WiringMatters
Your insight into BS 7671 www.theiet.org/wm

The impact of the 18th Edition (BS 7671:2018) – Sections 722, 753 and [new] 730

In this article, Geoff Cronshaw looks at the impact that some of the proposed changes in the DPC (draft for public comment) of BS 7671 will have on electrical installations, focusing on Section 722, Section 753, and the new Section 730.

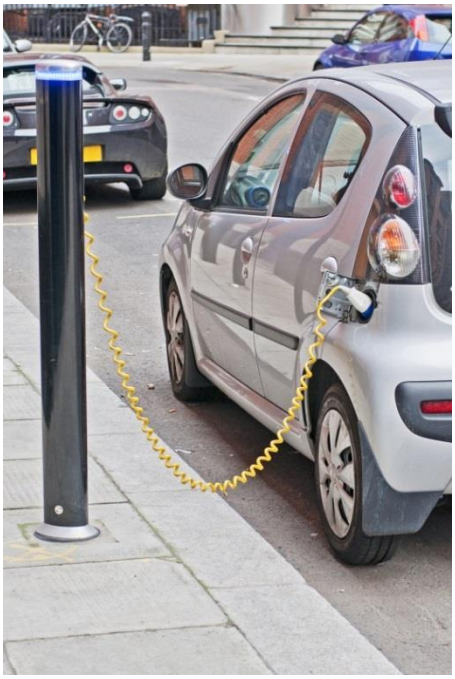
Note: the following are draft proposals only at this stage and may or may not be included in the 18th edition (BS 7671:2018), depending on the decision of the national committee, JPEL/64. This article is based on the DPC that is now available (on the BSI website) to anyone to view and to comment on.

Changes to Section 722

Section 722 (electric vehicle charging installations) provides requirements for the supplies to electric vehicles. There are a number of significant changes in Section 722 of the DPC:

Protection against electric shock

Regulation 722.411.4.1 concerning the use of protective multiple earthing (PME) supply has changed. The exception for a dwelling if none of (i), (ii), or (iii) is reasonably practicable has been deleted. This now means that PME cannot be used unless you meet (i), or (ii), or (iii) of 722.411.4.1. As a reminder of those regulations:



- Regulation 722.411.4.1(i) refers to a situation where a connecting point is supplied from a 3-phase installation used to supply loads other than charging points and where the load is sufficiently well balanced.
- Regulation 722.411.4.1(ii) requires a very low resistance earth electrode to mitigate the effects of an open circuit PEN conductor fault on the supply.
- Regulation 722.411.4.1(iii) refers to protection by a voltage operated device. An important change is that the regulation now makes the point that this device could be included within the charging equipment. It is worth noting that this device will also require an earth electrode.

The touch voltage threshold of 70 V mentioned in 722.411.4.1(i), 722.411.4.1(ii) and 722.411.4.1(iii) is on the basis that Table 2c (Ventricular fibrillation for alternating current 50/60 Hz) of IEC 60479-5{ed1.0} gives a value of 71 V for both-hands-to-feet, in water-wet conditions with medium contact area (12.5 cm^2).

What is PME?

The Electricity Safety, Quality and Continuity Regulations 2002 (as amended) permit the distributor to combine neutral and protective functions in a single conductor provided that, in addition to the neutral to Earth connection at the supply transformer, there are one or more other connections with Earth. The supply neutral may then be used to connect circuit protective conductors of the customer's installation with Earth if the customer's installation meets the requirements of BS 7671.

This PME has been almost universally adopted by distributors in the UK as an effective and reliable method of providing their customers with an earth connection. Such a supply system is described in BS 7671 as TN-C-S. Whilst a protective multiple earthing terminal provides an effective and reliable facility for the majority of installations, under certain supply system fault conditions (external to the installation) a potential can develop between the conductive parts connected to the PME earth terminal and the general mass of Earth.

The potential difference between true Earth and the PME earth terminal is of importance when:

(a) body contact resistance is low (little clothing, damp/wet conditions); and/or
(b) there is relatively good contact with true Earth.

Contact with Earth is always possible outside a building and, if exposed-conductive-parts and/or extraneous-conductive-parts connected to the PME earth terminal are accessible outside the building, people may be subjected to a voltage difference appearing between these parts and Earth.

External influences

In addition to IPX4 (protection against presence of water), Section 722 now requires IP4X as well to protect against presence of solid foreign bodies (AE3 – i.e. very small), and protection against impact (AG2 – i.e. medium severity).

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.

RCD protection

Regulation 722.531.2.101 has been redrafted concerning RCD protection. The regulation now contains further requirements for both Type A and Type B RCDs to take account of DC fault current.

Socket-outlets and connectors

It is now required that where a BS 1363-2 socket-outlet is used for EV changing it must be marked 'EV' on its rear, except where there is no possibility of confusion, a label shall be provided on the front face or adjacent to the socket-outlet or its enclosure stating: 'suitable for electric vehicle charging'.

Socket-outlets must be fit for purpose. They must be suitable for the load, and for the external influences such as protection against mechanical damage and ingress of water.

WiringMatters
Your insight into BS 7671 www.theiet.org/wm

Changes to Section 753

Extension of scope – embedded electric heating systems for surface heating

The scope of Section 753 has been extended to apply to embedded electric heating systems for surface heating. They also apply to electric heating systems for de-icing or frost prevention or similar applications, and cover both indoor and outdoor systems. These include heating systems for walls, ceilings, floors, roofs, drainpipes, gutters, pipes, stairs, roadways and non-hardened compacted areas (for example, football fields, lawns). Heating systems for industrial and commercial applications complying with IEC 60519 and IEC 62395 are not covered.

Consequently, Section 753 now includes additional requirements to cover wall heating, heating conductors and cables where laid in soil and concrete etc. Additional requirements are also included to cover prevention of mutual detrimental influence.

Documentation is also covered. The designer will be required to provide appropriate information about approved substances in the surroundings of the heating units.

Additional requirements for wall heating systems

For wall heating systems (which may be more vulnerable than floors and ceilings from penetration) the standard contains additional requirements to protect against the effects of overheating caused by a short circuit between live conductors due to penetration of an embedded heating unit.

Regulation 753.424.101 requires that for wall heating systems the heating units shall be provided with a metal sheath or metal enclosure or fine mesh metallic grid. The metal sheath

or metal enclosure or fine mesh metallic grid shall be connected to the protective conductor of the supply circuit.

Regulation 753.424.102 requires special care to be taken to prevent the heating elements creating high temperatures to adjacent material. This may be achieved by using heating units with temperature self-limiting functions or by separation with heat-resistant materials. Separation may be accomplished by placing on a metal sheet, in metal conduit or at a distance of at least 10 mm in air from the ignitable structure. A note adds that a larger separation distance may need to be considered depending on adjacent material.

A new Section 730: Onshore units of electrical shore connections for inland navigation vessels

Section 730 applies to onshore installations that are dedicated to the supply of inland navigation vessels for commercial and administrative purpose, berthed in ports and berths.

Most, if not all, of the measures used to reduce the risks in marinas apply equally for electrical shore connections for inland navigation vessels. One of the major differences between supplies to vessels in a typical marina and electrical shore connections for inland navigation vessels is the size of the supply needed. For example, vessels used on inland waterways in Europe can be up to 10, 000 tonnes, which are considerably larger than the average size of vessel used in a marina, which are generally small recreational craft (up to 24 m long).

Generally socket-outlets with a rating of 16 A will be provided for each craft in a marina. However, many of 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 inland navigation vessels. In this article we summarise some of the key requirements of Section 730.

Supplies

Section 730 requires that the nominal supply voltage shall be 400 V 3-phase AC 50 Hz.
Important: where the supply system is protective multiple earthed (PME), Regulation 9(4) of the Electricity Safety, Quality and Continuity Regulations 2002 (as amended) prohibits the connection of the neutral to the metalwork of any caravan or boat in the UK.

Galvanic separation

The immersion of metal components of a vessel 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 and for this reason 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 and the sacrificial anode(s) preferentially deplete as a consequence of providing galvanic corrosion protection to such immersed parts.

Section 730 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.
There have also been reports of increased rate of depletion of the sacrificial anodes of vessels that are connected on a longer-term basis to shore supplies, which is believed by some observers to be associated with the connection of the vessel's protective earth terminal (to which immersed components and sacrificial anodes are bonded) to the shore supply earth in an inland waterway or marina.

Section 730 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. Where a fixed on-shore isolation transformer is used to prevent galvanic currents circulating between the hull of the vessel and metallic parts on the shore side, equipment complying with BS EN 61558-2-4 shall be used.

Protection against electric shock

As you would expect, 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 730. These measures are not for general application. They are only for application in installations controlled or supervised by skilled or instructed persons.

Operational conditions and external influences

Any wiring system or item of equipment selected and installed must be suitable for its location and able to operate satisfactorily without deterioration during its working life. In ports and berths consideration must also be given to the possible presence of corrosive or polluting substances.

Section 730 requires that equipment shall be selected with a degree of protection of at least IP44.

Types of wiring system

Cables must be selected and installed so that mechanical damage due to tidal and other movement of floating structures is prevented.

Section 730 recognises that the following wiring systems are suitable for distribution circuits in berths and ports:

(a) underground cables;
(b) overhead cables or overhead insulated conductors;
(c) cables with copper conductors and thermoplastic or elastomeric insulation and sheath installed within an appropriate cable management system, taking into account external influences such as movement, impact, corrosion and ambient temperature;
(d) mineral-insulated cables with a thermoplastic protective covering;
(e) cables with armouring and serving of thermoplastic or elastomeric material; and
(f) other cables and materials that are at least as suitable as those listed above.

Section 730 recognises that the following wiring systems and cables are suitable for distribution circuits on floating landing stages:

(a) cables with copper conductors and thermoplastic or elastomeric insulation and installed within an appropriate cable management system taking into account external influences such as movement, impact, corrosion and ambient temperature; and
(b) armoured cables with a thermoplastic or elastomeric covering.

Other cables and materials that are at least as suitable as those listed under (a) or (b) may be used.

Section 730 requires that underground distribution cables shall, unless provided with additional mechanical protection, be buried at a sufficient depth to avoid being damaged, for example, by vehicle movement. Overhead cables are not permitted over waterways. Where overhead conductors are used they must be insulated. Poles and other supports for overhead wiring must be located or protected so that they are unlikely to be damaged by any foreseeable vehicle movement.

Overhead conductors shall be at a height above ground of not less than 6 m in all areas subjected to vehicle movement and 3.5 m in all other areas.

Isolation, switching and control (automatic disconnection of supply)

RCD protection

Section 730 gives additional requirements concerning RCD protection:

(a) Socket-outlets with a rated current up to 63 A shall be individually protected by an RCD providing additional protection in accordance with Regulation 415.1 having a rated residual operating current not exceeding 30 mA.
(b) The RCD selected shall disconnect all live conductors, i.e. phases and neutral.
(c) Socket-outlets with a rated current above 63 A shall be individually protected by an RCD having a rated residual operating current not exceeding 300 mA. The RCD selected shall disconnect all live conductors, i.e. phases and neutral.

NOTE: The purpose of these RCDs is to protect the shore supply and the flexible cable. It is not intended to provide protection for on-board circuits, which are outside the scope of Section 730.

Devices for protection against overcurrent

Similar to the requirements in marinas, socket-outlets shall be individually protected by an overcurrent protective device.

Isolation

Similar to the requirements in marinas, at least one means of isolation shall be installed for each distribution board. This device shall disconnect all live conductors.

Requirements for socket-outlets

Section 730 sets out the following requirements for socket-outlets:

(a) Socket-outlets shall comply with BS EN 60309-1 and BS EN 60309-4 and socket-outlets with a current rating up to and including 125 A shall comply with EN 60309-2.
(b) Where interchangeability is not required, socket-outlets shall comply with BS EN 60309-1 and BS EN 60309-4 and need not comply with BS EN 60309-2.
(c) Socket-outlets shall be located as close as practicable to the berth to be supplied.
(d) No more than four socket-outlets shall be grouped together in any one enclosure.
(e) Each socket-outlet shall supply only one electric circuit of a vessel.

(f) Socket-outlets shall be placed at a height of not less than 1 m above the highest water level.
(g) In the case of floating pontoons or walkways only, this height may be reduced to 0.3 m above the highest water level provided that appropriate additional measures are taken to protect against the effects of splashing.
(h) Socket-outlets shall be placed in an enclosure in accordance with BS EN 15869-2.

Conclusion

This article only gives an overview of draft proposals, which may or may not be included in the 18th edition (BS 7671:2018), depending on the decision of the national committee, JPEL/64.

The DPC (draft for public comment) is now available to the public (on the BSI website) for comment.