



INSTRUCTIONS FOR THE GUIDANCE OF SURVEYORS ON
ELECTRICAL EQUIPMENT AND INSTALLATIONS
MSIS27 CHAPTER 6

Rev 12.22

PREFACE

- 0.1 These Marine Survey Instructions for the Guidance of Surveyors (MSIS) are not legal requirements in themselves. They may refer to statutory requirements elsewhere. They do represent the MCA policy for MCA surveyors to follow.
- 0.2 If for reasons of practicality, for instance, these cannot be followed then the surveyor must seek at least an equivalent arrangement, based on information from the owner/operator. Whenever possible guidance should be sought from either Principal Consultant Surveyors or Survey Operation Branch, in order to maintain consistency between Marine Offices.

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Recent Amendments

The amendments made in the most recent publication are shown below, amendments made in previous publications are shown in the document Amendment History.

Version Number	Status / Change	Date	Author Reviewer	Content Approver	Next Review Date/Expiry Date
06.20	<ul style="list-style-type: none"> Amendments to reflect introduction of MGNs 628 and 629 	21/6/2020	D Fenner	G Stone	21/6/2023
09.21	<ul style="list-style-type: none"> Amendments to reflect issue of MSN1871 Amendment No.2 	31/8/2021	D Fenner	G Stone	31/8/2023
08.22	<ul style="list-style-type: none"> Amended definition of Fit for Purpose 	01/07/22	D Fenner	G Stone	01/07/2024
12.22	<ul style="list-style-type: none"> Surveyors should refer to Sections 1.23 and 1.24 of MSIS27 Chapter 1 when reviewing modifications to vessels. 	2/12/22	D Fenner	G Stone	28/11/24

MSIS27 Chapter 6

6. ELECTRICAL EQUIPMENT AND INSTALLATIONS

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6.1 GENERAL

- 6.1.1 This Chapter should be read in conjunction with Chapter 4 of [MSN 1871](#), [MSN1872](#) and Chapter 4 of [MSN 1873](#).
- 6.1.2 New vessels under 15m LOA will be constructed to the [Seafish Construction Standards prior to 21 July 2020](#) and to the [Construction Standards in MGN628](#) from that date forward. A certificate of compliance will be issued by the installer. [MSN1871 Amendment No.2](#) requires that vessels built to [MGN628](#) shall be maintained to the same standard. Vessels currently on the Register shall meet the requirements of [MGN628](#) whenever the electrical systems are renewed in part or whole.
- 6.1.3 If the vessel joined the Register after 16 July 2007 through the Registration Survey process, the vessel must be maintained in accordance with the standard required by the MCA at the time of its Registration Survey to allow its Registration
- 6.1.4 For vessels of less than 15m LOA, built to Standards which did not set out requirements for Electrical arrangements or a particular aspect of the Electrical arrangements or where at the time of construction Standards did not exist, the existing arrangements shall remain acceptable provided that it continues to remain fit for purpose. For the purposes of these Instructions, “fit for purpose” For the purposes of these Instructions, “fit for purpose” should be interpreted using section 4.2 of [MSIS27 Chapter 1 Annex 1](#).
- 6.1.5 New vessels over 24m will be constructed to Classification standards, and 15-24m vessels will be constructed to either Classification, or, prior to 21 July 2020 [Seafish Construction Standards](#) and from that date forward, the [Construction Standards in MGN629](#). Vessels which drop from class after initial surveys will be subject to MCA surveys, in accordance with an approved survey cycle. **These instructions are for guidance when undertaking such periodic surveys or inspections.**
- 6.1.6 Any additional electrical installations or modifications should comply with the above standards, approved by class or MCA, and should be carried out by a qualified electrical engineer. [Surveyors should refer to Sections 1.23 and 1.24 of MSIS27 Chapter 1](#) when reviewing modifications to vessels.
- 6.1.7 In general, and as a matter of good practice, all fishing vessels should comply with BS 8450:2006 Code of Practice for Installation of Electrical and Electronic Equipment in Ships. Vessels with a keel laid before 2006 should comply with The Institute of Electrical Engineers (IEE) - 'Regulations for the Electrical and Electronic Equipment of Ships with recommended Practice for their Implementation'. Vessels with a keel laid prior to 31 May 1992 should comply with the 5th Edition (1972) and vessels with a keel laid on or after that date should comply with the 6th Edition (1990) and subsequent amendments.

6.1.8 Alternatively, vessels constructed in Europe may comply with the International Electrotechnical Commission (IEC) recommendations. Note that BS – IEC standards are available for reference in the SCMS library.

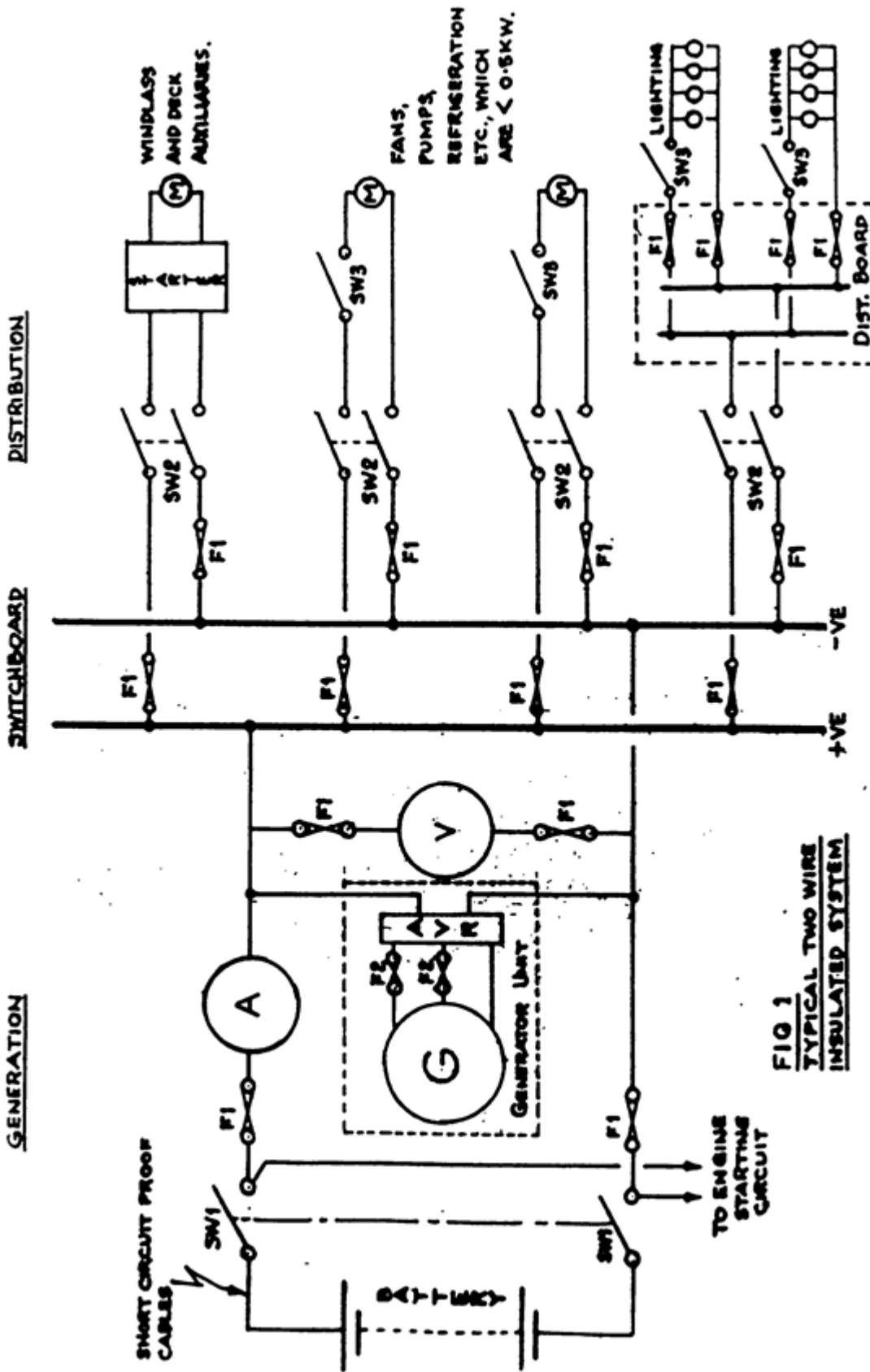


FIG 1
TYPICAL TWO WIRE
INSULATED SYSTEM

6.2 Standards

6.2.1 Requirements are contained in [MSN1871 Chapter 4.8](#); [MSN1872 Chapter 4.2](#) and [MSN1873 Chapter 4.2](#).

6.2.2 DC distribution should be two-wire insulated, as indicated in fig.1. Voltages of 12, 24, 110, and 220 volts are acceptable.

6.2.3 However, engine circuits comprising engine mounted equipment, single-wire systems are acceptable provided the return connection from these is made at the engine itself.

6.2.4 AC distribution should be either:

- 3 phase, 3 wire insulated;
- 3 phase, 4 wire with neutral earthed at power source; or
- Single phase, 2 wire insulated.

6.2.5 Voltages of 440, 380, 220 volts at 50 or 60Hz are acceptable.

6.2.6 The ship's hull is not to be used as a current carrying conductor. Electrical systems are to be wired as insulated return systems.

6.2.7 All circuits, including the primary windings of transformers, should be provided with electrical protection against overload and short-circuit in the form of fuses or circuit-breakers which should be capable of withstanding current surges. The exception to this is the main supply to the starter motor and electrically driven steering motors which should have overload alarms fitted. Short-circuit protection should be rated at not less than twice the total current rating of the motor in the circuit protected. Transformers arranged to operate in parallel should be provided with secondary isolation.

6.2.8 Means of monitoring via earth lamps or meter should be fitted to the switchboard. Generally, enclosed switchboards are required, but smaller older vessels having exposed components must have guards fitted for the safety of personnel.

6.2.9 Cables not provided with electrical protection should be kept as short as possible and should be "short-circuit proofed", i.e., single core with additional sleeve over the insulation of each core. Normal marine single-core cable compliant with BS 6883:1991 will meet this requirement without an additional sleeve, since it has both conductor insulation and a sheath.

6.2.10 Double-pole switches should be fitted in insulated systems, e.g., where there is no intentional connection of the circuit to earth, except in the final sub-circuit, where single-pole switches may be used.

6.2.11 Single pole switches are acceptable in systems with one pole earthed but fuses should not be fitted in an earthed conductor.

- 6.2.12 All wiring fitted should be flame-retardant cable (BS 4066). Normal domestic PVC-insulated, PVC-sheathed, power and lighting cable manufactured to BS 6004:2012 is acceptable, as is flame-retardant PVC cable manufactured to BS 6862: Part 1:1971(1990). Equivalent ISO, BS-EN, or IEC standards can be accepted.
- Note: When selecting cables pay particular attention to environmental factors such as temperature and contact with substances; polystyrene, for instance degrades PVC insulation.
- 6.2.13 All electrical connections should be properly made and secure, of the screwed or bolted type; spring loaded types are not acceptable. All electrical equipment should be securely mounted in position and wiring should be adequately supported.
- 6.2.14 The insulation resistance for electrical installations up to 50 volts, when measured using a low voltage instrument, should be not less than 1 megohms for all new vessels (.0.3 megohm when tested with a 500 Volt direct current instrument).
- 6.2.15 The insulation resistance for electrical systems over 50 volts, should be not less than 1.0 megohm for all vessels when tested with a 500 Volt direct current instrument.
- 6.2.16 The test should use an applied voltage of 500 V d.c for all circuits up to 500 V d.c. or V a.c.(r.m.s.).
- 6.2.17 BS IEC 60092-401:1980, Electrical Installation in Ships – Part 401: Installation and test of completed installation also applied the same standard 500 V d.c. test with the same acceptable minimum standards.
- 6.2.18 Lloyds Rules and IACS standards permit a lesser test voltage for circuits under 250V. However, the acceptable minimum insulation resistance is to 1MΩ instead of .0333MΩ. Lloyd's Register Rules and Regulations – Rules and Regulations for the Classification of Ships 2012, incorporating Notice 1, 2, 3, 4 & 5 0 Control, Electrical Refrigeration and Fire – Electrical Engineering Testing and Trials says:

21.2.2 The Insulation resistance is to be measured off all circuits and electrical equipment, using a direct current insulation tester, between:

- (a) All current carrying parts connected together and earth and, so far as reasonably practical;
- (b) All current carrying parts of different polarity or phase.

The minimum values of test voltage and insulation resistance are given in Table 2.21.2. The installation may be subdivided and appliances may be disconnected if initial tests produce results less than these figures.

Table 2.21.1 Test Voltage and minimum installation

Rated Voltage U_n V	Minimum voltage of the tests	Minimum insulation resistance, M Ω
$U_n \leq 250$	$2 \times U_n$	1
$250 < U_n \leq 1000$	500	1

6.2.19 Fish hold and net store lighting should have an isolation switch outside of the space.

6.2.20 Fluorescent lighting can have the stroboscopic effect of making rotating machinery appear stationary. Single tubes should be avoided and double tubes should be fitted in opposing directions.

6.3 EXISTING VESSELS SURVEY/INSPECTION

6.3.1 Requirements are contained in [MSN1871 Chapter 4.8](#); [MSN1872 Chapter 4.2](#) and [MSN1873 Chapter 4.2](#). For the purposes of this section Existing Vessels are:

- Vessels of less than 15m LOA on the Register prior to 16 July 2007 and not built to a Construction Standard
- Vessels of 15m LOA to less than 24m RL a fishing vessel, the keel of which was laid or the construction commenced before 23 November 2002;
- Vessels of 24m RL and over which are not new vessels. New Vessels of 24m and over are:
 - a fishing vessel for which:
 - on or after 23rd November 1995 the building or major conversion contract is placed; or
 - the building or major conversion contract has been placed before 23rd November 1995, and which is delivered three years or more after that date; or
 - in the absence of a building contract, on or after 23rd November 1995:
 - (i) the keel is laid; or
 - (ii) construction identifiable with a specific vessel begins; or
 - (iii) assembly has commenced comprising at least 50 tonnes or 1% of the estimated mass of all structural material, whichever is less;

6.3.2 Apart from maintaining the original standards, the following items may be considered when inspecting electrical installations:

- Fuses and circuit-breakers should be checked. Fuses should be the correct rating for the circuit and circuit-breakers should operate satisfactorily. Main circuit-breakers and all those on systems over 220v should be checked for general condition and should show no signs of deterioration e.g., burn marks.

- Earthing arrangements on non-current carrying parts of systems over 50v, should be randomly checked to ensure that earthing connections are fitted and in good condition. There should be no corrosion present.
- An existing vessel having a 2-wire system with 1 pole earthed, will remain acceptable but should have:
 - on metallic hulls, the earth connection to be direct to the hull
 - on wooden or GRP hulls, all earth connections including lightning conductor, to be direct to a special earthing plate fitted to the outside of the hull. This prevents problems arising from electrolytic corrosion and electromagnetic interference.
- Insulation resistance or ‘megger’ tests of components and circuits should indicate that the insulation resistance to earth for each core and for each core to core remains acceptable;
 - Installations below 50V should be tested using a low voltage instrument (to prevent damage to voltage sensitive components) and have any reading below 1 megohms investigated and actioned to increase it (0.3 megohms when testing with a 500Vdc megger).
 - Installations above 50V should be tested with a 500Vdc “megger” meter and have any reading below 1.0 megohms investigated and actioned to increase it.
 - Installations above 60Vac would require urgent action as an immediate risk to life is involved.
- The test should use an applied voltage of 500 V d.c for all circuits up to 500 V d.c. or V a.c.(r.m.s.).
- BS IEC 60092-401:1980, Electrical Installation in Ships – Part 401: Installation and test of completed installation also applied the same standard 500 V d.c. test with the same acceptable minimum standards.
- Lloyds Rules and IACS standards permit a lesser test voltage for circuits under 250V. However, the acceptable minimum insulation resistance is to 1, MΩ instead of .0333MΩ. Lloyd’s Register Rules and Regulations – Rules and Regulations for the Classification of Ships 2012, incorporating Notice 1, 2, 3, 4 & 5 0 Control, Electrical Refrigeration and Fire – Electrical Engineering Testing and Trials says:

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- b. All current carrying parts of different polarity or phase.

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6.3.3

The risks of electric shock are much greater on board ship than they are normally ashore because wetness, high humidity and high temperature (including sweating) reduce the contact resistance of the body. In those conditions, severe and even fatal shocks may be caused at voltages as low as 60V. It should also be borne in mind that cuts and abrasions significantly reduce skin resistance. A break down in insulation can cause live parts that are uninsulated and exposed so that they can be touched either directly or indirectly by a conducting object are hazardous if the voltage exceeds 50 V ac or 120 V dc in dry conditions and/or if the fault energy level is high

- Batteries should be secure, remain filled with electrolyte and charged, with clean and secure electrodes, and be well ventilated. Battery lockers should be well ventilated, gas tight from the accommodation, and any lighting should be flameproof type. Alkaline batteries should not be stored with the lead acid type;
- The system wiring, parts and items of equipment should be checked for general cleanliness and condition. Wiring should remain flexible without cracking the plastic sheathing;
- Switchboard earth indicators (lamps or meter) should be checked and any deficient circuit identified and made safe; and
- Switchboard guards to remain secured in position and rubber matting to be provided adjacent.

6.4 SURVEY SCHEDULE**6.4.1**

Where vessels are not classed and come under MCA survey, the approved schedule for machinery survey will include electrical components. The electrical overhaul to be undertaken by qualified contractors and witnessed by the surveyor:

- Motors should be overhauled in conjunction with the pump, compressor, winch, fan, etc. to which it is attached. The motor should be megger tested and appropriately dried or revarnished if readings are low. Chemical cleaning and drying should be undertaken, and renewal of ball races.

n.b. A motor uncoupled from its machine should run silently and smoothly, any noise indicating damaged ball races.

6.4.2

It is vital that when replacing the motor and its machine, that the coupling is correctly aligned, parallel in both profile and plan perspectives.

- Generators should be cleaned and the circumferential air gap checked. If the lower gap is smaller than the upper gap, then the pedestal bearing is probably worn and needs renewal. The generator should be megger tested and appropriately dried or revarnished if the readings are low;
- Switchboards should have all connections tested for tightness. Also fuses and contactors inspected. Suspect contactors to be opened up and the contacts renewed. This should be undertaken whilst blacked out. Alternatively, thermal or thermographic imaging can be undertaken to identify hotspots and this can be accepted towards survey requirements. Current injection equipment should be utilised on large breakers to confirm correct operation;
- D.C. equipment would involve polishing of commutators and cleaning of segment gaps, renewal of carbon brushes and checking of springs; and
- Transfer of load from one generator to another should not involve the vessel blacking out. Generator starting and load sharing should be demonstrated during survey.

6.5 ELECTRICAL PRECAUTIONS

6.5.1 ESSENTIAL SERVICES

6.5.1.3 On fishing vessels of less than 15m LOA, the electrical generating system must have sufficient capacity in normal running conditions to ensure the correct operation of all safety and navigation equipment including navigation and fishing lights.

6.5.1.2 On new vessels of 15m to less than 24m (a fishing vessel, the keel of which was laid or the construction commenced on or after 23 November 2002) where electrical power is the only means for maintaining auxiliary services essential for propulsion or safety of the vessel, a main source of electrical power shall be provided comprising of at least two independent generators, one of which may be driven by the main engine. Such services shall be capable of being provided when any one of the sources of electrical power is out of operation. Existing arrangements for existing vessels will continue to be accepted.

6.5.1.3 Vessels over 24m require two auxiliary generators and these provide the essential and emergency services. The propulsion and safety of the vessel must be provided for by each generator after shedding non-essential loads. Typically, the essential services are as follows:

- Propulsion;
- Bilge pumping and fire-fighting services;
- Engine and machinery space ventilation;
- Essential and emergency lighting;
- Steering gear;
- Communication systems;
- Alarms systems;

- Automatic control equipment; and
- Navigation lights and navigational aids

6.5.1.4 Providing there is no interference with the essential and emergency services the non-essential services can be arranged to be disconnected in any order to suit the owner.

6.5.2 EMERGENCY SERVICES

6.5.2.1 Requirements are contained in [MSN1871](#) Section 4.8, [MSN1872](#) Chapter 4.2.7 and in [MSN1873](#) Chapter 4.2.7.

6.5.2.2 On new fishing vessels built to Seafish Construction Standards, vessels must have emergency power to supply for one hour to

- (i) The vessel's lights which are sited at stairways and exits, engine room, wheelhouse, sleeping accommodation, mess room, boarding ladder position, and at the liferaft storage position;
- (ii) Emergency communications, navigation lights and signal equipment if they are operated from the vessel's main source of power
- (iii) The daylight signalling lamp if it is operated by the vessel's main source of electric power;
- (iv) Other equipment as required by the Code of Safe Practice.

6.5.2.3 On fishing vessels of less than 15m LOA, which underwent a Registration Survey, unless the Registration Survey allowed otherwise, 6.5.2.2 shall be applied.

6.5.2.4 Vessels not built to a Construction Standard shall, in the event of failure of engine and charging systems, have battery capacity, as a minimum, capable of supplying emergency lighting for at least one hour.

6.5.2.5 On vessels of 15m LOA to less than 24m RL, the emergency source of electrical power may be an independently driven generator, provided with an independent fuel supply and means of starting, or accumulator batteries. If the emergency electrical power source is an accumulator battery and the main electrical power source fails, the accumulator battery shall be automatically connected to the emergency electrical switchboard and supply power for an uninterrupted period of three hours to:

- (i) the internal communication system, fire detectors and emergency signals;
- (ii) the navigation lights;
- (iii) the emergency lights (in stairways, exits, machinery spaces, wheelhouse and liferaft launching stations);

(iv) the radio installation (reference shall be made to [The Merchant Shipping \(Radio\)\(Fishing Vessels\) Regulations, SI 1999, No. 3210](#), as amended, or any subsequent documents).

6.5.2.6 Vessels of 18 metres in length LBP and over, constructed before 23 November 1995, may continue to locate the emergency electrical power source inside the engine room, where structural characteristics do not permit relocation.

6.5.2.7 Requirements are contained in [MSN1872](#) Chapter 4.2.10 and [MSN1873](#) Chapter 4.2.10.

6.5.2.8 The emergency services must be provided for at least three hours, by means of batteries or emergency generator and consist of:

- General alarm;
- Watertight doors & their indicators, if applicable;
- Emergency lighting (stairways, exits, machinery spaces, wheelhouse and liferaft launching stations);
- Navigation lights;
- Internal Communication system;
- Radio installation;
- Fire detection;
- Aldis lamp; and
- Emergency fire pump, if applicable

6.5.3 FLOODING RISKS

6.5.3.1 Services essential for the propulsion and safety of the vessel should be protected against a partial flooding of the vessel's machinery space.

6.5.3.2 The amount of flooding against which safeguarding arrangements should be made cannot be stated exactly, but for guidance it is considered that adequate provision will have been made if generators, switchboards, essential pumps, and transformers, are situated or arranged so that they will continue to operate until a depth of water has accumulated in the space equal to one twelfth of the breadth of the vessel or 1.5 metres or 0.15 metres above the main engine seating or bearers, whichever is the least, assuming that the vessel is on an even keel. The depth should in general be measured from the tank top except in the case of vessels with open floors when the depth may be measured from the inside of the bottom shell.

6.5.4 EXPLOSION RISKS

6.5.4.1 Requirements are contained in Section 5.5 of [MSN1871](#), [MSN1872](#) Chapter 5.9.4 and [MSN1873](#) Chapter 5.4.5.

6.5.4.2 Electrical equipment installed in compartments containing explosive gases are to be ignition protected in accordance with ISO 8846.

6.5.4.3 For LPG systems this to be installed to ISO 10239

6.5.5 PORTABLE EQUIPMENT

6.5.5.1 Requirements are contained in [MSN1871](#) Chapter 4.8; [MSN1872](#) Chapter 4.2 and [MSN1873](#) Chapter 4.2.

6.5.5.2 Portable equipment, such as lamps and tools should not pose a hazard of electric shock. They should be maintained in good condition and with suitable connections to wandering leads. Equipment operating over 50v should be earthed through a conductor in the supply cable or protected by an isolating transformer or be double insulated.

n.b. body wetness including that caused by humidity or dampness can cause fatal shocks with voltages as low as 60v.

6.6 EMERGENCY SOURCE OF POWER

6.6.1 Requirements are contained in [MSN1871](#) Chapter 4.8.1; [MSN1872](#) Chapter 4.2.10 and [MSN1873](#) Chapter 4.2.10.

6.6.2 The generator, batteries and switchgear forming the emergency source of power are to be sited so that flames, heat or smoke emitted from skylights, doors or other openings in the event of a fire in the machinery space will not prejudice the safe operation of the equipment or render the space inaccessible or uninhabitable to the necessary personnel. Access to the emergency generator room should preferably be from the open deck but in any case, adequate air supply should be ensured for the proper running of the engine and for attendant personnel.

6.6.3 Where the main source of electric power is installed above the freeboard deck, outside the engine room, the arrangement should permit non-emergency circuits to be automatically disconnected from the switchboard to ensure sufficient power is available for the emergency circuits.

6.6.4 EMERGENCY GENERATOR POWER

6.6.4.1 An emergency generator is to be of sufficient power to supply, simultaneously, those services stipulated in 6.5.2 as well as the starting currents necessary to arrive at this simultaneous running condition.

6.6.5 EMERGENCY BATTERY CAPACITY

6.6.5.1 If the emergency source of supply is a battery, it is to meet the requirements of the above paragraph including fire pumping, without the on-load voltage falling outside the limits of +10 per cent and 12 per cent of rated circuit voltage during the specified period of service.

- 6.6.5.2 When inspecting batteries, surveyors should be satisfied that the capacity has not been reduced and is still sufficient to ensure performance of the required duty. Any cell suspected of being defective should be tested for capacity and if it fails to give 80 per cent of its rated capacity it should be considered unfit for further service. The specific gravity of the electrolyte, measured with a hydrometer, indicates the charge of a lead acid battery (low 1.110 to high 1.280). A certificate of inspection by a battery maker or his authorised agent regarding the satisfactory condition of the battery may be accepted.

6.7 EMERGENCY LIGHTING

- 6.7.1 Requirements are contained in [MSN1871](#) Chapter 4.8.1; [MSN1872](#) Chapter 4.2.4, 4.2.8, 5.3.11, 5.7.6, 6.1.9, 10.1.4 and 10.2.10; and [MSN1873](#) Chapter 4.2.4.

- 6.7.2 Emergency lighting systems should be of the 'maintained type'; the lighting circuits should have a power supply available at all times from either the main source of power or, should that fail, from the emergency source, so that in an emergency, satisfactory lighting of all those locations which are required to be served by the emergency system will be assured. Maintained systems have the advantage that, in general, failure of lamp filaments, fuses, etc. will attract attention so that they may be corrected before an emergency occurs.

6.8 STARTING EMERGENCY GENERATORS

- 6.8.1 Requirements are contained in [MSN1872](#) Chapter 4.2.3, 4.2.8, and 4.2.10; and [MSN1873](#) Chapter 4.1.13, 4.1.14, 4.2.3, 4.2.8, 4.2.10, and 4.3.4.

- 6.8.2 Emergency generating sets should always be capable of being started readily when cold. When hand starting is impracticable, other means should be provided. The means of starting should in general provide for not less than four starts in a period of ten minutes without recourse to sources of power within the machinery space. Where air starting only is used an independent recharging device should be provided adjacent to the emergency generator. The capacity of the air [air bottle or bottles air receivers](#) together with the independent recharging device should be such as to provide for the above number of starts in the time stated. The recharging device may be a manually operated compressor or a hand starting diesel compressor. If a manually operated compressor is fitted, a small air [bottle receiver](#) which would provide one start of the generator should be fitted in addition to the main [bottle or bottles air receivers](#).

- 6.8.3 Where an emergency generator forms the emergency source of power, it should be arranged for automatic starting and automatic connection to the emergency switchboard. Blackout starting can be simulated by tripping the interconnector breaker on the main switchboard.

- 6.8.4 Where battery starting only is to be used, two sets of batteries each capable of six starts without recharging should be fitted. The arrangements should ensure that at

least one set of batteries is always maintained in the fully charged condition, e.g., by trickle charging. The batteries to be positioned as close to the starter motor as possible to prevent the large voltage drops associated with long cables

6.8.5 Proposals to use one set of batteries will be considered if the battery is arranged so as to be kept fully charged in situ, e.g., by the provision of monitored trickle charging facilities provided with visual and audible fault alarms at the control station. The capability of the battery to produce the required number of starts should be demonstrated at each resurvey. The stowage arrangements of batteries should be such as to ensure that they will not be subjected to low temperatures which would affect their output.

6.8.6 In all cases, the surveyor should witness starting and running **trials trials** of the emergency generator. The voltmeter will indicate that the generator is working when on no load condition, but machinery will need to be started to indicate on the power meter (kW) that load is being taken, whilst maintaining the frequency (Hz).

6.9 WATERPROOFING

6.9.1 Electrical equipment intended for exposure to wetness, will be constructed to an ingress protection “IP” rating. The first numeral identifies protection against solid bodies and the second numeral to protection against liquids:

- 8 - indefinite immersion, e.g., IPX8 for bilge wells alarm sensors
- 7 - effects of immersion
- 6 - exposure to heavy seas, e.g., IP56 for motors on open decks
- 5 - exposure to water jets
- 4 - exposure to splashing, e.g., IP44 for equipment in galleys
- 3 - exposure to spray
- 2 - angle dripping water, e.g., IP22 for motors in machinery spaces
- 1 - vertically dripping water
- 0 - located in protected area, e.g., IP20 for equipment in accommodation

DOCUMENT AMENDMENT HISTORY

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06.20	<ul style="list-style-type: none"> Amendments to reflect introduction of MGNs 628 and 629 	21/6/2020	D Fenner	G Stone	21/6/2023
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