporary source of emergency power

Unless an emergency generator is designed to start and come on load automatically, all Class 1B vessels and all vessels of 25 m and over in measured length that carry berthed passengers shall be provided with a temporary source of emergency power. This temporary source of emergency power shall consist of a battery of sufficient capacity to—

a) supply emergency lighting continuously for 30 minutes;

b) close electrically-operated watertight doors; and

c) operate any electronic alarms and indicators associated with the watertight doors.

NOTE: All electrically operated watertight doors need not be closed simultaneously.

5.11 EMERGENCY SWITCHBOARD

5.11.1 General

An emergency switchboard may be supplied from the main switchboard in normal operation, and shall be supplied from an emergency supply in situations where the main supply has failed.

5.11.2 Location

Unless otherwise provided for in Clauses 5.11.3 and 5.11.4, an emergency switchboard forming part of the emergency electrical installation shall be installed adjacent to, or as near as possible to, the emergency source of electrical power.

5.11.3 Generators driven by diesel engines

Where the emergency source of electrical power is a generator driven by a diesel engine, the emergency switchboard shall be located in the same space as the generator, except where the operation of the emergency switchboard would be impaired by such a location.

5.11.4 Batteries

Where the emergency source of electrical power is a battery, the emergency switchboard shall not be installed in the same space as the battery.

5.12 EQUIPMENT REQUIRED TO BE SUPPLIED WITH EMERGENCY POWER

The electrically operated equipment required to be supplied with emergency power shall be as follows:

a) The following equipment as specified in Part C Section 4: Fire Safety of the NSCV:

   i) Fire alarms.

   ii) Emergency fire pumps.

iii) Fixed fire-extinguishing systems.

iv) Remote stops.

v) Communications equipment other than radios (e.g. PA systems).

b) Mustering alarm as specified in NSCV Part C Subsection 7A (Safety Equipment).

c) Signalling lamp as specified in NSCV Part C Subsection 7B (Communication Equipment).

d) Electronic navigational aids, navigation lights and sound signals as specified in NSCV Part C Subsection 7C (Navigation Equipment).

e) Watertight doors and their associated indicators and alarms.

f) Emergency lighting in accordance with Clause 5.14.

g) Any bilge pump relying on the emergency power source as its alternative power supply (see Part C Subsection 5A: Machinery).

5.13 CAPACITY OF EMERGENCY POWER SUPPLY

The emergency power supply for each Class of vessel shall be capable of operating continuously and simultaneously all equipment required to be supplied with emergency power for the periods specified in Table 1.

5.14 EMERGENCY LIGHTING

For vessels specified in Table 1, emergency lighting shall be situated to illuminate the following:

a) Service alleys, accommodation alleyways, stairways, exits and personnel lift cars.

b) The machinery spaces and main generating stations, including their control positions.

c) Control stations and all machinery control rooms.

d) The stowage positions for fire-fighting equipment.

e) The steering gear.

f) Pumps for fixed fire extinguishing systems, emergency fire pumps and any bilge pump relying on the emergency power source as its alternative power supply.

g) The starting positions for the motors of the pumps specified in Clause 5.14 f).

h) Public spaces, evacuation routes, exits and mustering areas.

i) Lifeboat stations on deck.

j) Stowage positions of life rafts for which launching devices are not provided.

k) Life rafts and their launching devices during mustering and launching.

l) The area of water into which life rafts are launched, for the period of time required for launching to be completed.

Table 1—Capacity of emergency power supply

Class of vessel	Minimum period for continuous and simultaneous operation of all equipment listed in Clause 5.12	
	Hours	**Requirement**
Class 1A	As specified in Marine Orders Part 12 for SOLAS passenger vessels.	As specified in Marine Orders Part 12 for SOLAS passenger vessels.
Class 1B	12 hours	—
Class 1C	3 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 25 m and over in measured length or 500 GT and over. Signalling lamps need only be supplied with emergency power where such lamps are normally operated from the main electrical power source.
Class 1D	3 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 25 m and over in measured length.
Class 1E	2 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 25 m and over in measured length.
Class 2A	As specified in Marine Orders Part 12 for SOLAS cargo vessels.	As specified in Marine Orders Part 12 for SOLAS cargo vessels.
Class 2B	6 hours—for vessels that are either ≥125 m in measured length or ≥5000 GT. 3 hours—for all other vessels.	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 50 m and over in measured length or 500 GT and over. Signalling lamps need only be supplied with emergency power where such lamps are normally operated from the main electrical power source.
Class 2C	3 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 25 m and over in measured length or 500 GT and over. Signalling lamps need only be supplied with emergency power where such lamps are normally operated from the main electrical power source.
Class 2D	3 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 25 m and over in measured length or 500 GT and over.
Class 2E	2 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 2 5m and over in measured length or 500 GT and over.

… Continued

Table 1 cont.

Class of vessel	Minimum period for continuous and simultaneous operation of all equipment listed in Clause 5.12	
	Hours	**Requirement**
Class 3A	As for Class 2A	As for Class 2A
Class 3B	6 hours—for vessels that are either ≥125 m in measured length or ≥ 500 GT. 3 hours—for all other vessels.	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 50 m and over in measured length or vessels 500 GT and over. Signalling lamps need only be supplied with emergency power where such lamps are normally operated from the main electrical power source.
Class 3C	3 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 500 GT and over. Signalling lamps need only be supplied with emergency power where such lamps are normally operated from the main electrical power source.
Class 3D	2 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 500 GT and over.
Class 3E	2 hours	The requirement for emergency lighting in accordance with Clause 5.14 applies only to vessels 500 GT and over.

NOTE: Check with your workplace authority for any additional requirements they may have for emergency lighting.