

# 4

## Electrically propelled vessels

The Boat Safety Scheme Essential Guide



### For more technical information

The requirements in this chapter have been informed by, and may refer to, the following technical references, codes and regulations. If you are building, fitting-out or making substantial changes to a vessel, we strongly recommend you refer to, and take account of, the codes and standards below:

**BS EN 60309-1:1999 'Plugs, socket-outlets and couplers for industrial purposes' – 'Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories'**



## **Electrically propelled vessels**

The particular risks related to electric boats are mainly due to the presence of large banks of batteries and associated charging equipment. Hydrogen, a highly flammable gas that is lighter than air, is the by-product of battery charging. This gas is very easily ignited by low-energy sparks and so minimising the risk of it causing a fire or an explosion is a key feature of these requirements.

This can be achieved by making sure that batteries are stored in accordance with suppliers' recommendations. They should be secured in a ventilated area. The propulsion motor must also be securely installed. It is also important to ensure that your battery-charging equipment and controller compartments are adequately ventilated.

The risks of overheating cables and of not being able to quickly isolate a high-current circuit must also be addressed.

**Boats obliged to meet BSS requirements must comply with the following:**

**12** All motors, controller equipment and charging equipment relating to electrical propulsion must be adequately ventilated.

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**8-11** All relevant requirements relating to electrical equipment as set out in Chapter 3 of this Guide must be complied with where applicable.

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**The following BSS general requirement is relevant to the securing of the engine:**

**1** All permanently installed fuel systems and fixed engines must be designed, installed and maintained in a way that minimises the risks of explosion or of fire starting or spreading.

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## 4.1 Electrically propelled boats

The detail of the risks and ways to help reduce those risks for all electrical supply installations are set out in Chapter 3.

Fires can be caused by sparks igniting flammable gases or by cables overheating.

Hydrogen and air can be a very explosive mixture, especially towards the end of a charging cycle when significant quantities of hydrogen can be given off by the bank of batteries.

### 4.1.1/R REQUIREMENT

**Is the electrical-propulsion supply system compliant with Chapter 3 as applicable?**

Identify boats having an electrical propulsion system.

Apply all of Chapter 3 to the electrical supply system.

The electrical supply systems on all electrically propelled boats must comply with the applicable Chapter 3 BSS requirements.

#### Best practice

If the propulsion-system batteries are connected to a charging source that has a maximum charge rate in excess of 2kW (approx. 150 A at 13.8 V), we strongly recommend installing a fan-assisted ducted ventilation system. The fan's motor is best placed externally to the duct and battery space to avoid any potential for spark ignition. The fan should operate automatically during charging and run for an hour after charging is completed. We also recommend that its safe operation be checked by a competent person on a routine basis.

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## 4.2 Electrical propulsion motor and controller

This section addresses the risks specifically linked to electric propulsion motors.

If electrical connections are damaged by excessive movement, they can cause a spark, which may start a fire or ignite nearby flammable fuels.

#### 4.2.1/R REQUIREMENT

##### **Are all parts of the electric-propulsion motor-mounting systems secure and in good condition?**

Check electrical-propulsion motor-mounting systems for condition and completeness where they can be seen or reached.

Apply light manual force to check the extent of outboard motor movement beyond that allowed by the use of any flexible mounts.

Electrical-propulsion motor-mounting systems must:

- show no signs of fractured engine mounting brackets; **and**,
- not have loose, missing or fractured bolts or nuts; **and**,
- show no evidence of significant breakdown of any flexible mounts.
- show no signs of damaged, rusted or rotten motor bearers.

Electric outboard motors must be securely mounted so that there is no movement in any direction at the mounting points.

**Notes** – The check for condition and completeness includes mounting systems to electric outboard motors.

Do not apply light manual force to electric outboard motors you assess to be too heavy to move.

**The risk of the motor and controller equipment overheating must be minimised.**

#### 4.2.2/R REQUIREMENT

##### **Is the motor and controller equipment adequately ventilated and in good condition?**

Check for any means to dissipate heat from the motor and controller equipment.

Check the condition of the motor and controller equipment.

Electric-propulsion motor and controller equipment spaces must be adequately ventilated by:

- the volume of the space being 10 or more times greater than the volume of the equipment; or,
- having ventilation provided.

Electric-propulsion motor and controller equipment must be free of:

- any obviously missing components; **and**,
- signs of damage and deterioration; **and**,
- signs of overheating on the equipment and the surrounding surfaces.

## 4.3 Battery-charging equipment

Battery-charging circuits can produce large amounts of heat and have the risk of components or wiring overheating, leading to shorting and/or fire.

Charging equipment that is 'open', damaged or incomplete could lead to a short-circuit or overheating. It may also be a potential source of harm for people aboard the boat.

### 4.3.1/R REQUIREMENT

**Is the battery-charging equipment ventilated, complete and in good condition?**

Check for any means to dissipate heat from the battery-charging equipment.

Check the condition of battery-charging equipment.

Battery-charging equipment compartments must be adequately ventilated by:

- the volume of the space being 10 or more times greater than the volume of the equipment; or,
- having ventilation provided.

Battery-charging equipment must be free of:

- any obviously missing components; **and**,
- signs of damage and deterioration; **and**,
- signs of overheating on the equipment and the surrounding surfaces.

**Note** – This check does not require the removal of covers provided by the equipment manufacturer.

### Best practice

To minimise the risk of overheating cables, or short circuits, we recommend fitting a manually operated switch that isolates the battery charger from the incoming A.C. supply.

It is also a good idea to have an indicator light on your charging panel that shows when the boat's batteries are charging.

**b**

## 4.4 Battery-charger connection

Fires can be caused by overheated cables, which can occur if the cables do not have adequate capacity for carrying the current.

### Best practice

To reduce the risk of this happening, maintain the cable, including the connectors from the battery charger on the boat to the charging point on shore, in good condition. We recommend that the charging cable is a suitable three-core flexible cable of adequate current-carrying capacity and of suitable construction and grade.

To avoid the risk of electric shocks or electrocuting people around you, we recommend that the charging connection on the craft itself has male (pins) configuration. This will ensure that the live charge lead will have female configuration and will not have exposed pins.

To protect the cables from water damage, we recommend that connectors comply with the splash-proof category of BS EN 60309 Part 2. Having splash-proof cable connections will greatly reduce the risk of electric shocks.

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Charging connection - male pins on the boat's connector will help prevent electrocution.

