

Secondary Legislation

DCE - MTI 3F - 1/1

Maritime Transport (Electrical) Instrument [year]

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Contents

Section 1	Preliminary provisions	2
1.1	Title.....	2
1.2	Commencement.....	2
1.3	What this MTI does	2
1.4	Application of MTI provisions	2
1.5	Interpretation	2
Section 2	General safety requirements	3
2.1	Electrical systems, electrical equipment, and electrical fittings	3
2.2	Lightning protection systems	3
2.3	Alternative sources of electrical power	3
2.4	Electrically propelled ships.....	5
2.5	Batteries and battery installation.....	5
Section 3	Inspections and tests	6
3.1	Application of inspection and testing requirements	6
3.2	Electrical inspection and test	6
Appendix 1	Minimum requirements for existing ships of less than 45 metres in LOA	7
Appendix 2	Codes of practice and official standards	9

Section 1 Preliminary provisions

1.1 Title

This MTI is the Maritime Transport (Electrical) Instrument [year].

1.2 Commencement

This MTI comes into force on [same date as Part 3F].

1.3 What this MTI does

This MTI specifies, for the purposes of Part 3F: Maritime (Design, Construction, and Equipment – Electrical) Rules, standards and requirements for—

- (a) the design, construction, installation, and repair of electrical systems, electrical equipment, electrical fittings, lightning protection systems, lithium-ion batteries, and overcurrent protection for batteries; and
- (b) generators supplying an emergency source of power; and
- (c) inspection and testing of electrical systems and equipment; and
- (d) the circuit and supply source of electrical protection, shore power connections, and reverse polarity protection for ships.

1.4 Application

This MTI specifies—

- (a) requirements that a ship, described in rule 3F: A1.3(1), must comply with; and
- (b) standards that are, for the purposes of rule 3F: C1.1, the relevant design, construction, and installation standards.

1.5 Interpretation

- (1) If a conflict exists between this MTI and material incorporated by reference in this MTI, the MTI applies.
- (2) A term that is used in this MTI and defined in Part 3F has the same meaning as in Part 3F.
- (3) In this MTI, unless the context otherwise requires,—
classification society means a classification society specified in clause 2.1(4)
MCB means miniature circuit breaker
RCD means residual current device.
- (4) In this MTI, codes and official standards (such as AS/NZS) are referred to as standards and by the abbreviations listed in Appendix 2.

Section 2 General safety requirements

2.1 Application of requirements for electrical systems, electrical equipment, and electrical fittings

- (1) This Section specifies requirements and standards for electrical systems, electrical equipment, and electrical fittings on a ship for the purposes of rules 3F: B1.4; C1.1, C2.2, C3.2, C9.1 and C10.1.
- (2) A ship of less than 45 metres in LOA must comply with—
 - (a) the relevant rules of a classification society; or
 - (b) *AS/NZS 3004.2*; or
 - (c) the minimum electrical system requirements in Appendix 1.
- (3) A ship of 45 metres or more in LOA must comply with—
 - (a) the relevant rules of a classification society; or
 - (b) the applicable parts of *IEC 60092*.
- (4) A classification society means any of the following:
 - (a) American Bureau of Shipping;
 - (b) Bureau Veritas;
 - (c) Det Norske Veritas (DNV);
 - (d) Lloyd's Register;
 - (e) Nippon Kaiji Kyokai (ClassNK).

2.2 Lightning protection systems

- (1) This clause specifies requirements for the purposes of rule 3F: C2.2.
- (2) A lightning protection system on a ship must comply with—
 - (a) clause 2.1(2)(a) or (b), or clause 2.1(3); or
 - (b) *NFPA 780*.

2.3 Alternative sources of electrical power

- (1) This clause specifies requirements for the purposes of rules 3F: C3.1 to C3.3.
- (2) An alternative source of electrical power (batteries or an emergency generator and associated starting arrangements), and any fuel required to supply the generator on a ship, must be—
 - (a) self-contained; and
 - (b) located above the freeboard deck or, if there is no freeboard deck, as high as practicable above the design waterline, and accessible from the open deck; and
 - (c) located and arranged, unless the alternative source of electrical power is a torch, to ensure that a fire or other unplanned incident in the propulsion machinery space or the space containing the main source of electrical power will not—
 - (i) interfere with the supply or distribution of emergency power outside that space; or
 - (ii) make the space inaccessible.
- (3) The space where the alternative source of electrical power is located must be—
 - (a) protected from moisture; and
 - (b) provided with ventilation sufficient to enable the generator to operate at full power for the duration required by rule 3F: C3.3, if the source of power is an engine-powered generator.

Fuel to supply an engine-powered generator

- (4) Fuel to supply an engine-powered generator must comply with the following requirements:
- (a) fuel for an engine-powered generator must have a flashpoint of 60 degrees Celsius or more:
 - (b) sufficient fuel must be available to ensure that the generator is able to operate at full load for the minimum duration required by rule 3F: C3.3.

Starting arrangements for a generator providing an emergency source of electrical power

- (5) If an engine-powered generator described in rule 3F: C3.2 is designed to start and come on load automatically, the following requirements apply:
- (a) starting methods may be electrical from batteries, or compressed air, and hydraulic or other forms of stored energy:
 - (b) the generator must be able to be started under all temperature conditions that are likely to occur:
 - (c) the starting equipment must be capable of providing 3 start attempts of 5-seconds each:
 - (d) a second source of energy capable of providing an additional 3 starts within a 30-minute duration must be provided:
 - (e) where the generator is electrically started, the battery or battery bank providing electrical power must be always maintained at a full state of charge:
 - (f) where compressed air is used as the sole means of starting an engine, a manually started air compressor that is mechanically driven must be provided:
 - (g) where an air receiver for an emergency generator is supplied from the main or auxiliary compressed air system, the air supply line must be fitted with a non-return valve that must be located in the emergency generator space:
 - (h) where a hydraulic starter is used, it must have both an engine-driven and a manual pump for charging the accumulator.

Transitional source of emergency electrical power

- (6) Where an engine-powered generator is used to provide essential equipment with an alternative source of electrical power, and it is not designed to start and come on load automatically, a transitional source of emergency power must provide electrical power to that equipment.
- (7) The transitional source of power must consist of a battery or battery bank of sufficient capacity to provide electrical energy to the following items for a 30-minute duration:
- (a) a network control system:
 - (b) emergency lighting:
 - (c) navigation lights:
 - (d) a radio installation:
 - (e) a fire detection and fire alarm system, and manual call points:
 - (f) an electronic alarm and indicator associated with a watertight door:
 - (g) electrically operated watertight doors:
 - (h) internal communication equipment that the ship is required, by Part 3H: Maritime (Design, Construction, and Equipment – Life-saving Appliances) Rules, to have available in an emergency:

Transfer of power supply without interruption

- (8) A means must be provided to allow the transfer of electrical power, without interruption, to the power supply, from the main source to—
- (a) the transitional source of power (if the ship has one); and
 - (b) the alternative source of power.

2.4 Electrically propelled ships

- (1) This clause specifies requirements for electrically propelled ships for the purposes of rules 3F: C8.1 and C9.1
- (2) The electrical systems, components, and arrangements of electrical propulsion equipment and associated batteries in an electrically propelled ship must comply with—
- (a) the rules of a classification society; or
 - (b) *AS/NZS 3004.2*.
- (3) The compartment containing lithium-ion battery banks that provide the source of energy for propulsion must be treated as a major fire hazard area and comply with the requirements of Part 3D: Maritime (Design, Construction, and Equipment – Fire Protection) Rules.

2.5 Batteries and battery installation

- (1) This clause specifies requirements for electrically propelled ships for the purposes of rule 3F: C9.1.

Batteries and battery installations

- (2) The batteries and battery installations on a ship must comply with clause 2.1(2)(a) or (b), or clause 2.1(3).

Charging of batteries and battery banks

- (3) For the purposes of rule 3F: C9.1,—
- (a) a battery system that provides an alternative source of electrical power for radiocommunication equipment must be arranged so that it can be recharged within 10 hours from 20 percent state of charge to 90 percent state of charge; and
 - (b) the means of recharging a battery or battery bank must have sufficient capacity to supply the connected background load and maintain the battery at a full state of charge during the ship's foreseeable operating conditions; and
 - (c) equipment for charging a battery or battery bank must—
 - (i) be installed in accordance with the manufacturer's instructions including, but not limited to, being provided with appropriate ventilation, and not being located above batteries or battery banks, or below fuel system components; and
 - (ii) supply charging voltages and a rate of charge as specified by the manufacturer of the battery being charged.

Batteries used for engine-starting

- (4) For the purposes of rule 3F: C9.1, when the sole means of starting an internal combustion propulsion engine is by battery or battery bank,—
- (a) 1 battery or battery bank must be reserved for engine-starting and to supply the engine's own control, monitoring, and safety arrangements as well as propulsion control systems, in the normal course of operation; and
 - (b) the other battery or battery bank must be reserved for supplying the ship's electrical services; and

- (c) it must be possible to start each propulsion engine from either battery or battery bank using a changeover switch; and
 - (d) each battery or battery bank must have sufficient capacity to start the propulsion engine.
- (5) A conductor connecting the battery or battery bank used for engine-starting to the engine start motor is not required to be provided with overcurrent protection but must be—
- (a) insulated and sheathed; and
 - (b) selected to cope with the thermal effects of prolonged engine-cranking without damage; and
 - (c) installed to protect the cables against mechanical damage.

Section 3 Inspections and tests

3.1 Application of inspection and testing requirements

This Section specifies requirements for inspection and testing for the purposes of rule 3F: C10.1.

3.2 Electrical inspection and test

- (1) Electrical inspections and tests on a ship must comply with clause 2.1(2)(a) or (b), or 2.1(3).
- (2) An electrical inspection and test must include—
 - (a) visual inspection; and
 - (b) inspection for continuity of all conductors; and
 - (c) insulation resistance tests; and
 - (d) verification of polarity; and
 - (e) confirmation of earthing, ensuring that:
 - (i) contact with bare live parts is not possible; and
 - (ii) alarms and shutdown devices are functional and sized correctly; and
 - (iii) electrical equipment, switchboards, and conductors have been selected and located so that they are not adversely affected by water, oil, heat, or other environmental conditions they may be exposed to.
- (3) The insulation resistance of all circuits and equipment must be—
 - (a) measured, using a direct current insulation tester, between all current-carrying parts—
 - (i) connected and earthed; and
 - (ii) of opposite polarity or phase; and
 - (b) not less than 1 megohm.
- (4) However, if an initial test produces results less than 1 megohm,—
 - (a) an electrical appliance may be disconnected and tested separately; and
 - (b) a disconnected electrical appliance must have an insulation resistance of not less than 0.5 megohm.

Appendix 1

Minimum requirements for existing ships of less than 45 metres in LOA

Ref: rule 3F: C1.1, and clause 2.1(2)(c) of this MTI

1 Application

An existing ship of less than 45 metres in LOA is deemed to comply with the electrical systems requirements in rule 3F: C1.1 if it complies with the requirements in this Appendix.

2 Overcurrent protection

- (1) The protection of electrical circuits and electrical supply must comply with *AS/NZS 3004.2*.
- (2) RCDs, MCBs, fuses, and switches must be in working order and without evidence of mechanical damage.
- (3) An RCD—
 - (a) installed for personal protection must be Type A and have a residual operating current of 30mA or less; and
 - (b) must operate in the live conductors (active and neutral) of the circuits it is connected to.
- (4) Semi-enclosed rewirable fuses, where fitted, must be in good condition and must have no exposed live parts when the fuse carrier is fitted to the fuse base.

3 Cables

A cable insulation or sheath must be in sound condition and must have appropriate mechanical protection for its function and the environment it is installed in.

4 Switchboards

- (1) A switchboard and electrical equipment must have adequate conductor insulation and comply with the following requirements:
 - (a) the incoming main neutral wire must be connected to the neutral bar of the main switchboard:
 - (b) neutral conductors of circuits must be connected to the neutral busbar of the switchboard from which the circuit is supplied:
 - (c) where separate earth and neutral bus bars are used, earthing conductors must be connected to the earth bar and neutral conductors must be connected to the neutral bar:
 - (d) neutral bars must be supported on insulated fittings:
 - (e) the main earthing conductor from the ship's structure or earth plate must be correctly connected at the switchboard:
 - (f) conductors must—
 - (i) be securely held in terminals of fittings and not be subject to tension at the terminations; and
 - (ii) have adequate insulation and distance between live conductors, and between live conductors and earth if they are bare.
- (2) A ship with an isolation transformer (fully isolated from earth) low voltage AC or DC system must have a continuously operating earth fault or insulation monitoring and alarm system installed.

5 Switchboard labelling

- (1) When an inverter is installed, a hazard warning label must be fitted to or beside the AC switchboard stating that—
 - (a) dangerous voltage is present; and
 - (b) the ship is equipped with a DC power inverter; and
 - (c) both AC shore power and DC battery power to the inverter must be disconnected before opening the panel or servicing electrical systems.
- (2) The switchboard must have a label identifying any wiring that uses non-standard colours.
- (3) Switches and protective devices must be clearly labelled to show the circuit type they control or protect.

6 Earthing and equipotential bonding

- (1) The main earthing and equipotential bonding conductor terminations must—
 - (a) be accessible; and
 - (b) have bonding connections that are mechanically sound, fixed by a secure system, and protected against mechanical damage, corrosion, and vibration.
- (2) A conductor of a cable must be correctly identified and connected to the correct terminals of fittings.
- (3) The resistance of each equipotential bonding conductor must not exceed 0.5 ohm.
- (4) The connection between any point on the installation required to be equipotentially bonded and the switchboard earth bar must be continuous.
- (5) The main AC earthing conductor between the main AC switchboard and the ship's electrical earth must be continuous, with a resistance of the main earthing conductor not exceeding 0.5 ohm.

7 Electrical equipment and electrical fittings

- (1) An electrical fitting that is located in an explosive gas area must be rated for use in that area.
- (2) An incandescent lamp must not exceed the wattage rating of its fitting.
- (3) Electrical equipment and fixed-wire appliances forming part of the electrical installation must not be damaged.
- (4) A cover of a fixed-wired electrical appliance must not be broken or missing, or prevent access to live parts or basic insulation.
- (5) Electrical equipment must be adequately supported, correctly positioned and mounted, suitable for its environment, and protected against mechanical damage.
- (6) Electrical equipment in a damp area must have an appropriate IP rating.
- (7) Fixed-wired appliances requiring earthing (Class 1), and exposed metal on appliances that could become live, must be earthed.
- (8) Heating appliances must be permanently installed.

8 Connecting to shore power

Shore power connections must comply with *AS/NZS 3004.2*.

Appendix 2

Codes of practice and official standards

AS/NZS means joint **Australian and New Zealand Standard** in the following:

AS/NZS 3004.2 Electrical installations – Marinas and boats – Part 2: Boat installations

IEC means **International Electrotechnical Commission** in the following:

IEC 60092 series of standards – Electrical installations in ships

NFPA means **National Fire Protection Association, Massachusetts, USA**, in the following:

NFPA 780 Standard for the Installation of Lightning Protection Systems