Maritime and Coastguard Agency

MARINE GUIDANCE NOTE

MGN 177 (M + F)

Accidents Involving Electrical Test Equipment

Notice to Ship Owners, Ship Builders, Certifying Authorities, Surveyors, Masters and Ships Officers.

Summary

This Guidance Note draws attention to the hazards arising from testing electrical circuits and particularly the use of unsuitable or poorly maintained electrical test equipment.

Key Points:

- Qualified personnel only should carry out testing.
- Permit to work systems should be used.
- Maintenance should not be carried out at inappropriate times.
- Only "ship issue" test equipment should be used.
- Test equipment should be examined and calibrated regularly.
- Test instruments should be rated for the circuit under test.
- Personnel should be aware of additional dangers in the space in which they are working.
- Persons not taking part in the operations should be excluded from the area.

1.0 INTRODUCTION

1.1 Following a fatal accident, which occurred when an Electro Technical Officer was checking the phase to phase voltage at live side of a fuse switch and a "flash over" explosion resulted, the Marine Accident Investigation Branch carried out an investigation which identified a number of unsafe practices.

1.2 Although not all of these practices were relevant to this particular accident, each by itself could lead to injury and are believed to be endemic within the industry.

1.3 This Guidance Note is intended to highlight these unsafe practices, other unsafe practices which, although not associated with this incident are believed to be common in the industry and finally, what is considered good practice.

2.0 UNSAFE PRACTICES ASSOCIATED WITH THE FATAL ACCIDENT

Test Equipment

2.1 The test meter being used on the ship was not part of its equipment. Consequently it was not subjected to the ships calibration and testing regime.

2.2 The leads/probes being used were probably "home made". Both leads were the same colour (black) and fitted with 4 mm diameter plugs at both ends. This enabled one lead to be connected across the meter and the other across the live circuit. The plugs also had a considerable length of exposed metal, which increased the chance of bridging the live conductor to adjacent metalwork.

2.3 The test meter in use was not rated for the voltage to which it was being applied.

2.4 The testing circuit was not proved to be complete, which could have been done by using a simple resistance check between the probe tips, prior to switching the meter to measure the voltage and taking the reading.

2.5 Protective gloves were not worn while working on live equipment.

Ship Operational Issues

2.6 This maintenance was carried out whilst the vessel was manoeuvring in confined waters and with the knowledge of the ship's senior engineering staff. The resulting partial loss of power endangered the vessel, passengers and crew.

2.7 Personnel were present who had no direct involvement in the operation, thus unnecessarily exposing them to danger.

2.8 No permit to work system was in place. Such a system should have prevented the use of unauthorised equipment, the presence of non-essential personnel and maintenance being carried out at an inappropriate time.

3.0 COMMON UNSAFE PRACTICES NOT ASSOCIATED WITH THIS ACCIDENT

3.1 The following are unsafe practices which, although not a cause of the fatal accident, are believed to be common to the industry and can cause danger.

3.2 Multi-meters are often set to the incorrect range (ie current setting when taking a voltage reading). This results in excessive current being drawn through the test leads and measuring instrument.

3.3 Test leads and/or probes are often inadequately insulated.

3.4 Either by damage or poor design, the measuring instrument has exposed live terminals.

3.5 Leads can fall off one of the meter terminals and leave the lead terminal and/or the instrument terminal live.

3.6 Use of damaged measuring equipment occurs e.g. cracked meter cases or perished, cut or abraded insulation, which can cause danger to the user.

4.0 INDUSTRY GOOD PRACTICE

4.1 The following descriptions of Good Practice in sections 5 to 7 should help to eliminate the instances of dangerous practice as set out previously and result in a safer working environment.

5.0 GOOD PRACTICE TEST LEAD/PROBES

5.1 Lead and probe sets should be coloured to enable easy distinction between one lead and probe and the other.

5.2 The conductor and insulation should be suitable for the expected loading and working environment.

5.3 The probes should incorporate finger guards, which prevent contact with live conductors.

5.4 Where practicable, probes should be fitted with a high breaking capacity fuse (typically 500 mA) or a current limiting resistor and fuse.

5.5 The conducting tips of probes should have a maximum dimension of 4 mm (and where possible 2 mm or less and/or fitted with a retractable shield).

5.6 Leads should be flexible and of sufficient length for the purpose but not so long as to be unwieldy.

5.7 Meter sockets and lead plugs should not allow any possibility of finger contact being made with the conductor should the lead become detached from the socket.

6.0 GOOD PRACTICE VOLTAGE DETECTORS

6.1 Markings should clearly state the maximum voltage and any short term limitations.

6.2 The instruments should be protected from excess current flow either by a fuse or internal circuitry.

6.3 Where test lamps are used, breakage of the bulb should not result in danger to the user.

6.4 Indicators should be proved to be operational before and after use either by use of internal test circuits or by comparison with known voltages.

7.0 GOOD PRACTICE ACCIDENT PREVENTION

7.1 The following are guidelines on good practice in the use of equipment, checks prior to use and working practices.

7.2 Only suitably qualified persons should carry out testing.

7.3 All personnel should be made aware of the potential dangers in the space in which they are working, giving consideration to:-

- Live circuits other than those under test.
- Security of footing.
- Lighting.
- Damp conditions.
- Presence of flammable or conductive gases, vapours or dusts.

7.4 The test equipment should be suitable for the system under examination, and the operator aware of its limitations.

7.5 Test equipment should be checked for any damage before it is used.

7.6 Test equipment should be proved to be operational both before and after use.

7.7 Where possible, a meter specific to the parameter being measured should be used.

7.8 Personal protective equipment (eg gloves for electrical protection) should be used where practical.

7.9 Work should not be conducted alone but unnecessary personnel should be excluded from the area of operation.

7.10 Continuity testing by resistance checking of a "dead" circuit should be given preference over progressive voltage testing.

7.11 When using tong type test instruments, the operator should be aware of adjacent bare conductors

7.12 Amp-meters, other than tong type, should only be connected with the power off the circuit.

7.13 "Permit to work systems" should be developed, which will restrict access to live circuits, especially on high voltage systems, based on a risk assessment.

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