MARINAS AND JETTIES

We review the requirements for electrical installations in marinas, examining the risks associated and future European-level developments for inland navigation vessels

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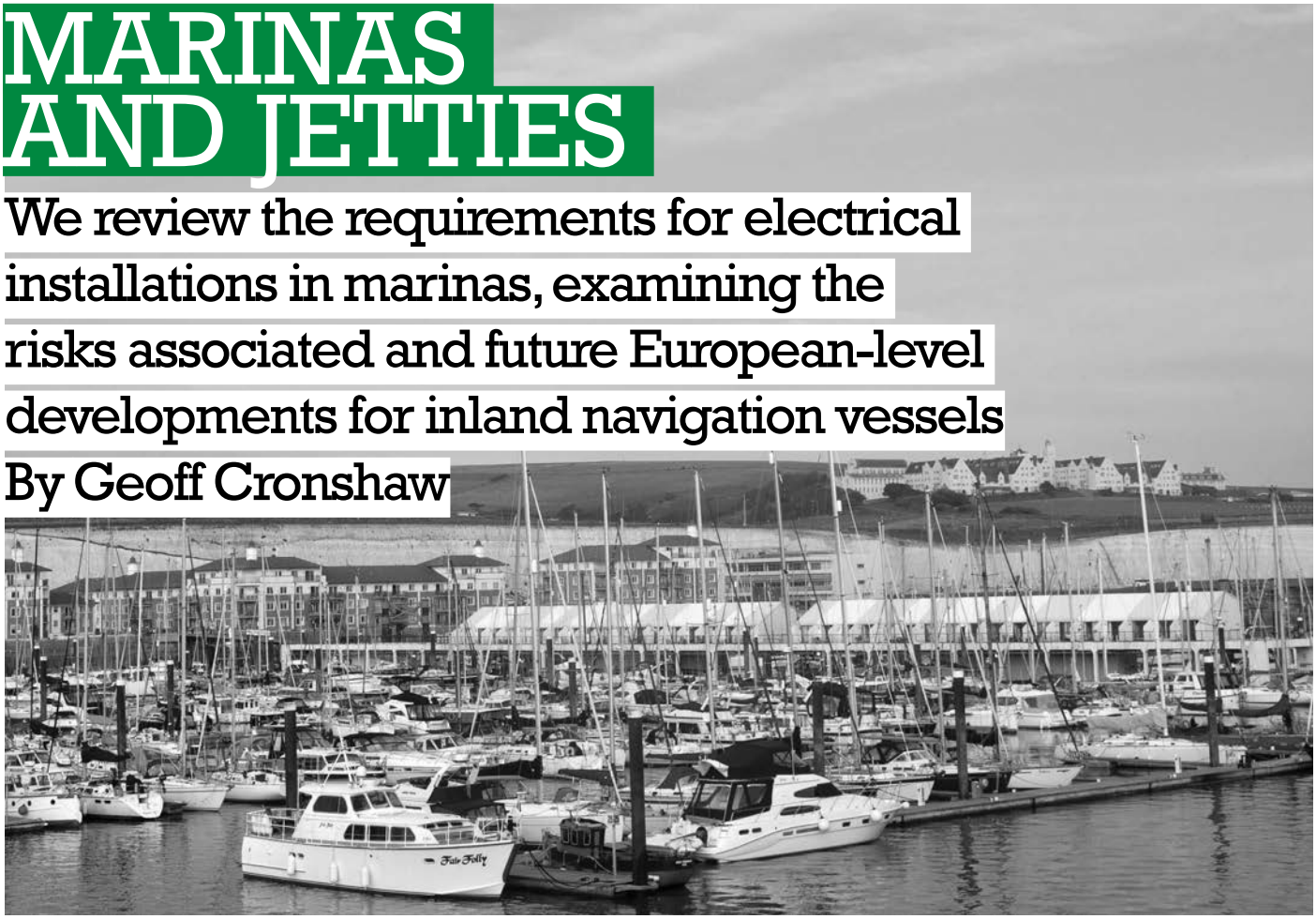

CORBIS

SECTION 709 of BS 7671 contains requirements for marinas and similar locations. This is based on European CENELEC Harmonisation Document HD 60364-7-709.

Most, if not all, of the measures used to reduce the risks in marinas may equally apply to electrical shore connections for inland navigation vessels using the network of navigable rivers and canals throughout Europe, for which CEN is developing a standard.

One of the major differences between supplies to small craft in a typical marina and those required for electrical shore connections for European inland navigation vessels is the size of the supply which may be required. For example, seagoing vessels accessing river navigations can be up to 10,000 gross tonnes and motor barges and tugs used on inland waterways in Europe are considerably larger than the average size of vessel berthed in marinas; these are generally recreational craft (up to 24m length) or work boats and small commercial vessels and fishing boats.

Generally socket outlets with a rating of 16A will be provided for each craft in a marina. The risks associated with electrical installations in marinas, such as the presence of water, movement of structures and harsh environmental conditions, are the same as for electrical shore connections for larger inland navigation vessels.

In this article we summarise some of the existing key requirements for electrical installations in marinas and similar locations. The CEN requirements for electrical shore connections for larger inland navigation vessels are expected to be very similar to those in CENELEC HD 60364-7-709 and there is a joint working group set up to address convergence of the requirements.

Protection against electric shock

The protective measures of obstacles, placing out of reach, non-conducting location and protection by earth-free local equipotential bonding, are not permitted in section 709 (of BS 7671) for marinas. These measures are contained in Sections 417 and 418 of BS 7671:2008, and are not for general application. The protective measures of section 417 provide basic protection only, and are for application in installations controlled or supervised by skilled or instructed persons. The fault protective provisions of Section 418 are special and, again, subject to control and effective supervision by skilled or instructed persons.

Supplies

Regulation 709.313.1.2 states that the nominal supply voltage of the installation for the supply to small vessels, recreational crafts or houseboats shall be 230V a.c. single-phase, or 400V a.c. three-phase. It is important to note that where the supply system is protective multiple-earthed (PME), Regulation 9(4) of the Electricity Safety, Quality and Continuity Regulations 2002 prohibits the connection of a combined neutral and protective conductor to any metalwork of a caravan or boat.

Operational conditions and environmental factors

Electrical equipment to be installed on or above jetties, wharves, piers or pontoons must be selected according to the external influences that may be >

Socket outlet details	
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	

present. In the marina environment consideration must also be given to the possible presence of corrosive or polluting substances. Equipment should be located to avoid any foreseeable impact, be provided with local or general mechanical protection and have a degree of protection for external mechanical impact – IK08.

Any wiring system or equipment selected and installed must be suitable for its location and able to operate satisfactorily without deterioration during its working life. Suitable protection must be provided, both during construction and for the completed installation. Regarding presence of solid foreign bodies, a minimum degree of protection of IP3X is required. For presence of water the following applies:

- Presence of water splashes – IPX4
- Presence of water jets – IPX5
- Presence of waves of water – IPX6

Devices for fault protection by automatic disconnection of supply RCDs

Regulation 709.531.2 requires that socket-outlets shall be protected individually by an RCD having the characteristics specified in Regulation 415.1.1. Devices selected shall disconnect all poles, including the neutral. Final circuits intended for fixed connection for the supply to houseboats shall be protected individually by an RCD having the characteristics specified in Regulation 415.1.1. The device selected shall disconnect all poles, including the neutral.

Isolation

Regulation 709.537.2.1.1 requires that at least one means of isolation shall be installed in each distribution cabinet. This switching device shall disconnect all live conductors including the neutral conductor. One isolating switching device for a maximum of four socket outlets shall be installed.

Types of wiring system

The following systems should not be used above a jetty, wharf, pier or pontoon:

- cables suspended from or incorporating a support wire;
- non-sheathed cables in cable-management systems;
- cables with aluminium conductors;
- mineral insulated cables.

Conduit and ducting installations should have apertures or holes and be fixed at an angle sloping away from the horizontal, to allow for moisture drainage.

Cables should be selected and installed so that mechanical damage due to tidal and other movement of craft and other floating structures is prevented. To clarify this requirement, cables should be installed so that they are protected from damage due to:

- displacement by movement of craft or other structures;
- friction, tension or crushing;
- exposure to adverse temperatures.

At locations where cables are subject to flexing, flexible cables should be used, such as:

- cross-linked insulated flexible cables harmonized type H07RN-F, H07BN4-F or H07RN8-F (insulated and sheathed), e.g. cables to Tables 14, 15, 16, 17 and 20 of BS 7919:2001;
- thermosetting insulated flexible cables harmonized type H07Z-K, e.g. cables to BS 7211 Table 3b within flexible wiring systems.

Note 1 Many cable types including PVC insulated and sheathed cables are not suitable for continuous immersion in water. Suitability should be checked with the cable manufacturers. Floating pontoons are usually manufactured with a service void in them, enclosed and accessible from above, to accommodate cables and water piping.

Note 2 Take care 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 flexing must be used.

Distribution boards, feeder pillars and socket outlets

Socket outlets when mounted on floating installations or jetties should be fixed above the walkway and preferably not less than 1m above the highest water level. This may be reduced to 300mm if appropriate additional measures are taken to protect against the effects of splashing (IPX4), but care should be taken to avoid creating a low-level obstacle which may cause risk of tripping on the walkway. When mounted on fixed jetties they should be mounted not less than 1m above the highest water level.

Galvanic corrosion

The immersion of metal components of a craft in water, particularly in salt water, provides the natural mechanism of galvanic corrosion. Where there are dissimilar metals on the electro-chemical series in proximity, the detrimental effect of galvanic couples can be exacerbated. As a counter measure, small vessels, recreational craft, houseboats, ships and many immersed metal structures are provided with sacrificial anodes (zinc for salt water) to which the more valuable/essential immersed metal parts, such as propellers, shafts, hull fittings and fixings are electrically bonded. The sacrificial anode(s) is preferentially depleted as a consequence of providing galvanic corrosion protection to the valuable/essential immersed parts.

Section 709 of BS 7671:2008 is based on European CENELEC Harmonisation Document HD 60364-7-709. Annex A of the document contains examples of methods of obtaining a supply in a marina. HD 60364-7-709 recognises that there is an additional risk of electrolytic corrosion resulting from circulating galvanic currents in the protective conductor from the shore supply to a vessel when connected to a shore supply.

There have also been reports of increased rate of depletion of the sacrificial anodes of recreational craft which are connected on a longer-term basis to shore supplies. Some observers believe this is associated with the connection of the recreational craft's protective earth terminal (to which immersed components and sacrificial anodes are bonded) to the shore supply earth in a marina or similar location.

HD 60364-7-709 recognises the use of an isolating transformer to prevent galvanic currents circulating between the hull of the vessel and the metallic parts on the shore side. The current standard for isolating transformers is BS EN 61558.

Conclusion

This article only gives an overview of electrical installations in marinas and similar locations. For more information refer to section 709 of BS 7671:2008 incorporating Amendment 1. Be aware that requirements for electrical shore connections for inland navigation vessels are still at a very early stage of discussion and may or may not become a European standard.