



MARINAS AND SIMILAR LOCATIONS

by John Ware

Introduction

In this article, the recommendations for electrical safety and standardization at marinas are discussed. The 16th Edition of the Wiring Regulations does not contain additional requirements for Marinas; but the general requirements apply and the IEE gives guidance in Guidance Note 7. The 17th edition of

BS 7671, due to be published in 2008, includes marinas as a special location (Section 709) and will include requirements similar to those discussed below.

A marina is a facility for the mooring of leisure craft and has fixed wharves, jetties, piers or a pontoon arrangement capable of berthing one or more leisure craft. A leisure craft is a boat, vessel, yacht, motor launch, houseboat or other floating craft used exclusively for sport or leisure and a houseboat is a floating decked structure which is designed or adapted for use as a place of permanent residence often kept in one place on inland water.

An electrical installation at a marina consists of the equipment

which supplies the leisure craft or houseboat and the installation is subject to additional recommendations because of electrical safety issues and in order to provide for standardisation of power facilities. The recommendations do not apply to the parts of the electrical installations in offices, workshops, leisure accommodation etc. which form part of the marina complex, to the supply of houseboats if they are directly supplied from the public network, or to the internal electrical installations of leisure craft or houseboats.

Additional requirements are considered necessary because of increased electric shock risks associated with a wet environment, reduction in contact resistance and contact with earth potential. In addition, the environment of a marina is harsh for electrical equipment. The water, salt, and movement of structures accelerate deterioration of the installation. The presence of salt water, dissimilar metals and a potential for leakage currents increases the rate of corrosion. There is a real possibility of electrical equipment being splashed or even submerged. Flammable fuel may be present.

A risk associated with an electrical supply to a craft at a marina includes the possibility of an open circuit fault of the PEN conductor were a PME supply to be used. This would raise the potential of all metalwork (including that of the craft, if connected) to a dangerous level above true earth and hence the connection of a neutral conductor to the metal body of a boat or caravan is specifically prohibited in legislation (Electricity Safety, Quality and Continuity Regulations (ESQCR) Regulation 9(4)). Further risks include the inability to establish an equipotential zone external to the craft, the possible loss of earthing due to long supply cable runs, connecting devices exposed to weather and flexible cord connections liable to mechanical damage.

ADDITIONAL REQUIREMENTS AND RECOMMENDATIONS FOR MARINAS

Protection against electric shock

The nominal supply voltage should not exceed 230 v a.c. single-phase or 400 v a.c. three-phase.

As previously mentioned, Regulation 9(4) of the ESQCR prohibits the connection of a neutral to the metalwork of a boat. A distributor must not offer a connection to an earthing terminal from a PME networks for a consumer's installation in a leisure craft. Therefore where a PME supply is available a TT system having a separate connection with Earth, independent of the supplier's PME earthing system must be employed for the supply to the leisure craft; alternatively, protection by electrical separation may be considered.

The separation of the TT earthing system should be effected at the main distribution board where the exposed-conductive-parts connected to each system can be more readily identified and inspected periodically. The main earth electrode for the TT system should be provided nearby, with no overlap of resistance area with any earthing associated with the PME supply. TN-S supplies may be made available both to permanent shore installations and to leisure craft.

Furthermore, Regulation 8(4) of the ESQCR prohibits consumers from combining the functions of neutral and protective conductors within their installations, i.e. consumers must not operate TN-C systems or use CNE cables within their installations.

The protective measures of obstacles, placing out of reach, non-conducting location and earth-free local equipotential bonding should not be employed.

Socket-outlets and circuits supplying leisure craft and houseboats

Each socket-outlet should be individually protected by (i) an RCD

External influence				Minimum IP rating
Water splashes	AD4	Solid foreign bodies	AE2	IP34
Water jets	AD5			IP35
Waves	AD6			IP36

Table 1: Water and solid foreign bodies

Note 1: AE2 refers to the presence of foreign solid bodies where the smallest dimension is not less than 2.5 mm (Tools and small objects are examples of foreign bodies of which the smallest dimension is at least 2.5 mm)

Note 2: For socket-outlets, the recommendations of Table 4 should be met.

Atmospheric corrosive or polluting substances	AF2	If hydrocarbons are present	AF3
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Table 2: Corrosive or polluting substances

Note: AF2 refers to atmospheric conditions where the presence of corrosive or polluting substances of atmospheric origin is significant. AF3 refers to conditions where the equipment will be intermittently or accidentally subject to contact with corrosive or polluting substances being used or produced.

Wiring system for a marina	
Suitable for distribution circuits of marinas	Not suitable on or above a jetty, wharf, pier or pontoon
Underground cables buried at a sufficient depth and/or provided with additional mechanical protection	Cables in free air suspended from or incorporating a support wire
Overhead cables or overhead insulated conductors a height of 6 m in areas where vehicles are moving and 3.5 m in other areas	Insulated conductors in conduit or trunking. Note, however, that suitable insulated and sheathed cables would be permitted
Cables with copper conductors and thermoplastic or elastomeric insulation and sheath installed within an appropriate management system taking account of cable external influences	Cables with aluminium conductors
Mineral insulated cables with a PVC protective covering	Mineral insulated cables
Cables with armouring and serving of thermoplastic or elastomeric material	

Table 3: Wiring systems for marinas

Up to 63 A	Should comply with BS EN 60309-2
Above 63 A IP rating	Should comply with BS EN 60309-1 At least IP44. Alternatively this IP rating can be provided by an enclosure. (Note that if AD5 (water jets) or AD6 (waves) is applicable, the IP rating should be at least IPX5 or IPX6 respectively)
Located as close as practicable to the berth to be supplied	
Installed in a distribution board or in a separate enclosure	
A maximum of four socket-outlets should be installed in any one enclosure	
One socket-outlet should supply one leisure craft or houseboat	
Placed at a height of not less than 1 m above the highest water level except for floating pontoons or walkways where this height may be reduced to 300 mm providing appropriate additional measures are taken to protect against the effects of splashing	

Table 4: Socket-outlets

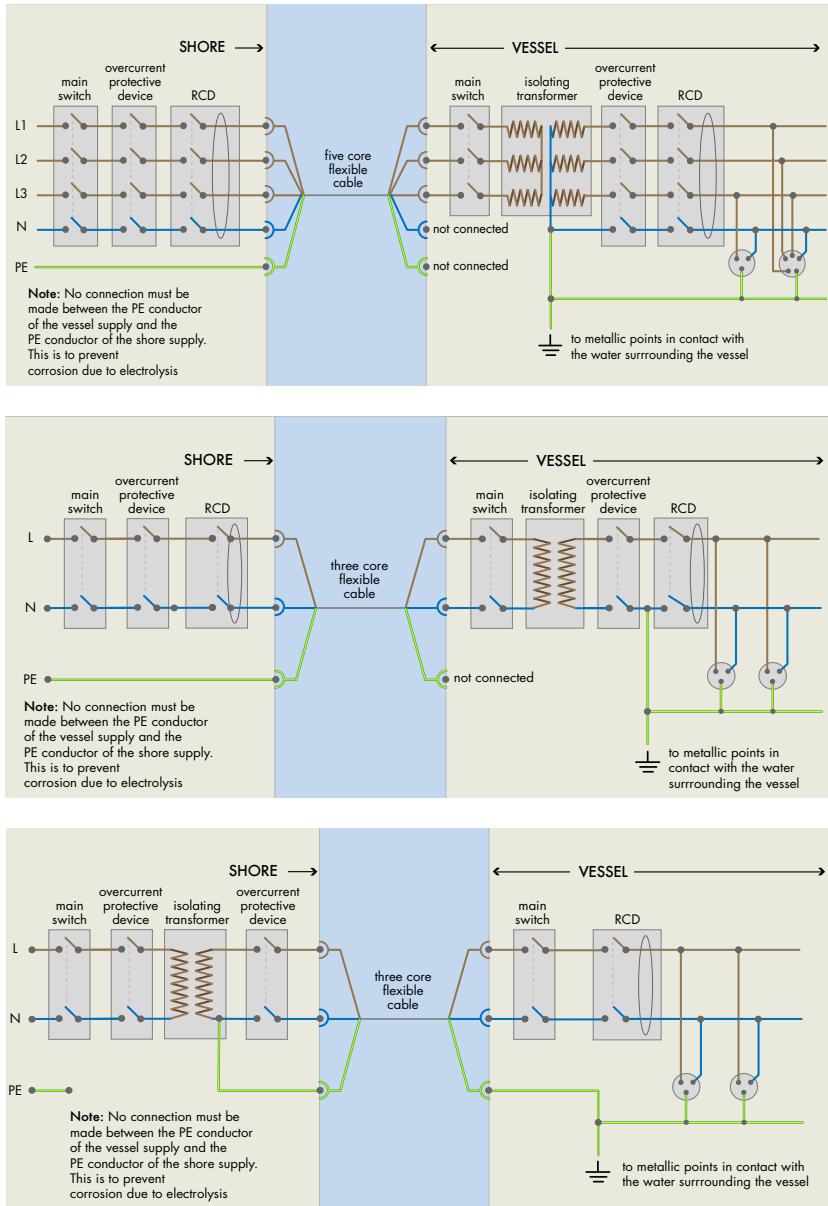


Figure 1: Examples of methods of obtaining a supply in a marina

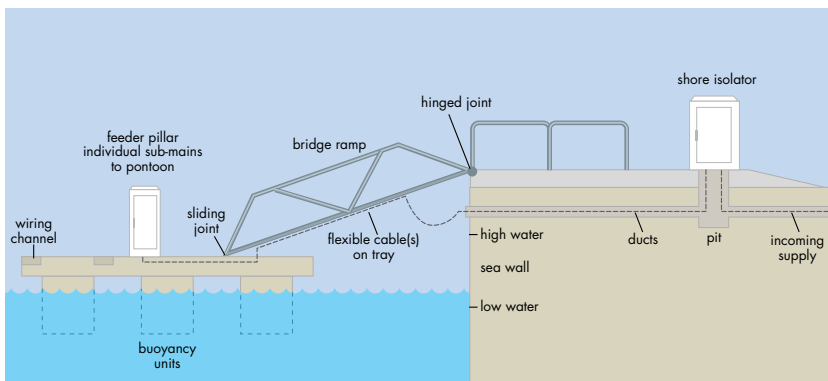


Figure 2: Wiring arrangement on a pontoon

with a rated residual operating current not exceeding 30 mA which disconnects all poles, including the neutral conductor and (ii) an individual overcurrent device. Where a houseboat is permanently connected by a means other than a socket-outlet, once again an all-pole 30 mA RCD and an individual overcurrent device should be used to protect the circuit.

The recommendations for overcurrent and RCD protection can be met by installing a single device, an all-pole RCBO with a rated residual operating current not exceeding 30 mA.

Selection and installation of equipment

For marinas, particular attention is given to the likelihood of corrosive elements, movement of structures, mechanical damage, presence of flammable fuel and the increased risk of electric shock due to the presence of water, the reduction in contact resistance and contact of the body with earth potential.

Water (AD) and solid foreign bodies (AE).

In a marina, equipment installed on or above a jetty, wharf, pier or pontoon should be selected in accordance with Table 1.

Corrosive or polluting substances (AF).

Equipment installed on or above a jetty, wharf, pier or pontoon should be suitable for use in the presence of atmospheric corrosive or polluting substances (AF2) and, if hydrocarbons are present (AF3) as in Table 2.

Impact (AG).

Equipment installed on or above a jetty, wharf, pier or pontoon should be protected against mechanical damage, (impact of medium severity (AG2) corresponding to industrial conditions) by means such as selecting the location of the equipment to avoid damage by reasonably foreseeable impact, the provision of mechanical protection or installing equipment complying with a

minimum degree of protection against external mechanical impact of IK08.

Wiring systems

Table 3 lists wiring systems suitable for use in a marina.

Cables should be installed in locations where they are protected from physical damage and wherever practicable out of water. Care should be exercised when installing cables to prevent damage from abrasion due to movement between pontoon sections, etc. Cables must be adequately fixed, protected and supported, and if necessary cable types suitable for the flexing movement must be used.

Many cable types including PVC-insulated and sheathed cables are not suitable for continuous immersion in water. The suitability of the cable types should be checked with the manufacturers. Floating pontoons are

usually manufactured with a service void in them, enclosed and accessible from above, to accommodate cables and water piping.

Due to the possibility of corrosion, the galvanised steel armouring of cables should not be used wholly or in part as a circuit protective conductor (cpc) on the floating section of marinas. A separate protective conductor should be used. The armour must still, however, be connected to protective earth.

Where cables are installed at onshore locations due consideration should be given to the routing, depth of lay and protection especially where heavy traffic and point loads are experienced. Cables should normally be laid above the water table, or cable types suitable for continual immersion used. It is not usually practicable for buried cable duct systems to be made totally watertight. The watertight termination of ducts

into drawpits and cable trenches below switchboards is also difficult.

Isolation and switching

At least one means of isolation and switching should be installed in each distribution cabinet and it should disconnect all live conductors including the neutral conductor. One isolating switching device should be installed for a maximum of 4 socket-outlets.

Socket-outlets

Recommendations for socket-outlets are given in Table 4.

Notice

At each supply point a clearly legible, durable and weatherproof notice should be installed. The marina operator should supply every leisure craft operator wishing to connect to an electrical supply a copy of the notice.

INSTRUCTIONS FOR ELECTRICITY SUPPLY BERTHING INSTRUCTIONS FOR CONNECTION TO SHORE SUPPLY

This marina provides power for use on your leisure craft with a direct connection to the shore supply which is connected to earth. Unless you have an isolating transformer fitted on board to isolate the electrical system on your craft from the shore supply, corrosion (electrolysis) could damage your craft or surrounding craft.

ON ARRIVAL

- (i) Ensure the supply is switched off and disconnect all current-using equipment before inserting the craft plug. Connect the flexible cable first at the leisure craft socket inlet and then at the marina socket-outlet.
- (ii) The supply at this berth is1) V,1) Hz . The socket-outlet will accommodate a standard marina plug colour * (technically described as BS EN 60309-2, position 6 h)
- (iii) For safety reasons, your craft must not be connected to any other socket-outlet than that allocated to you and the internal wiring on your craft must comply with the appropriate standards.
- (iv) Every effort must be taken to prevent the connecting flexible cable from falling into the water if it should become disengaged. For this purpose securing hooks are provided alongside socket-outlets for anchorage at a loop of the cord.
- (v) For safety reasons, only one leisure craft connecting cable supplying one leisure craft may be connected to any one socket-outlet.
- (vi) The connecting flexible cable must be in one length without signs of damage and not contain joints or other means to increase its length.
- (vii) The entry of moisture and salt into the leisure craft inlet socket may cause a hazard. Ensure the supply is disconnected and examine carefully and clean the plug and socket before connecting the supply.
- (viii) It is dangerous to attempt repairs or alterations. If any difficulty arises, consult the marina management.

BEFORE LEAVING

- (i) Ensure that the supply is switched off and disconnect all current-using equipment on the craft, before the connecting cable is disconnected and any tie cord loops are unhooked.
- (ii) The connecting flexible cable should be disconnected firstly from the marina socket-outlet and then from the leisure craft inlet socket. Any cover that may be provided to protect the inlet from the weather should be securely replaced. The connecting flexible cable should be coiled up and stored in a dry location where it will not be damaged.

* Appropriate figures and colours to be inserted. Nominally 230 V 50 Hz blue, would be rated at 16 A single-phase and nominally 400 V 50 Hz red, three phase would be rated at 32 A.