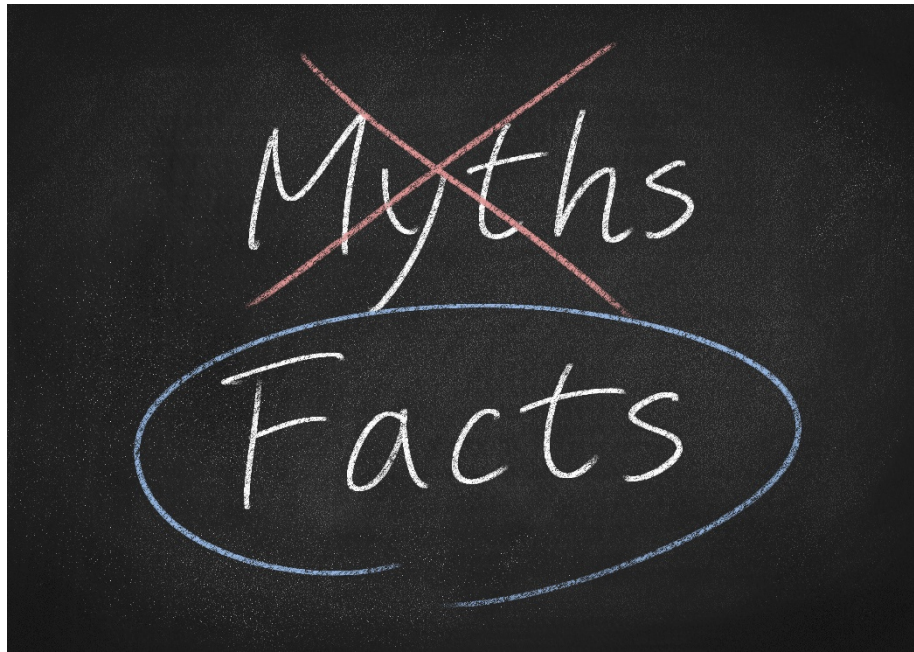




Wiring Matters

November 2018





Myth busters #2 - All metal gas and water pipes must be bonded to the main earthing terminal

Sometimes we do tasks without giving things too much consideration, often because we were taught to do something a particular way and never really thought about (or forgot) the reasons why. A good example of this is Regulation 411.3.1.2 of BS 7671: 2018, which requires that:

“In each installation main protective bonding conductors complying with Chapter 54 shall connect to the main earthing terminal extraneous-conductive-parts including the following:

- I. Water installation pipes
- II. Gas installation pipes
- III. Other installation pipework and ducting
- IV. Central heating and air conditioning systems
- V. Exposed metallic structural parts of the building.”

Therefore, is it true to say that all gas, water, aircon pipes and ducts along with structural metalwork should be bonded? The answer is no, and the reason is because they might not be extraneous-conductive-parts. As with many British Standards, the requirements are often written in a particular way to eliminate ambiguities; if you talk to any British Standards committee member they will usually be able to regale tales of sitting around the table for hours just to write a single sentence which is not only technically correct, but also one that everyone can agree on. To the casual reader though such carefully crafted language can, on occasion, have the opposite effect.



In the above Regulation, it states that conductors “shall connect to the main earthing terminal extraneous-conductive-parts” and then goes on to list examples including gas and water pipes. But if an item of metal is not an extraneous-conductive-part, Regulation 411.3.1.2 does not apply. It follows that if an air handling duct, gas or water pipe does not fulfil the definition of an extraneous part, then it won’t need protective bonding.

The advent of plastic plumbing caused some confusion over the application of this Regulation in practice, so in the 18th Edition it was modified to include the statement “Metallic pipes entering the building having an insulating section at their point of entry need not be connected to the protective equipotential bonding.” And the reason for that is because with a plastic insert, the electrical continuity between the mass of Earth and the metallic pipework in the installation has been broken and so the pipework is no longer considered an extraneous-conductive-part.

IET Guidance Note 8 covers earthing and bonding and in Part 6 it goes on to explore the definition of an extraneous-conductive-part. Part 2 of BS 7671 defines one as “A conductive part liable to introduce a potential, generally Earth potential, and not forming part of the electrical installation.”

Even with such a definition, it is sometimes difficult to establish what is, and what is not an extraneous-conductive-part. To assist in making this decision, Guidance Note 8 encourages the reader to analyse the definition by breaking it down into three discrete parts:

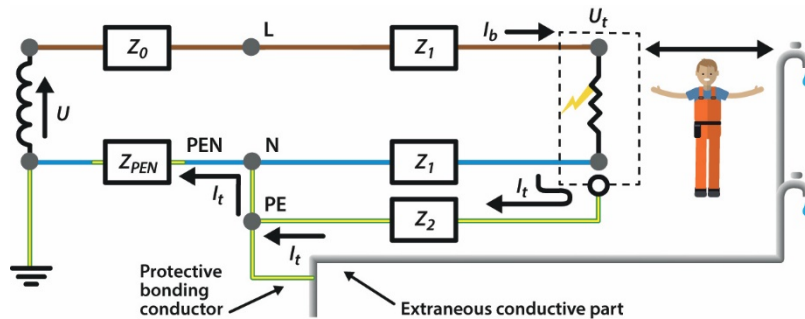
1. a conductive part;
2. liable to introduce a potential, generally Earth potential; and
3. not forming part of the electrical installation.

Given that many modern buildings now have plastic services (gas, water, sewage etc.) the need for protective bonding is reducing but may still be necessary.

To be sure, it is always wise to check and Guidance Note 8 gives some methods for achieving this. In essence, the intention behind bonding extraneous-conductive-parts is to limit the potential difference across the body when a fault occurs in part of the electrical system.

Take for example an earthed appliance (such as a kettle) on the worktop next to a metal kitchen sink with metal plumbing connected to a buried metal cold water main as illustrated in Figure 1.

Figure 1 - Example of touch voltage between earthed metalwork and faulty appliance in a TN system (Reproduced from Commentary on the IET Wiring Regulations)



Where:

Z_0 = line impedance of the supply

Z_{PEN} = impedance of the PEN conductor of the supply

Z_1 = line impedance of the installation (neutral impedance similar)

Z_2 = line impedance of the protective conductor of the installation

U = supply system voltage

I_b = load current

I_t = fault current

U_t = prospective touch voltage

The kitchen sink and taps are likely to be at Earth potential, i.e. 0 V. Without any protective bonding, if there was a fault with the kettle and a person had one hand on the sink when they grabbed the kettle, itself in a fault condition, then a potential difference will be present across the person leading to an electric shock.

If the water pipe is connected to the main earthing terminal (to which the case of the kettle is also connected) then the two are effectively joined together and the potential difference between them will be negligible and the shock risk will be mitigated.

It also follows from this that the extraneous-conductive-part must be accessible and that it is possible for someone to be in contact with it and a part of the electrical installation under fault conditions. If the conductive part is inaccessible and will be for the life of the installation and there is no opportunity for simultaneous contact, then it may not be *part of the electrical installation* and hence not an extraneous-conductive-part.

Guidance Note 8 details some simple continuity tests that can be conducted to check whether a part is extraneous or not, depending on the protection installed in the installation.

Figure 1 shows an inappropriate application of this requirement. In this installation, the gas bottles are connected to a changeover valve via rubber hoses, so the changeover valve is quite isolated from the bottles and the mass of Earth, as is the gas pipework connected to it (in this example, the gas pipe is fed straight into a boiler the other side of the wall).

Other examples of items that are commonly bonded but are unlikely to require it include metallic window and door frames (except those in metal buildings), cable tray or basket which is not used as a protective conductor, kitchen sinks where plastic plumbing is in use, IT equipment racks and doors and so on. It is easy to think that bonding such items won't hurt even if it is not necessary, but remember that by doing so it gives rise to the possibility of exporting fault voltages throughout an installation; it could transpire to be more dangerous than not bonding in the first place.

Generally, the consideration for extraneous-conductive-parts are where they will introduce Earth potential into an installation, but that may not always be the case. Telecoms, data or control circuits derived from other supplies or buildings for example could introduce other voltages into the electrical installation and hence may present a shock hazard under fault conditions, so they should also be considered.

Finally, if earthed conductors from another electrical system are introduced into an installation (such as a supply from one building into another) the joining of them may require special consideration – see Regulation 411.3.1.1, which requires them to be joined together. If this would be problematic (for example for interference or safety reasons) then other measures may be required.

The IET Wiring Regulations 18th Edition

BS 7671 and local Network Events

By Steven Devine

Being a member of the IET has several benefits one of which is having advanced notification of local network events covering a vast array of subjects relative to the engineering industry. The publication of the 18th Edition of the *IET Wiring Regulations* has created a surge in demand for local network events to provide updates and insight into the new and amended requirements. As the IET are the secretariat for JPEL/64 and its sub-committees responsible for the development of the Wiring Regulations, it is only natural that those in the electrical industry seek information from the IET.

The technical regulations team is headed up by Mark Coles, Secretary of JPEL/64/D (External Influences) Our team of engineers at the IET :



Chief Engineer Geoff Cronshaw, Secretary of JPEL/64 National committee



Senior Engineer Leon Markwell, Secretary to JPEL/64/A (Verification) & JPEL/64/ B (Thermal effects)



Senior Engineer Steven Devine, Secretary to JPEL/64/C (Shock Protection)

We all visit various locations around the UK and overseas to deliver IET Local Network events, the most recent delivered by myself in Scunthorpe providing an overview of the most significant changes to the 18th Edition of *The IET Wiring Regulations*.

Local network events are a fantastic way for us to meet with electricians, electrical engineers, designers and many others working in the electrotechnical industry to inform, influence and inspire. It also provides us with the opportunity to hear from those that the Wiring Regulations matter to the most and we seldom leave an event without a thought provoking question or two.

The Scunthorpe event was organised by IET member Richard Rennie and held at the British Steel conference centre. As with all the local network events the host is responsible for arranging the venue and marketing the event and I am very pleased to say that Richard did a terrific job. The British Steel conference centre was conveniently located with great facilities and there was plenty of tea and coffee to go around for what turned out to be a busy event.

There were over 60 attendees ranging from electrical apprentices to electrical design engineers as well as many lecturers who are delivering 18th Edition training courses. With the presentations designed to last around an hour it is imperative that we make the most of the time available at these events so without delay at 19:00 the presentation commenced. Many of the new requirements and amendments to existing requirements are quite complex and require significant time to discuss in detail. I therefore focused on the most significant changes to the requirements including the recommendation for AFDDs, the need to take into consideration atmospheric conditions to assess whether Surge Protective Devices (SPDs) are required, some changes to requirements for electric vehicle charging stations and Chapter 46 Requirements for Isolation and Switching.

The presentations usually last for around one hour and afterwards we have time, for a chat with those who are not inclined to raise a hand and speak out during the Q&A session. It is a great way to add a personal touch to the event and it provides no end of networking opportunities for attendees and the IET alike.

The IET 18th Edition seminar is being held in London on 7th January 2019 for more information please visit events.theiet.org



Latest developments in International Standards for supplies for electric vehicles

by Geoff Cronshaw

A new standard, IEC 60364-7-722 Edition 2, was published in September 2018. This replaces IEC 60364-7-722 Edition 1 published in February 2015. In this article, we give a brief overview of some of the latest requirements at international level, which may or may not be incorporated in BS 7671 in the future.

Protection against electric shock

IEC 60364-7-722 Edition 1 (February 2015) stated that “protection by placing out of reach shall not be used”. This is because this measure of protection, which provides basic protection only is for applications in installations controlled or supervised by skilled or instructed persons.

However, IEC 60364-7-722 Edition 2 (September 2018) now states:

“The protective measure placing out of reach, as specified in IEC 60364-4-41:2005, Clause B.3 may only be applied where an automatic connection system in accordance with IEC 61851-23-13 (which is under consideration) is used”.

This clarification of the requirements regarding the protective measure placing out of reach is to allow the use of pantographs in areas accessible to the public.

Wireless power transfer systems

IEC 60364-7-722 Edition 2 recognises wireless power transfer (WPT) systems for electric vehicles (EVs) and requires compliance with the appropriate parts of the IEC 61980 series. Part 1 (General

Requirements) gives a list of possible WPT technologies. These are new and emerging technologies. Possible technologies include:

- a) Inductive power transfer – Energy transfer through magnetic field (MF-WPT)
- b) Capacitive power transfer – Energy transfer through electric field (EF-WPT)
- c) Microwave power transfer – Energy transfer through electromagnetic waves 1 GHz – 300 GHz (MW-WPT)
- d) Infrared power transfer – Energy transfer through electromagnetic waves 300 GHz – 400 THz (IR-WPT)

It is expected that future Parts of the IEC 61980 series will cover specific requirements. For example, Part 2 will cover communication between electric road vehicle (EV) and WPT systems including general background and definitions.

A future Part 3 will cover specific requirements for electric road vehicle (EV) magnetic field wireless power transfer (MF-WPT) systems including general background and definitions (for example efficiency, electrical safety, EMC, EMF).

As you would expect the technical requirements for the various WPT technologies are very different, and therefore the requirements for each technology will be dealt with in a specific part of the 61980 series.

EV operating as a source in parallel with other sources

In IEC 60364-7-722 Edition 1 it was stated that feeding back electricity into the supply network was under consideration. The new standard (IEC 60364-7-722 Edition 2) introduces requirements covering the case where the EV may operate as a source in parallel with other sources. It states that where EVs are intended to feedback energy to the electrical installations, the requirements of IEC 60364-8-2 apply. However, it is important to note that IEC 60364-8-2 is under preparation and that the requirements for these circuits are under consideration.

Overvoltage control

IEC 60364-7-722 Edition 2 now makes it clear that a connecting point accessible to the public is considered as part of a public service. Therefore, this means it must be protected against transient overvoltage's, as clause 443.4 of IEC 60364-4-44 states that protection against transient overvoltage shall be provided where the consequence caused by overvoltage affects public services.

Conclusion

This is only a brief overview and highlights some of the key changes in the new IEC standard. For more information refer to IEC 60364-7-722 Edition 2.

Important: please note these are requirements at international level (world standards) which may or may not be incorporated in BS 7671 in the future.