An Roinn Iompair
Department of Transport

Marine Notice No. 18 of 2023

This Marine Notice replaces Marine Notice No. 58 of 2011

Notice to all Vessel Owners and Mariners

Electrical Systems in Small Pleasure, Fishing and other Craft

The purpose of this Marine Notice is to highlight again a number of matters relating to the safety of electrical systems on small pleasure, fishing and other craft and to provide important safety advice and recommendations in relation to the requirements. Failure to give due attention to these matters could result in high risk of fire and/or explosion.

1. Introduction

1.1. A Marine Casualty Investigation Board Report into the fire and subsequent sinking of a fishing vessel a number of years ago recommended that owners of fishing, pleasure and other craft carry out regular visual checks of cabling and ensure that all cable runs and connections are secure.

1.2. Owners of pleasure craft, fishing vessels and other small craft are also recommended to carry out routine 'earth checks' and 'megger tests' on cables and, where appropriate, equipment. It is also recommended that earth faults should be cleared promptly, especially on systems having a voltage to earth of greater than 55 V.

1.3. The Merchant Shipping (Safety of Fishing Vessels) (15-24 metres) Regulations 2007 (S.I. No. 640 of 2007) require that electrical distribution systems comply with the requirements of the International Electrotechnical Commission (IEC) Standard 60092-507:2017, "Electrical installations in ships", the most relevant part being "Part 507:2015 small vessels", or the International Organization for Standardization (ISO) Standard EN ISO 13297:2020 Small craft – Electrical equipment – Alternating and direct current installations. As a matter of good practice, other small vessels should also comply with these standards.

1.4. In pleasure craft, fishing vessels and other small craft, many of the systems are of the type that operate at not more than 50 V (usually 24 V), having a propulsion engine-driven alternator and batteries, similar to those generally installed in public transport vehicles (e.g. buses).

1.5. In applying the IEC Standards to small craft, the small scale of the installation **must not** permit a reduction in the degree of safety and it must be appreciated that the modern alternator and, in particular, the battery, are capable of giving very high currents. It is therefore important that steps are taken to cut off any excess current as quickly as possible by the use of a fuse or circuit breaker (electrical protection) or by minimising the risk of excess currents by the use of suitable cable.

1.6. If the electrical protection of the wiring is unsatisfactory, an engine starting battery is capable of causing wiring to glow red hot and even to melt the conductor in severe fault conditions. It will be readily appreciated that these temperatures would be sufficient to start a fire in almost any part of the craft.

1.7. Consequently, particular attention should be paid to the way that additional equipment is connected, irrespective of whether it is permanently or temporarily installed. Examples are public address systems and sound amplification equipment. The power supply should be taken from a point in the circuit which is protected by a fuse or circuit breaker and never connected directly to the battery or alternator or associated wiring.

1.8. Traditional alkaline and lead acid batteries emit flammable hydrogen gases which can escape to a high level within the space through the vent plugs provided. Consequently, loose or poorly made electrical connections, wiring with unsatisfactory electrical protection and other sources of ignition such as loose metallic objects, spanners, etc., should be kept clear. Hydrogen gas does not "flow" particularly well and any vent pipes should avoid having bends with an internal angle of less than 135 degrees ("45 degree bend").

1.9. It is not always appreciated that flammable gases can be emitted from both alkaline and lead acid batteries of the so called "sealed" or "maintenance free" type. The majority of the hydrogen and oxygen produced within the cells is re-combined to form water, but the process is not 100% efficient. Consequently, these batteries are fitted with valves to relieve internal pressure, and some ventilation should always be provided for the space where they are located.

1.10. It is highly recommended that any additions or modifications to the electrical installations are carried out by qualified personnel who are competent and aware of the requirements for marine electrical systems and equipment as per the regulations and guidelines referred to in point 1.3.

2. Existing Craft

2.1. It is recommended that an examination of the electrical installation is carried out regularly, at least at statutory survey periods where these are applicable, to ensure that:

2.1.1. all circuits, except the main supply from the battery to the starter motor and electrically-driven steering motors, are provided with electrical protection against overload and short circuit (i.e. fuses or circuit breakers are provided). Electrically-driven steering motors are seldom fitted to small vessels but if they are fitted, requirements are given at Annex 1;

2.1.2. when additional wiring has been installed, it is in compliance with sub-paragraph 2.1.1 above and is properly installed away from sources of heat, e.g. exhaust pipes etc., and is of a suitable type of cable. Examples of suitable cable types are given at Annex 1;

2.1.3. the battery installation and ventilation are in accordance with the IEC/ISO Standards;

2.1.4. all connections are tight (see also Annex 2), properly made and, if necessary, insulated;

2.1.5. the insulation resistance is maintained at an acceptable level. Details are given at Annex 1.

3. New Electrical Systems

It is recommended that in designing new electrical installations of the type described in this Marine Notice, account is taken of the items listed at Annex 1.

4. Testing of Electrical Systems

4.1. All persons should be satisfied that the requirements of the IEC 60092 International Standard are generally followed and that the condition of the electrical installation, equipment, wiring, safety devices, control gear, fittings on switchboards and spare gear remain fit for purpose. Over-current and reverse power trip systems for generators should be tested in the surveyor's presence. The condition of generator stators and rotors and their windings and the electrical connections, slip rings etc. should be verified.

4.2. Electrical equipment, where used for lighting only, shall be given a general examination and, if considered necessary, a test shall be made on the wiring and fittings. When electrical equipment is used for driving essential machinery, steering gears or windlasses, the prime movers shall be opened up for inspection, if necessary. All generators and essential motors shall be inspected as far as practicable without dismantling any fixtures or casings, unless such dismantling is deemed necessary. A test shall be made on generators, motors, cables, heaters and fittings, if necessary. All generators shall be run and all main switches and circuit breakers shall be operated.

4.3. Surveyors should be satisfied that routine testing and overhauling of generators, motors and other electrical parts of essential auxiliaries and electrical installations are carried out and recorded, and insulation tests should be made if considered necessary. Refer to Annex 3 for further details regarding the testing of electrical systems.

4.4. Annex 4 gives some examples of defective electrical installations that were found during inspections of craft.

Note: Marine Notices are issued purely for maritime safety and navigation reasons and should not be construed as conferring rights or granting permissions.

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Encl: Annex 1, Basic requirements for electrical systems not exceeding 50 V DC
Annex 2, Ageing, loose connections and parts of electrical equipment
Annex 3, Testing of electrical systems
Annex 4, Examples of defective electrical installations found during inspections of craft

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ANNEX 1

BASIC REQUIREMENTS FOR ELECTRICAL SYSTEMS NOT EXCEEDING 50 V DC

1. Systems should be two wire, except that single wire systems are acceptable for engine circuits comprising engine mounted equipment, provided the return connection from these is made at the engine itself. All circuit breakers should be the correct DC type of circuit breaker.

2. All circuits except the main supply from the battery to the starter motor and electrically driven steering motors should be provided with electrical protection against overload and short circuit (i.e. fuses or circuit breakers should be installed). Steering motors should have an overload alarm in lieu of overload protection and short circuit protection. The short circuit protection should be for not less than twice the total rated current of the motors in the circuit protected.

3. Cables which are not provided with electrical protection should be kept as short as possible and should be “short circuit proofed”, e.g. single core with additional insulated sleeve over the insulation of each core. Normal marine cable (e.g. in compliance with IEC 60092-350 or BS 6883) which is single core will meet this requirement without an additional sleeve since it has both conductor insulation and a sheath.

4. In systems where there is no intentional connection of the circuit to earth (insulated systems), double pole switches should be provided, except that single pole switches may be used in the final sub-circuit.

5. Single pole switches are acceptable in systems with one pole earthed. Fuses should not be installed in an earthed conductor.

6. A battery cut-out switch is recommended for all systems. It is preferred that this switch acts as an isolator, i.e. it is double pole. If a battery change-over switch is fitted and is provided with an “off” position, this may serve as the cut-out switch also.

7. The battery installation and ventilation should be in accordance with IEC or ISO Standards. Batteries should be located in the upper part of a vessel and as close to equipment as possible. Where an outside battery box is used to store batteries, it should be properly ventilated, corrosion-proof and protected against the ingress of seawater. All battery units should be securely braced so that the movement of the vessel will not dislocate them. Batteries should be installed in such a manner that they are readily accessible for inspection, maintenance and replacement. Batteries must not be located in the wheelhouse, underneath seats or bunks or anywhere in the accommodation areas of a vessel. A label should be affixed to each battery unit, which clearly indicates its make, type, voltage, capacity, and date of installation.

8. All wiring should be carried out with flame retardant cable. Normal domestic PVC insulated, PVC sheathed, power and lighting cable manufactured to BS 6004 is acceptable. PVC cable to BS 6862, Part 1 “Cables for Vehicles” is also acceptable provided it is flame retardant. Note that when selecting cables, particular attention should be given to environmental factors such as temperature and contact with substances, e.g. polystyrene, which degrades PVC insulation.

9. The insulation resistance, using a low voltage instrument so as not to cause damage, should be not less than 0.3 Megaohm (MΩ) for all new vessels, but a minimum of 0.1 MΩ can be accepted on existing vessels.

10. It is recommended that for all vessels a schematic diagram of the vessel electrical system is available on board, which should be updated after any modifications.

ANNEX 2

AGEING, LOOSE CONNECTIONS AND PARTS IN ELECTRICAL EQUIPMENT

1. Connections and parts of electrical equipment becoming loose in service leads to a risk of overheating and electric shock. All electrical equipment for use in ships should be suitably specified, constructed and maintained for the conditions of vibration and mechanical shock to which it will be subject in normal shipboard service.

2. Sufficient attention should be paid to the provision of locking facilities and to ensuring during regular maintenance periods that connections and securing devices of electrical equipment are tight.

3. Those responsible for the design and installation of such equipment should ensure that adequate provision is made for securing and/or locking of parts and connections and that the equipment is not put into service unless such provision has been made effective.

4. Once the equipment is in service those responsible for its operation and maintenance should ensure that it is checked at suitable intervals so that any wear or other deterioration which could eventually lead to loose parts, overheating or disintegration, is detected and corrected before any serious consequences arise.

5. The performance of the securing arrangements should be monitored during regular maintenance periods. If the performance in this respect is unsatisfactory, the need for modification or replacement of existing equipment should be considered.

6. Overheating of parts and equipment may be readily detected using thermal imaging cameras and infrared heat detectors.

7. Insulating and protective sheathing of cable used in small craft is susceptible to ageing due to exposure to heat and movements. Inspection of cabling should pay particular attention to chaffing between the outer sheathing and solid contact points. All cable should be located away from sources of heat and should be securely clipped in place to reduce work hardening due to movement.

ANNEX 3

TESTING OF ELECTRICAL SYSTEMS

1. General

1.1. Owners should be reminded that circuits, which contain variable speed alternating current generators, transistorised regulators and semi-conductors used in such alternating current generators, should be tested in accordance with the manufacturer's instructions. Irreparable damage can be done to voltage sensitive items of equipment by megger testing. Polarity conscious equipment, i.e. alternating current generators and some transistorised regulators, can suffer similar damage by reversed polarity connections to the battery.

1.2. It is recommended that insulation resistance be measured by self-contained instruments such as a direct-reading ohmmeter of the generator type, applying a voltage of at least 500 V. The test voltage for systems rated less than 230 V should be limited to twice the rated voltage of the equipment being tested. The insulation resistance should be recorded together with the ambient temperature and the relative humidity at the time of test.

2. General

After the electrical installation has been completed and before the vessel is placed in commission, the entire electrical installation should be tested. Such tests are intended to indicate the general condition of the installation at the time of completion; however, satisfactory test results do not in themselves necessarily ensure that the installation is satisfactory in all respects.

3. Earthing

Tests should be made to verify that all protective conductors and bonds are connected to the frame of the apparatus and to the hull or earthing plate and that earth contacts in socket outlets have been connected to earth. The maximum value of the resistance to earth should be 1.0 ohm.

4. Insulation resistance

4.1. It is recommended that insulation resistance be measured by self-contained instruments such as a direct-reading ohmmeter of the generator type, applying a voltage of at least 500 V. The test voltage for systems rated less than 230 V should be limited to twice the rated voltage of the equipment being tested. The insulation resistance should be recorded together with the ambient temperature and the relative humidity at the time of testing.

4.2. The results obtained may depend not only on the characteristics of the insulation materials and on the way in which they are applied but also on the ambient temperature and the relative humidity.

4.3. NOTE - Care should be taken on electronic equipment to ensure that no damage is sustained due to the application of test voltages.

5. Switchboards, panel boards and distribution boards

Before switchboards or panel boards and distribution boards are put into service, their insulation resistance should be not less than 1 MΩ when measured between each busbar and earth and between each insulated busbar and busbars connected to the other pole or poles. The test

should be made with all circuit-breakers and switches open and all fuse-links for pilot lamps, earth-fault indication lamps, voltmeters, etc. removed and voltage coils temporarily disconnected.

6. Lighting and power circuits

A test for insulation resistance between all insulated poles and earth and, where practicable, between poles, shall be applied to all permanent wiring. A minimum value of 1 MΩ shall be obtained.

7. Generators and motors

The insulation resistance of generators and motors should be measured at operating temperature immediately after running at normal load. The embedded temperature sensor of the machine, if any, is connected to earth during testing. A minimum value of 1 MΩ should be obtained. The following motors should be tested as a minimum – fire pumps, bilge pump, steering gear, start air compressors and fuel pumps.

8. Transformers

The insulation resistance of transformers should be measured at operating temperature. A minimum value of 1 MΩ should be obtained.

9. Switchgear and controlgear

The switchboards or panel boards and distribution boards should be loaded as near as practicable to their normal working load in order to ensure no overheating occurs due to faulty connections or incorrect rating. Switches, circuit-breakers and controls should be operated on load to test their suitability and to demonstrate that the operation of over-current, undervoltage and reverse-current or reverse-power protective devices are electrically and mechanically satisfactory. The test may be carried out by simulation using testing equipment designed for the purpose.

10. Voltage drop

Tests should be made on consuming devices to verify that excessive voltage drop does not occur.

11. Internal communication circuits

Circuits operating at a voltage of 50 V and above should have an insulation resistance between the two conductors and between each conductor and earth of not less than 1 MΩ. For circuits operating at a voltage below 50 V, the insulation resistance should not be less than 0.3 MΩ.

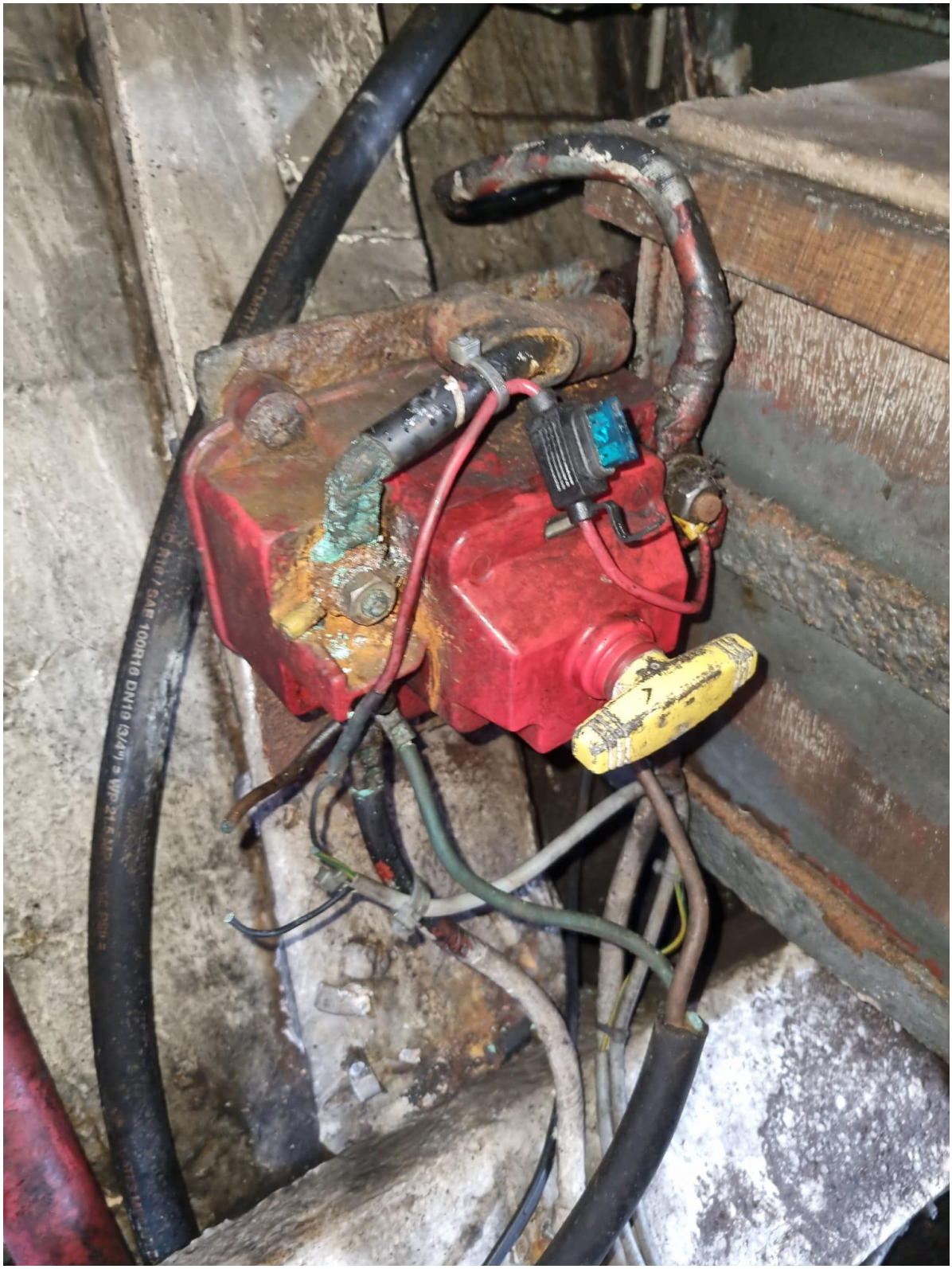
NOTE - If necessary, any or all appliances connected to the circuit may be disconnected while the insulation resistance is tested.

12. Lighting, heating and galley equipment

Electrical devices and circuits should be tested under operating conditions to ensure that they are suitable and satisfactory for their purposes.

ANNEX 4

Examples of defective electrical installations found during inspections of craft

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