Wiring Matters

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

Summer 2014

BEC Young Professionals event

Nicole Whitton reports on the BEC Young Professionals event

On 1 April 2014, a group of talented young professionals, together with a fair number of more experienced professionals, descended upon Austin Court, the IET's conference centre in Birmingham. The aim of the day was to immerse ourselves in the subject of standard setting by learning how standards are developed and by understanding the critical benefits of robust standard setting.

All young professionals in attendance stood a chance of winning one of two places at the next IEC's Young Professionals programme in Tokyo. Against the backdrop of that giddy thought, the day opened with a series of lectures from a range of prominent guest speakers – all experts in the standards industry: Geoff Young, Chairman of the BEC, started the day with a warm welcome for attendees, thereafter, Jack Sheldon from the IEC introduced the importance of standard-setting; Julie Skirvin from Otter Controls gave a fascinating insight into her experience sitting on the various standard-setting committees for domestic appliances; Hilary Roberts provided an introduction to the BSI's CE and Kitemark symbols; Kevin Harris from BEAMA gave an insightful and illustrative depiction of the counterfeit-goods market and Newell Hampson-Jones, from BSI, discussed what young professionals can do to get involved with standard setting.

After lunch, which neatly provided a good opportunity for attendees to meet one another and network, it was time to dedicate the afternoon to practically applying the content of the morning's lectures. Attendees split into two groups; in the first session, each group worked through how a standard is generally created, and in the second session each group took a subject area (plugs and sockets or electric vehicles) and created their own standard-scoping document for their chosen topic.

Dr Scott Steadman, Director of Standards at BSI, closed the day with a final overview of standard-setting, which left Geoff Young with the pleasure of announcing the two winners: Neil Moran, already a member of the IET, and Marcin Wloch will be heading off for an all-expenses paid trip to Tokyo in November this year.

Neil and Marcin were thrilled with their win, with Neil saying it was "absolutely amazing" and admitting that he was "a bit overwhelmed" and Marcin looking forward to his trip to Tokyo as an excellent step in his career.

Congratulations to Neil and Marcin and we look forward to hearing about their trip in due course!

About our winners

Neil Moran, EngTech MIET

What is your job?
Electrical Operations Support Manager for British Gas

What does your job involve?
I provide support to various business units to ensure that they comply with electrical standards, legislation and regulations. A wide range of installation activities within British Gas require the organisation to be up to date with the latest regulatory requirements.

Why did you attend today?
I wanted to gain more insight into standards committees, how they operate and how best to influence the development of standards, as well as to gain a deeper understanding of the importance of standards. I also felt that this would be a good event to attend as part of my career development.

Marcin Wloch

What is your job title?
R&D Design Engineer for Eaton Electric

What does your job involve?
I oversee the design and partial testing of low voltage electrical distribution products.

Why did you attend today?
I wanted to gain more knowledge about how to interpret and apply standards, as well as how I can become more involved with the standard committee.

Left to right: Dr Scott Steadman, Neil Moran, Marcin Wloch with BEC Chairman Geoff Young.

About the organisers

The IEC

The IEC – the International Electrotechnical Commission – is the world's leading organisation that prepares and publishes international standards for all electrical, electronic and related technologies – collectively known as 'electrotechnology'. It brings together 163 countries and close to 10,000 experts. For more information: http://www.iec.ch/.

The BEC

The BEC – the British Electrotechnical Committee – was established in 1906. The BEC was a founder member of the IEC.

The BEC is the national committee responsible for representing the interests of the UK electrotechnical sector in the IEC and in the European Committee for Electrotechnical Standardisation (CENELEC). For more information: https://standardsdevelopment.bsigroup.com/Home/Committee/50002036.

Cable safety: fixing cables securely

Nicole Whitton, Editor of Wiring Matters, discusses the importance of securing cables correctly.

The Technical Regulations team was shocked to be notified of the untimely death of Mr Peter Paterson, who was killed on 16th August 2010 after being struck by six armoured electrical cables that broke free from a vertical cable tray situated 55 feet above in the roof area. Mr Paterson was unloading a truck that was parked at a loading bay when the incident happened.

Given that this is an area covered by The IET Wiring Regulations, the national committee responsible, JPEL 64, discussed at their February 2014 meeting whether adequate regulations exist for the securing of cables. The underlying activity leading to Mr Paterson's death was a course of work that had been carried out at the warehouse, during which time some armoured cables in the ceiling had been removed. The remaining cables had not been suitably secured, the fixings subsequently gave way and the cables fell, striking Mr Paterson and resulting in his untimely death. The question put to the Committee Members was whether the Regulations provide enough clarity on how cables should be secured.

After studying the circumstances of Mr Paterson's death, and the Regulations that underpin the securing of cables, Committee Members were in agreement that the following Regulations for the installation and fixing means of cables within BS 7671:2008(2013) are sufficient:

> **Regulation 134.1.1**
> *Good workmanship by competent persons or persons under their supervision and proper materials shall be used in the erection of the electrical installation. Electrical equipment shall be installed in accordance with the instructions provided by the manufacturer of the equipment.*
>
> **Regulation 522.8.4**
> *Where the conductors or cables are not supported continuously due to the method of installation, they shall be supported by suitable means at appropriate intervals in such a manner that the conductors or cables do not suffer damage by their own weight.*
>
> **Regulation 522.8.5**
> *Every cable or conductor shall be supported in such a way that it is not exposed to undue mechanical strain and so that there is no appreciable mechanical strain on the terminations of the conductors, account being taken of mechanical strain imposed by the supported weight of the cable or conductor itself.*

What does this mean for electricians?

Electricians and installers need to be aware that the Wiring Regulations do not provide detailed guidance on the installation and fixing means of cables. It is imperative that each cable is assessed appropriately to ascertain the unique method by which that cable should be fixed.

The case is a reminder of how quickly safe working conditions can be compromised, whether as a result of negligence – for example, not properly following the regulations – or as a result of outside interference in an environment – for example, theft of cables. Any suspicious activity should always be reported and a robust assessment of all possible resulting risks should be performed where possible.

Where can you get more guidance about how to secure cables?

See Guidance Note 1 Selection and Erection for more details.

Cable testing

The rigorous testing of cables is crucial to maintain confidence in their performance, quality and fitness for purpose – not least where their application is in fire detection, alarms, emergency lighting and evacuation systems.

Not all tests for fire resistant cables are the same and, asks Dr Jeremy Hodge, chief executive of the British Approvals Service for Cables (BASEC), are tests and the methods currently being used keeping up with technology and the needs of the industry?

Cables form the backbone of electrical power and communications systems and many installations have critical functions to perform in the event of fire, or their contribution in a fire might affect fire growth or safe evacuation. For this reason many cable standards include fire performance tests and other tests that are available as stand-alone indicators of performance. However, such tests can measure quite different features of performance, so the designer and specifier needs to understand their purpose, how to specify fire performance of cables and how to identify what they are installing.

Fire testing is the most problematic area of cable testing due to the inherent uncertainties involved in the progress of a fire. BASEC is working with other laboratories in the industry to develop more reliable and consistent tests in this field. For the specifier, can they be confident that test results are reliable? The key point is to make sure that the tests have been carried out properly in the first place.

Cable fire tests can be divided into three main technical groups.

Reaction to fire

How does the cable react when exposed to fire? Example tests include single flame tests ('Bunsen' test, IEC 60332-1), ribbon burner tests on bunched cables (ladder rack, IEC 60332-3) and tests involving the measurement of heat release. They are usually performed on a non-energised cable with a gas burner applied to the cable for a fixed period of time. Measurement criteria are usually based around linear spread of burning, or the emission of gases or smoke from the cable.

Fire resistance (circuit integrity)

Will the circuit continue to operate as normal during a fire and for how long? Tests include furnace and ribbon burner tests on power distribution cables, often including indirect or direct impact and/or the application of water. For example, the main test for cables to achieve compliance with BS 5839-1 fire alarm systems or BS 5266-1 emergency lighting (BS EN 50200 Annex E; BS 8434-2) applies a dry burner for up to two hours with impacts every few minutes and then a water spray is applied half way through the test period. Another key test for users is BS 6387, which has recently been updated. Circuit integrity tests are generally performed on an energised cable at maximum operating voltage using a ribbon burner. Other national tests may involve high temperature furnaces or other techniques. Measurement criteria are usually based on how long the cable can continue to operate for a specific time period without failure.

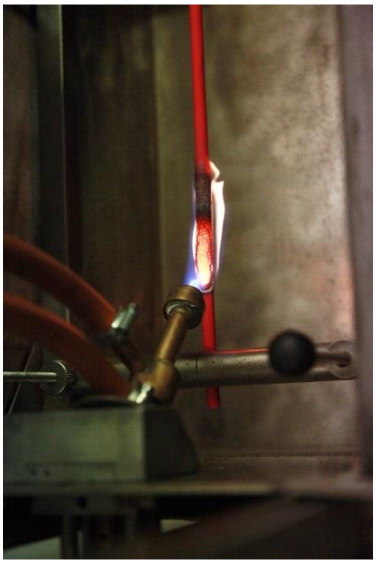
Material properties

Does the cable or material emit problem substances in a fire? Tests include smoke emission (3 m cube test, IEC 60134), corrosive and acidic gas emission or halogen content (tube furnace tests, IEC 60754), carried out on a small length of cable or piece of material. Measurement criteria are usually based on physical properties or chemical measurements. The group of tests on material properties are generally the more reliable and consistent tests because burning conditions are better controlled (furnace temperature or standard liquid fire) and quantitative results are obtained that can be readily calibrated. If the test apparatus and conditions are maintained then reliable and reproducible results can be obtained.

Fire resistance (circuit integrity) tests are generally pass/fail only and the results are subject to variations in flame temperature, airflow conditions and flame impingement on the sample. In some cases a cable may be found to fail the test in one laboratory while passing in others. One additional factor in these tests is the variability of cable design and materials allowed in cable construction standards. Manufacturers may chose different polymer technologies that all conform to the requirements of the construction standards but that favour different aspects of the test. BASEC is working with the sector to try to better understand the factors leading to pass or failure and to tighten up the test method standards to achieve better consistency.

Reaction to fire tests are generally based on the fire spread not exceeding a certain distance from its origin. They may also be subject to variations in flame temperature, airflow and flame impingement, but other factors such as packing density also affect results. However, the tests are generally more consistent. A new test that will have significant impact is the EN 50399 test, which is to be used for categorising cables for the Construction Products Regulation. This is based on the standard IEC 3 m vertical ladder test, but it adds gas and smoke measurements, and heat release rate, leading to a graded classification or performance. While the test has been extensively researched, significant differences will occur between laboratories.

At BASEC we are currently collaborating with other organisations to improve the reliability of the ‘Bunsen burner’ flame propagation test (IEC 60332-1), which has been around for 20 years. A flame is played on a piece of cable clamped vertically in a rig within an open fronted box, and to pass it should travel up the cable no further than 50 mm from the top clamp before extinguishing.



The Bunsen burner flame propagation test

The test method says that it should be carried out in an area that is ‘substantially draught free’ but what does ‘substantially’ mean? With some cables the test is very sensitive to the movement of air and we have found that what are nominally the same compliant test rigs can produce quite different results. With accredited test laboratories this test should be consistent – if there is one thing a test should not be, it is inconsistent.

Fire tests are generally specified in cable standards as a type-test, i.e., that is they might not be repeated very often once initial performance is established. As part of our regular surveillance testing of cables in production, BASEC is changing to repeat all fire tests annually. The Construction Products Regulation is taking a similar approach with annual surveillance testing. Three or more years between critical cable tests is a long time and changes in materials and production methods can occur.

Further information about BASEC is available at www.basec.org.uk or you can contact BASEC directly at mail@basec.org.uk or +44 1908 267300

LED FEATURE:

- **Keeping the lights under control**
- **The electrician's experience**
- **Catching our eye**

LED lighting: keeping the lights under control

Sam Woodward of Havells Sylvania Europe, and one of the technical authors of the IET *Code of Practice for the Application of LED Lighting Systems*, writes about the reasons for and approaches to controlling lighting as part of new and retro-fit lighting schemes.

Developments in the lighting controls market

Whereas the wiring of most building services involves connecting up a tried and tested mains supply, be it single- or three-phase, or connecting 240 V wires for mains switching, the installation of modern lighting controls often involves adding a mysterious extra pair of wires carrying a low-voltage signal and conveying data that are often unfathomable even with the aid of a trusty multimeter.

Perhaps this is one reason why the world of lighting controls is often portrayed as a dark art, populated by mysterious protocols with acronyms for dimming, such as DALI, DSI and DMX[1]. Furthermore, with a wide array of new wireless technologies now gaining market share, lighting controls can be implemented without any wired connections whatsoever!

Many have asked what the purpose of lighting controls is, and how they can best be applied to LED and other lighting systems. In this article I'm going to explore the motivations and methods for controlling lighting, rather than going into the detail 'under the hood'.

Why control lighting?

The primary reasons to control lighting in the first place are clear, pressing, and far from technical. I like to think of them as the three-Cs: conservation, cost-saving and compliance.

Conservation: the environmental imperative to preserve the planet. It's estimated that in the UK the demand for electricity could outstrip supply[2] as soon as 2016. Lighting consumes 18% of the UK's electricity production, at 58,000 TWh per year (a significantly scary amount). Properly considered and commissioned controls would enable this to be cut by 70% to around 5% of UK electricity production[3].

Cost-saving: reduced energy usage leads to reduced energy bills. Typical pay-back on a lighting controls system can be in the region of 1-2 years, depending on occupancy and available daylight. Consequently, adding automatic controls to lighting schemes makes good sense from a financial point of view.

Compliance: there's a tsunami of new legislation concerning the efficient lighting of buildings. For example, the new 'Part L', which came into effect earlier this year in an attempt to help fulfil our Kyoto promises, makes significant allowances for lighting that allow for the use of some of the control strategies outlined below.

However, there's also a fourth 'C'-initialled reason for deploying lighting controls, and that's ***Comfort***. Lighting controls enable us to ensure that a space is adequately lit when people are in it, to ensure that the space isn't uncomfortably over-lit, and to add dynamic elements of colour, colour-temperature and brightness variation throughout the day to make the space more interesting to users, more productive for work or more livable. There's no need for the requirements of energy saving to be in conflict with the requirements of user comfort; instead, the two strategies go hand-in-hand when a control system is commissioned. Adequate light levels can mean artificial light, daylight, or a measured mixture of the two.

Techniques for controlling lighting

A number of energy-saving strategies can be facilitated by controls:

- ***Putting users in control*** – this has the dual effect of enabling personal buy-in by end users into the light levels in the space and, as studies have proven, increasing productivity by as much as 5%[4] by giving users the ability to customise their environment.

- ***Occupancy detection*** – by passive infrared (PIR) or microwave sensors. PIR sensors detect the movement of a warm body, whereas microwave sensors utilise the 'Doppler effect' to sense any movement at all. Occupancy detectors typically function in one of two ways:

  - *presence detection*, where lights come on automatically when someone enters the space and extinguish automatically after the space has been unoccupied for a set period of time; or
  - *absence detection*, where occupants are required to switch on the lights manually (typically with a wall switch or control panel) but the switching off will be automatic.

  Where a space is unoccupied for long periods of time (such as in store rooms, corridors, WCs, meeting-rooms and back-of-house areas), substantial energy-savings can be made through occupancy detection

- ***Daylight harvesting and maintained illuminance*** – light-level sensors measure the amount of light reflected for surfaces below. The technique of measuring the amount of light in a space has two benefits.

  Firstly, a new lighting installation is usually designed with a 'maintenance factor' in mind. This is an amount by which the space is over-lit on day one, such that it will still meet required standards for lighting levels after the light sources have begun to degrade, or a build-up of dirt has taken place on the luminaires. This over-lighting factor is typically as much as 120% at the time of installation. Automatic controls can dim the lighting from day one, gradually increasing the power delivered to the light-sources over time to compensate for the dimming effects of aging and grime.

  Secondly, an automatic measurement of the light in a space can enable artificial lighting to be dimmed or even extinguished when the space is adequately lit by natural light, such as sunlight through windows or light-pipes. Use of free sunlight in this way removes a portion, typically around 25%, of the energy required to light a space. This can also allow for other combinations such as the integration of automated artificial lighting with shading controls for natural lighting.

- ***Dimming*** – it's no secret that lighting fixture companies are continually trying to outdo each other in terms of light output from fixtures as part of the specification process in order to win sales - as though partaking in a game of Top Trumps. A fixture that outputs 2,000 lux must be better than one at 1,800 lux at the same price, surely? This thought process can lead to spaces becoming over-lit, and dimming controls can have the effect of correcting that problem, whilst saving energy at the same time.

- ***Timing*** – if the occupancy pattern of a building is known then automatic timing can be deployed. Likewise many systems now offer astronomical time-clock features, such that lighting can be synchronised with sunrise and sunset times. For example, consider a restaurant that might be brightly lit during the day, but which has lighting configured to slowly fade to a more intimate, dimmed lighting scene as the sun sets, to better capture the more relaxed and romantic interests of evening diners.

Moving ahead with lighting controls

There are many other strategies for automating lighting in a building to achieve a perfect blend of comfort, conservation, cost-saving and compliance.

With the reasons for controlling lighting being simple and compelling, and the strategies straightforward and effective, there is a very real imperative to consider controls on all new-build and retro-fit lighting projects.

End note

The role of lighting control systems, relevant technologies, wiring, protocols and overall integration in lighting schemes are examined in detail in the IET's new *Code of Practice for the Application of LED Lighting Systems*: http://www.theiet.org/resources/standards/led-cop.cfm.

Sam Woodward's presentation from the *IET Built Environment Sector Summit: Lighting* is also available on the IET Lighting MyCommunity website: http://mycommunity.theiet.org/groups/blogpost/view/478/549/1090.

References:

[1] See also Wiring Matters feature #47, Summer 2013.
[2] Source: Society of Light and Lighting
[3] Source: UK Lighting Sector Strategy, LIA & UK Government, May 2014
[4] Boyce et al. Lighting Quality and Office Work: A Field Simulation Study

The electrician's experience: LED lighting systems

Dean Coleman, of Crest Electrical Services, gives his view on the LED installer market, based on his domestic installation experience.

How long have you been fitting LEDs?
I've been fitting LEDs for approximately 8 years.

From a consumer perspective, the market seems muddled. How have you navigated your way?
Extensive reading and research over the years and buying products to test at home.

What do you find is the biggest selling point for your clients?
It varies, most clients like the fact that LEDs will last many years, particularly the elderly and the less able. (Although LEDs are newer to the consumer market and, to my knowledge, the projected life expectancy is still a theoretical projection, approximately 25,000 hours.)

Also LEDs generate a fraction of the heat that most traditional lamps do, and for flush downlights, this brings safety benefits.

Many are keen to hear the cost saving e.g. less energy usage, often recovering the cost of the LED lamp within 1 year of purchase.

What is the biggest challenge?
Influencing clients that the initial purchase cost brings far greater benefits.

Also sadly, people and media still refer to LED lamps as 'low energy lamps', which have a bad reputation. They are generally referring to CFLs (compact fluorescents) that were given freely by energy companies and take a long time to warm up.

LEDs are very low energy (average 5 Watts) and illuminate instantly.

Is the line of work growing?
Yes – and will continue, as the development of LEDs give more options to clients, e.g. colour, spread of light, brightness, aesthetics and design, etc.

What is generally involved in fitting LEDs?

- *What needs to be taken into consideration?*

  Type of fitting required, e.g. 240 V or 12 V.

  240 V mains lights can generally accept a new LED lamp without further expense or disruption; however, 12 V fittings ideally need the transformer replaced within the lamp location, e.g. bathroom/kitchen, internal/external.

  Purpose of the LED, e.g. aesthetics, task, ambience etc.

- *What checks need to be made?*

  As per the IET Wiring Regulations, the normal checks to ensure the fitting is safe for continued use and the upgrade of the lamp/fitting.

- *Practically, how do you go about it?*

  Consulting with the client to assess their requirements and whether LEDs are suitable. If so, discuss the various features and benefits to ensure they meet client requirements. By going through this process I ensure that my clients are extremely satisfied with the outcome.

How does the installation of LED lighting compare to older/existing lighting products?
At this time, for me, because I mainly retro-fit lamps, the installation is similar as fittings are of similar size. If retro-fitting, the cable needs to be adequate to carry the existing load as per the original design.

What do you need to consider when designing an LED lighting installation and how does it differ from installing older/existing lighting products?
Many considerations are similar, however, now there is a huge choice of application that can be discrete but functional and safe, such as lighting stair cases, book cases, wardrobes (this needed careful planning due to fire risks from heat output) and kitchen/cupboard drawers. So there is now a wider scope of installation that needs consideration, such as colour rendering, smart/intelligent controls.

What are your top tips for other installers in the field?
Listen to what the client requires. Take your time explaining the benefits and address their concerns. Demonstrate examples of LEDs in operation during the initial appointment.

Do you expect the market to continue to grow?
Yes, greatly. The cost of LEDs is decreasing and the choice of fittings is rapidly expanding.

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LED lighting: catching our eye

Paul Ruffles, of Lighting Design & Technology, sent through two photographs showcasing the use of LED lighting systems in museums settings.

The American Museum in Britain, lit with eighteen 2 W adjustable LED downlights. These were positioned on the ceiling to light a given area or object well with a specific beam angle. For example, the long information panel at the front was lit by just three spots with elongation beams to give a long wide light spread.

The History Gallery at the Birmingham Museum & Art Gallery showing LED spots on tracks, adjustable LED downlights in structures and cases using LED projectors.

Lighting Summit event

Nicole Whitton reports on the IET Built Environment Sector Summit: Lighting

The IET Built Environment Sector Summit: Lighting took place on 9 April in the Building Centre in central London. The focus of the summit was on LED lighting systems, a fascinating topic wide in scope and discussed from different angles by four specialists in the field:

- Paul Ruffles, from Lighting Design & Technology, discussed the existing standards and regulations for LEDs, and also provided an illustrative showcase of LED application in a variety of buildings (including listed buildings!) from 2009 to today.

- Kevin Grant, from Light Alliance, spoke about how advances in lighting, and specifically LED lighting, can both enhance environments and illuminate buildings, from functional to accent applications.

- Sam Woodward, from Havells Sylvania, focused on lighting controls and 'smart lighting' – how effective lighting can be enhanced by smart applications.

- Bill Wright, from ECA, used his experience working with John Lewis and Waitrose to discuss the economic importance of retail lighting – for example, how designing lighting systems effectively can lead to a whopping 400% increase in sales of products.

It was evident from the day's discussions that LED lighting is a hot topic, and that the various applications of LED lighting – and the performance of LED lighting – have improved significantly alongside a downward spiral of costs. However, certain challenges still remain for applying LED lighting systems: retrofitting is still a big challenge, particularly for larger retail spaces, where the existing lighting fittings are often part of the ceiling structure. From a residential point of view, LED lighting remains a confused market, wherein consumers face the challenge of understanding what LED luminaires (or light bulbs) they require, with the cost of an LED luminaire being a significant barrier to 'testing the water'.

That said, it's clear that LEDs are illuminating the future of lighting, and that more needs to be done to educate consumers and empower installers and designers to become familiar enough with LED lighting systems so that they are confident about using them in their line of work.

The Code of Practice for the Application of LED Lighting Systems is an excellent starting point for understanding how to apply LED systems in a variety of environments. However, do also join the discussions on the lighting community: http://mycommunity.theiet.org/communities/home/478.

Third party certification schemes for domestic electrical work in England

Chief Engineer Geoff Cronshaw provides clarity on the new Part P third party certification schemes introduced in April this year, and answers some frequently asked questions.

New Part P third party certification schemes for electrical installation work in dwellings were introduced in England on 6th April this year. The bodies that have been authorised to operate schemes are listed on the DCLG website at www.gov.uk/third-party-certification-schemes-for-domestic-electrical-work.

A person registered with one of the schemes will be able to check domestic electrical work undertaken by installers who are not registered with a Part P competent person self-certification scheme (typically DIY work) and certify that the work is compliant with the Building Regulations. Before 6th April, only building control bodies (usually local authorities) could certify work by non-registered installers.

Overview

Part P of the Building Regulations was introduced in England and Wales on 1 January 2005. As part of the government's commitment to cut red tape, significant changes came into effect in England that:

- from 6 April 2013 reduced the amount of 'notifiable' work that must be checked by a building control body unless self-certified by an installer registered with a competent person scheme; and
- from 6 April 2014 introduced the new third party certification schemes.

All electrical installation work in dwellings must be carried out in line with the technical and procedural rules of Part P of the Building Regulations. This means that:

- all electrical work, no matter how minor, should follow the rules in BS 7671 for the design, installation, inspection, testing and certification.
- all notifiable work (certain types of higher risk work specified in the Building Regulations) must be certified as compliant with the Building Regulations.

Installers registered with a Part P competent person scheme are allowed to self-certify that notifiable electrical installation work complies with the Building Regulations. Before 6th April, only building control bodies (local authorities or private, approved inspectors) could certify notifiable work carried out by non-registered installers.

Part P doesn't just apply to flats and houses. Business premises that have a common metered supply that is shared with a dwelling – for example, shops and public houses with a flat above – are covered too, along with common access areas in blocks of flats and shared amenities such as laundries and gymnasiums. However, if the business unit is separately metered to the dwelling it does not come under Part P.

The legislation also extends to parts of installations in or on land associated with dwellings. This would include fixed lighting, pond pumps in gardens, photovoltaic panels on roofs, or a supply to outbuildings such as sheds, detached garages and greenhouses.

A clear distinction has to be made between residential accommodation that is a place of work – such as university halls of residence and residential care homes – and dwellings. University halls of residence and residential care homes do not come under Part P but are covered by the Electricity at Work Regulations and would be subject to HSE investigations in the event of an incident. The building control body will be able to confirm whether Part P of the Building Regulations applies in a specific case.

The Building Regulations now define notifiable work more simply as the installation of a new circuit or consumer unit, or any addition or alteration to an existing circuit in a special location. For the purposes of the Building Regulations, a special location is essentially defined as the space within the zones in a room containing a bath or shower (see figures 1, 2 and 3), or as a room containing a swimming pool or sauna heater. Additions and alterations to existing circuits outside special locations, and replacements (other than consumer units) and repairs anywhere, are not notifiable. The building control body will be able to confirm whether work is notifiable in a specific case.

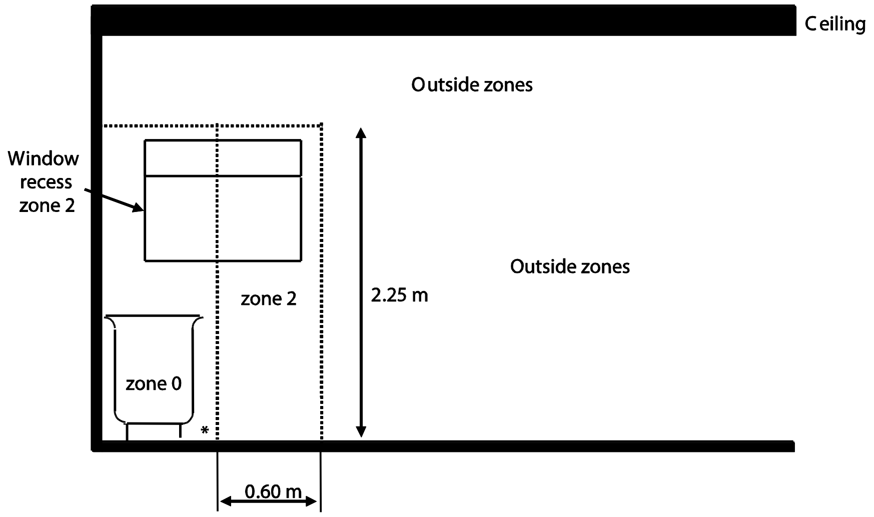


Figure 1: Zone dimensions - elevation view showing a bath tub

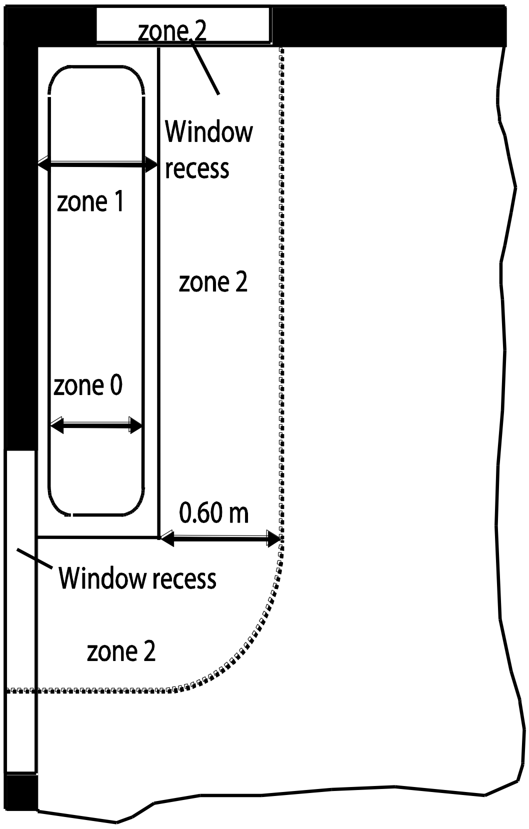


Figure 2: Zone dimensions - plan view showing a bath tub

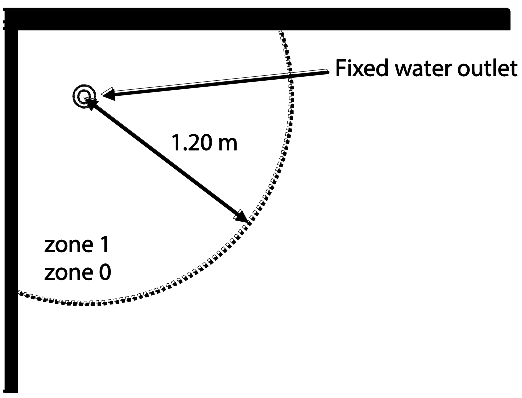


Figure 3: Zone dimensions - plan view showing a shower without a basin

Certification and reporting

Anyone carrying out domestic electrical installation work must carry it out in line with Part P of the building regulations. Where work is notifiable (new circuits, the provision of a consumer unit and any addition or alteration to an existing circuit in a special location), it must be certified as compliant with the Building Regulations. An installer registered with a competent person scheme is allowed to self-certify compliance; non-registered installers must, before work begins, either appoint a registered third party certifier to inspect and test the work or alternatively notify a building control body (usually the local authority). The extent of inspection and testing needed to establish that the work is safe will depend on the type of work and the competence of the installer and may affect the fee payable.

Where notifiable work is self-certificated by an installer who is registered with a competent person self-certification scheme, the installer's registration body will give a copy of the Building Regulations compliance certificate to the occupier, and the certificate (or a copy of the information on the certificate) to the building control body.

A registered third party certifier will (subject to inspection and testing being satisfactory) issue a condition report to the person ordering the work, and the certifier's registration body will give a copy of the Building Regulations compliance certificate to the occupier, and a copy to the building control body.

A building control body will often contract a specialist to inspect and test some or all of the work. The occupier will receive a Building Regulations completion certificate from a local authority, or a final certificate from an approved inspector.

All work, whether it is notifiable or non-notifiable, should be designed, installed, inspected, tested and certificated in accordance with BS 7671.

Typical questions

Work in a bathroom – light fitting
Question
Is the replacement of a light fitting in zone 2 of a bathroom notifiable work?
Answer
No, provided that the light fitting is a like-for-like replacement.

Question
Is the replacement of a light fitting located outside the zones in a bathroom by a number of downlighters notifiable work?
Answer
No, provided that the alteration work involving the downlighters is all outside the zones.

Work in a bathroom – shower
Question

If I replace an existing electric shower with a new electric shower connected to an existing shower circuit is this notifiable work?
Answer
Even though the shower is within the zones the answer is No, provided that the shower is a like-for-like replacement.

Work in a kitchen – additional socket outlets
Question
If I install additional socket outlets wired on an existing circuit in a kitchen is this notifiable work?
Answer
No, alteration work in a kitchen is no longer notifiable.

Work outside – outside light
Question
Is the installation of a light fitting installed outside notifiable work?
Answer
No, provided that the light fitting is connected to an existing circuit, because additions and alterations to existing circuits outside a dwelling are no longer notifiable.

Caravans, mobile homes and park homes
Question
Do caravans, mobile homes and park homes come under Part P?
Answer
Caravans, mobile homes and park homes are all treated as caravans under legislation and do not ordinarily fall within the definition of a building in the Building Regulations; consequently, these would not normally come under Part P. Most two-unit park homes (those which are delivered in two sections and bolted together on site) fall within the definition of caravans.

Extra low voltage wiring – alarm wiring
Question
Is the installation of intruder alarm wiring notifiable?
Answer
No, provided that the intruder alarm wiring is not in a special location and does not involve a new connection to the consumer unit.

Consumer units
Question
How can compliance with Part M be achieved in new dwellings for mounting multi-row consumer units where it is not possible to have all the switches between 1350 mm and 1450 mm above floor level?
Answer
In the case of multi-row consumer units, it is generally recommended that the bottom row of switches should be between 1350 mm and 1450 mm so that they are out of reach of

young children to avoid interference and inappropriate operation of switches, but this would be subject to agreement with building control.

More information

Please note: this article only gives a brief overview of Part P of the Building Regulations for England and the new third party certification schemes. For more information please refer to:

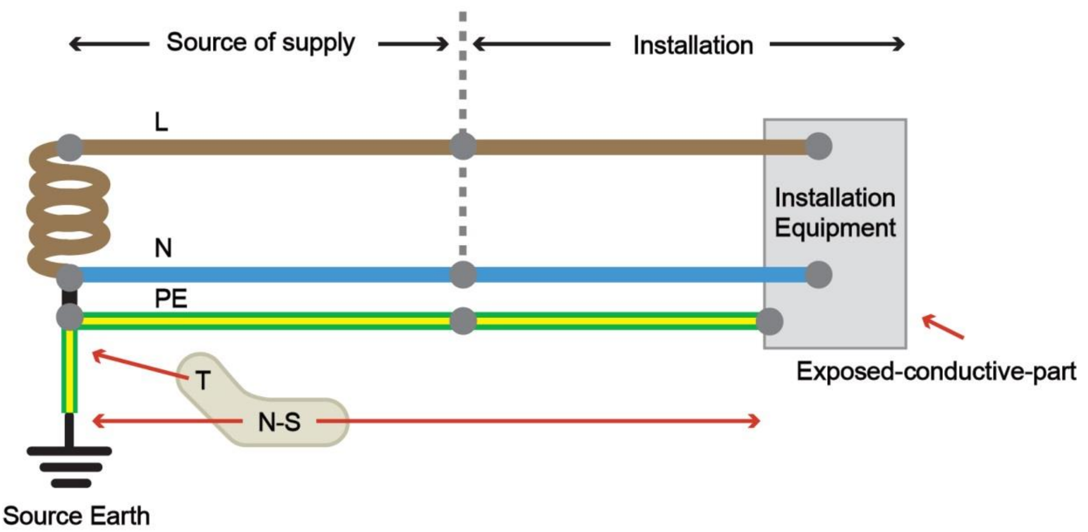
- the DCLG website at: www.gov.uk/third-party-certification-schemes-for-domestic-electrical-work
- the DCLG circular at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/291791/140313_dclg-circular-0114-web_final.pdf
- the 2013 edition of Approved Document P at: www.planningportal.gov.uk/buildingregulations/approveddocuments
- details of all competent person self-certification schemes at: www.gov.uk/building-regulations-competent-person-schemes

IT systems in railways

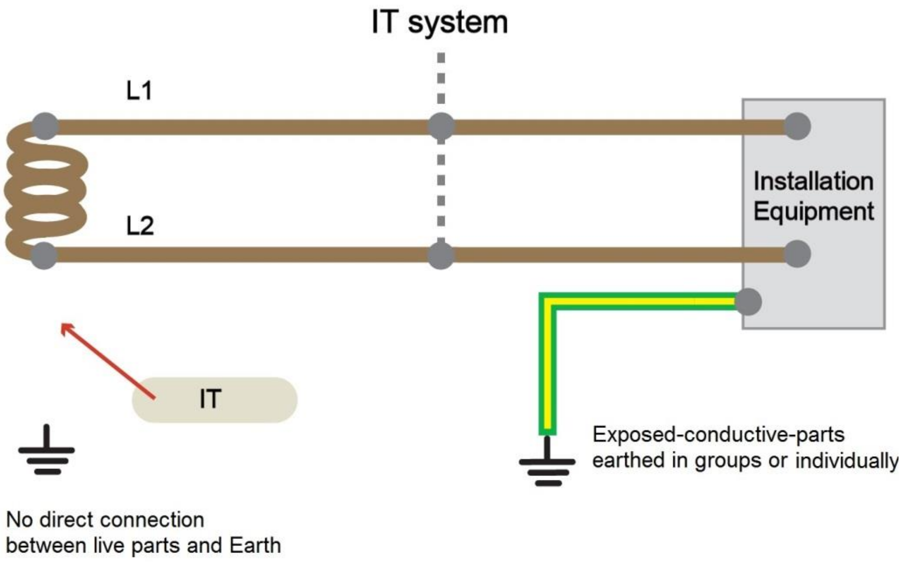
Tim Granger MEng CEng MIET, from Mott MacDonald, talks us through IT systems in railways.

BS 7671 covers the three primary types of earthing arrangement: TN, TT and IT. The majority of electricians and electrical engineers will be very familiar with the TN type, including TN-C, TN-S, and TN-C-S variations, as these are by far the most common type of supply provided by Distribution Network Operators (DNOs). The TN arrangement is deemed suitable for most installations as the provision of a protective earthing conductor ensures that under earth fault conditions there is a large amount of fault current and thus the protective devices are able to disconnect faults within the times required by BS7671.

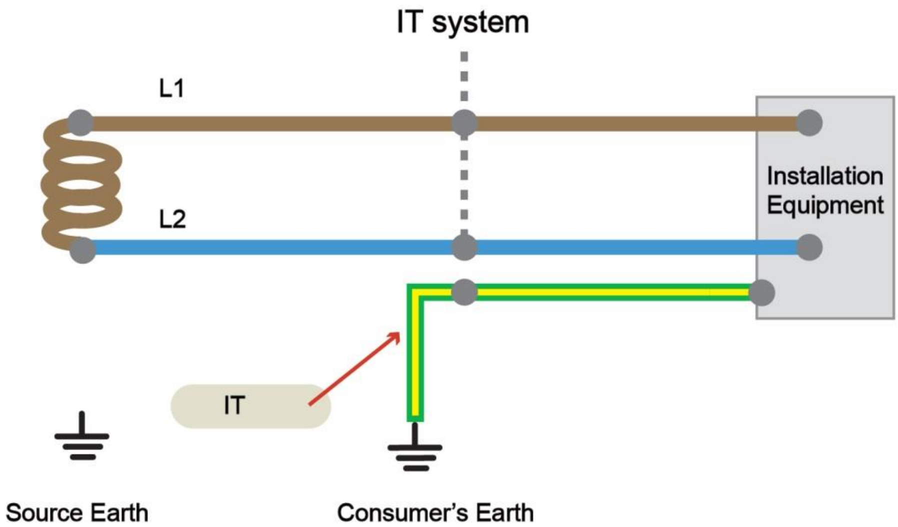
TN-S system



Although less common, most people in the industry will also have some experience of the TT arrangement. These are more usually found in rural or remote areas where the use of overhead cables for transmission purposes leaves the PEN conductor more susceptible to damage. Instead, an earth electrode is provided at the supply transformer and the onus is on the consumer to maintain an earth electrode on their property. The downside of a TT installation is the high external loop impedance (Ze) value, which results in a relatively low fault current and therefore requires an RCD at the source in order to effectively disconnect earth faults.



The third type of earthing arrangement, and the particular focus of this article, is the 'IT' type, in which the source transformer is isolated from earth, whilst all exposed conductive parts of the installation are connected to earth electrodes. So what are the benefits and where are IT systems used? To answer these questions it's best to first look at how the system operates, especially in a fault situation.



It is worth noting the colour scheme shown in the diagram above, in particular the fact that both cores are live so there is no neutral. The two live cores are usually referred to as L1 and L2 even though the system is effectively a single-phase system; due to this, and to ease identification, Network Rail use brown and black for L1 and L2 respectively.

Normal Operation

We saw earlier that the source transformer is isolated from earth. This is true in the sense that there is no direct connection to earth (technically, BS 7671 allows for a direct connection if through a high impedance); however, this is only part of the story as the system is naturally earthed by the stray capacitances of the cables. This capacitance means that in normal operation there is a small amount of leakage current. This current can generally be considered insignificant and has no adverse effect on operation or safety.

First earth fault situation

Should there be a breakdown in the insulation, or a direct short to earth at some point in the circuit, the real benefit of the IT is seen. With no connection to earth at the source, there is no return path for the earth fault current, and current is therefore limited by the capacitances previously mentioned. So in a fault situation the touch voltages are limited to only a few volts and the equipment remains operational. This is the main benefit of using an IT system and, consequently, BS 7671 gives no requirement to disconnect the supply under first earth fault conditions as long as one of the following is permanently installed and gives an audible and/or visual signal:

- insulation monitoring device;
- residual current monitoring device; or
- insulation fault location system

Alternatively, the first fault can be disconnected using an appropriate detection device with trip unit, however, this loses the fault resilience benefit of the IT system.

Second earth fault situation

Whilst the system can happily operate with a single earth fault, should a second fault occur on the opposite phase to the first fault there is potential for significant current to flow and, consequently, BS 7671 has requirements for protection against electric shock similar to TN systems; these conditions are covered in Regulation 411.6.4 of BS 7671.

Railway signalling power supplies

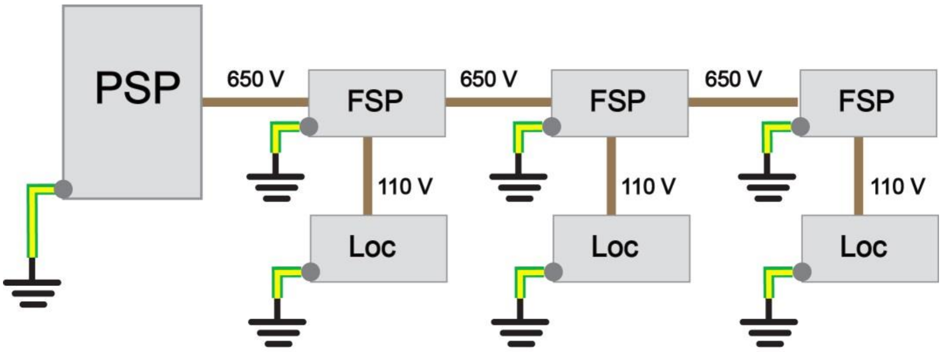
One area of industry where the IT earthing is significantly used is the rail industry, particularly as a way of providing power to the signals and other equipment located trackside along the route. The primary reason for this is due to its resilience against earth faults, making it ideal for a system that is critical from both a safety and an operational perspective. In the last forty or so years there have been three main arrangements used:

- Class I individually earthed;
- Class I collectively earthed; and
- Class II individually earthed.
  (Classes I and II in accordance with IEC 61140.)

We'll have a brief look at each of these in turn, but first we'll start with an overview of what a typical signalling power supply system looks like; this is based on the Network Rail catalogue of standards, which cover the design and maintenance of all the equipment they own, that is, the majority of the rail infrastructure in England.

Wiring Matters

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



Principal Supply Point (PSP)

This is where the incoming 400 V supply is converted to the distribution voltage of, typically, 650 V. Most PSPs use a 400 V DNO supply as one of the main power sources, with additional sources either being taken from the traction power system (25 kV overhead line in the north or 750 V DC third rail in the south) or a standby diesel generator. It is also typical for a PSP on an important route, to have an uninterruptible power supply (UPS) so that the supply is maintained during the changeover between primary and secondary power sources. The PSP is also where we find the permanent insulation monitoring device as well as various other remote condition monitoring systems.

An example of a PSP, copyright Mott MacDonald Ltd.

Functional supply point (FSP)

These are some of the grey cases that you'll see if you look out of the window when you're on a train. The primary equipment that the FSP houses is one or more 650 V to 110 V transformer(s), but the FSP also houses lockable switchgear to allow for safe working practices within the case and at other FSPs/Locs further downstream on the 650 V feeder. In some instances, the term FSP is used to describe the above equipment found within a Loc (or other trackside equipment housing); it does not necessarily need to be a separate case.

Location Case (Loc)

Locs make up the bulk of the grey cases located trackside. They house the real working of the railway signalling installation, including systems that detect where the trains are, control the trackside signals, switch the points on the track to direct the train, and a whole host of monitoring and failsafe systems to provide a robust and, above all, safe arrangement. The equipment typically uses both a.c. and d.c. voltages less than 110 V, so the Loc cases also house a number of transformers and rectifiers to obtain the correct voltage from the incoming 110 V a.c. supply from the FSP.

Example of Locs, copyright Mott MacDonald Ltd

So with most signalling power supplies using the above arrangement, we can now go back to look at the three power supply arrangements found on the rail network.

Class I individually earthed arrangement

This is the oldest of the common arrangements and was in use until the mid-2000s. Trackside cables were of the two-core unarmoured variety, and each FSP was individually earthed using an earth rod/electrode. The issue with this system is that in the event of a second earth fault very little current flows as the earth path between faults is through the general mass of earth – with 650 V feeder lengths extending to a few miles, the earth fault loop impedance can easily reach to tens of thousands of ohms. It is clear that this is not compliant with the latest edition of the regulations and is therefore no longer being installed.

Class I collectively earthed arrangement

The difference with this system is that rather than having 2-core 650 V supply cables, a 3-core armoured cable is used. The third core and armour are used together in parallel as a CPC to equipotentially bond all PSPs and FSPs. This bond ensures that in a second fault situation there is a low impedance path as it is effectively a short circuit fault using the CPC to connect between the two phases. This collectively earthed arrangement meant that the system could disconnect second earth faults in a way that is compliant with BS 7671. The downside of this arrangement isn't so much a technical one (although terminating a 3-core armoured cable into an FSP designed for a 2-core rubber cable isn't without issue) but a financial and environmental one as you are paying to have 50% more copper than the older arrangement.

Class II individually earthed arrangement

The financial implications described above have been the primary driving force behind the latest iteration of signalling power supplies. This arrangement, which has been in use since 2013, goes back to using a 2-core unarmoured cable but, to get around second earth fault issues, Class II double insulated equipment is used within the FSPs. This satisfies the requirements of BS 7671 Regulation 410.3.3 by utilising *double or reinforced insulation* instead of the traditional *automatic disconnection of supply*. As a result, this arrangement has the benefit of lower capital cost whilst also satisfying the safety requirements.
So as you can see, there's a whole technical world behind the structures you see as you whizz past them on the train, and this is one of the few areas of industry where you'll find IT power distribution so widely used, all helping to keep the signals and trains running.

WiringMatters

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

To bond or not to bond: domestic swimming pools

With the summer sun warming our skin and tempting us into plans for weekends spent poolside, Paul Harris BEng (Hons) CEng FIHEEM MIEE MCIBSE, of Harris Associates Ltd, looks at whether or not to bond domestic swimming pools – a question that is often put to the wet leisure industry trade associations.

Please note: in this article, earth (with no capital) refers to the earth of the electrical system, whereas Earth (with a capital) refers to the general conductive mass of the earth.

When it comes to domestic swimming pools, the question of whether to bond is a very good one and is put to the wet leisure industry trade associations, such as SPATA (Swimming Pool and Allied Trades Association), all the time. The first initial answer is: "it depends ...".
In reality, when met with this response, it is not from a person vying for a fee, it generally does depend on the circumstances. The circumstances surrounding the installation of a swimming pool in the UK vary considerably; the main considerations are:

- where is the pool to be located?
- what type of pool construction is employed?
- What are the earthing arrangements of the electricity supply entering your premises?
- where are you locating the electrical equipment relative to the pool?

Additional risks around swimming pools

The increased risk associated with swimming pools is that of electric shock due to:

- a reduction of body resistance (because a person is wet);
- the possibility that a person is in contact with earth potential; and
- in outdoor installations, the risk of contact with the general conductive mass of the earth, which may be at a slightly different potential than the earth of the electrical system.

Due to these additional risks, requirements for safety above and beyond the general requirements placed by BS 7671 apply to basins of swimming pools, paddling pools and their surrounding zones. The additional requirements are detailed in Section 702 of BS 7671.

Reasons to bond

Traditionally, swimming pools have been located in sports complexes and, sometimes, as part of an indoor 'extension' to the house. In these instances there is no question as to whether to bond due to the requirements of Section 411 and Chapter 54 of BS 7671, as these require exposed- and extraneous-conductive-parts to be bonded in accordance with the requirements of regulation group 411.3 of BS 7671.

Image produced with permission from Portrait Pools & Enclosures

Where the installation is outside the house, either in a raised or a sunken pool, there is a change in circumstances and external influences to the system. In these circumstances, additional considerations need to be made and the type of earthing arrangement for the incoming supply has a significant effect on the installation design.

The main type of earthing arrangement that used to be supplied to domestic premises was TN-S, however, since the 1970s the majority of installations are provided with a TN-C-S (PME) earthing arrangement, with a relatively small number of TT supplies being provided to typically rural areas.

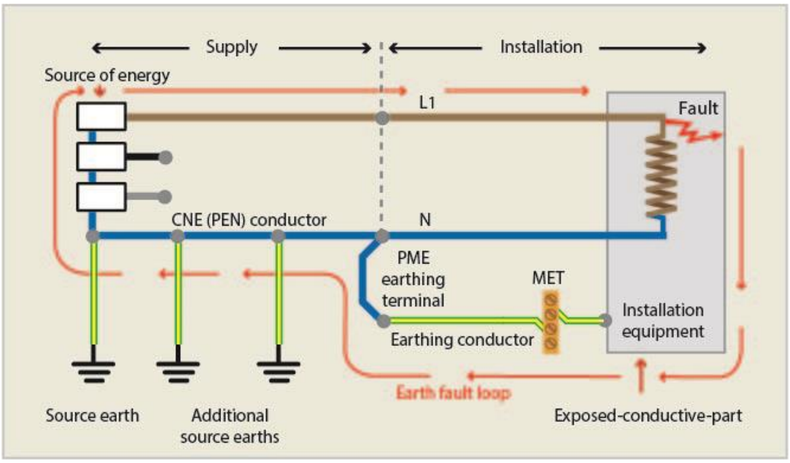
TT systems have a number of challenges with respect to RCDs, but TN-C-S arrangements provide the greatest number of challenges when dealing with swimming pools in the domestic environment.

How do you know what type of supply is provided?

Generally, this information should be available at the meter position as a label would state ‘PME terminal’. Where this is not the case, the electrical designer/installer should examine the equipment to establish the earthing arrangement. It may be possible to obtain the information from the distributor of electricity as they may have it on record but alterations could have occurred in the intervening years, so, it is always advisable for the designer/installer to establish the earthing arrangement on site. For further information, see the IET’s On-Site Guide to BS 761:2008(2011), figures 2.1 (i)-(iii).

Protective Multiple Earthing

The Electricity Safety, Quality and Continuity Regulations 2002 (as amended) permit the Distribution Network Operator (DNO) 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.



Protective Multiple Earthing (PME) has been almost universally adopted by DNOs in the UK as an effective and reliable method of providing their customers with an earth connection. This supply system arrangement is described in BS 7671 as TN-C-S.

Whilst a PME 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 conductive mass of Earth. The potential difference between true Earth and the PME earth terminal is of importance when:

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

The local DNO may therefore decide not to provide a PME earthing terminal for an installation such as that of a swimming pool, etc.

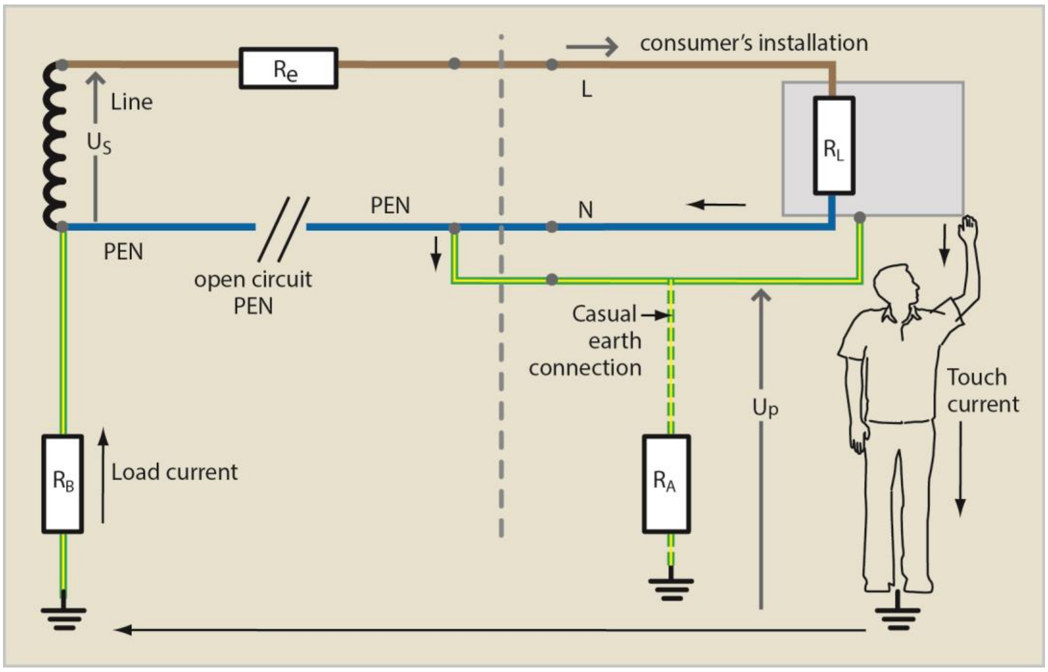
As far as BS 7671 is concerned, it does not preclude the use for an installation that includes a swimming pool but recommends that an earth mat or earth electrode of suitably low resistance, for example, 20 ohms or less, be installed and connected to the equipotential bonding.

This has two benefits.

Reducing risk of electric shock

Firstly, should a discontinuity occur in the DNO supply PEN conductor (under very exceptional circumstances), all metalwork will rise to approximately 230 V with respect to true Earth, which will in itself mean that there could be a lethal touch voltage present between the exposed-conductive parts, extraneous-conductive-parts and true Earth. In an indoor environment, this is normally adequately dealt with by the protective bonding arrangements. In an outdoor environment, there is much more likelihood that a person will come into contact with the earth of the electrical system earth, i.e. the metalwork connected to the protective bonding system and true Earth. This separate earth mat or earth electrode will help to minimise the potential difference between the two.

The diagram below assumes that there is no casual connection to true Earth in the house through protective bonding. This is, of course, a pessimistic view that all other services are isolated from earth. The additional earth electrode(s) provided outside will therefore have the effect of minimising the touch voltage in the installation. This will be further reduced if the structure of the pool forms an earth electrode itself. However, the thought of the pool structure forming the earth electrode is uncomfortable.

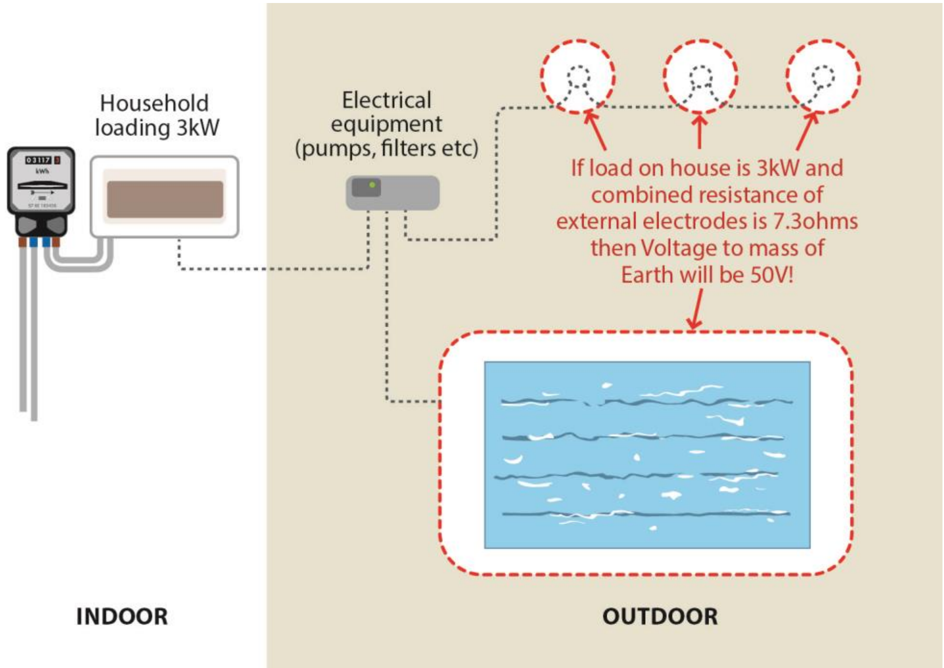


The touch voltage will be determined by the load connected within the installation and the value of the earth electrodes and any casual connections to earth that is provided by the bonded services.

Using the formula:

$$R_A = R_L \times \frac{V_P}{(V_s - V_P)}$$

Load (kW)	R_L (ohms)	R_A (ohms)		
		Vp= 25V	Vp = 50 V	V_p = 100 V
7	7.6	0.92	2.1	5.8
3	17.6	2.14	4.9	13.5
2	26.4	3.21	7.3	20.3
1	52.9	6.45	14.6	40.6



Above diagram indicating an installation with no casual connection to earth

As the table above demonstrates, to reduce the voltage to a significantly low value requires a considerable earth electrode. In the above example with the pool and additional earth electrodes, for an earth electrode resistance of 20 ohms, to restrict the value of touch voltage to a ‘safe voltage’ of 50 V a.c. the connected load on the system would need to be 0.73 kW.

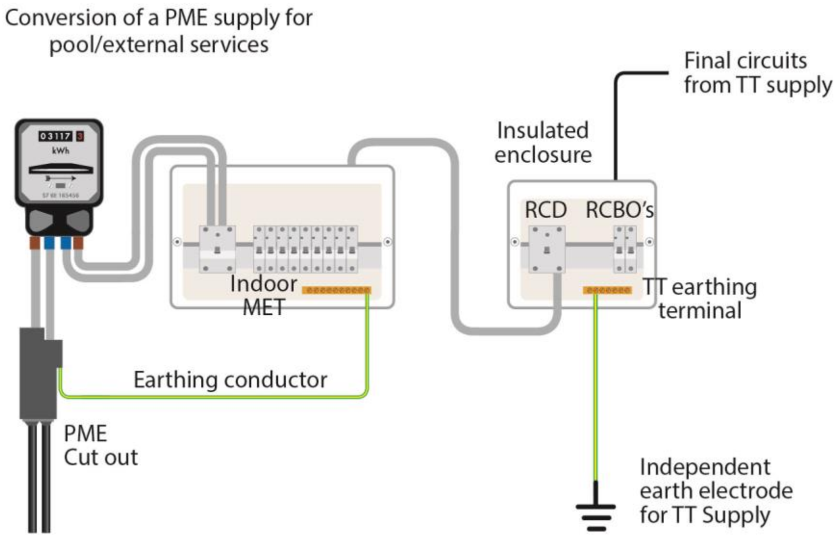
'Tingles'

Secondly, under normal operating conditions, it is possible, due to small differences in potential between the earth of the electrical system and true Earth, for a small voltage to be present. This is usually due to the voltage drop in the PEN conductor creating the difference in potential. This difference is detectable, for instance, by a wet person touching a handrail and coming into contact with true Earth. This perceived electric shock is minimised by installing the additional earth mat or earth electrodes as recommended by BS 7671, however, the most effective method of removing this risk is to provide a TT earthing arrangement and completely isolate the pool's metalwork and any pipework from the PME supply.

Customer derived TT Supplies

Often, the DNO will refuse to provide a means of earthing to a property in a rural area; commonly, where an overhead supply is the means of distributing electricity in that area. Where this occurs, the electrical installer will install an earth electrode as the means of earthing for the consumer's electrical installation. However, where PME supplies are available, it is usual to find where PME is not compatible with the proposed installation, i.e. petrol stations or remote sports pavilions with showers, that a number of these supplies have been converted to a TT earthing arrangement.

As far as swimming pools are concerned, this does not mean that the earthing arrangement for the whole house has to be changed; it simply means that, for the external supply and associated services, a TT earthing arrangement should be formed for those services. This would involve providing a supply to an insulated enclosure in which an RCD or an RCBO is installed. A separate earthing conductor and earth electrode is required, which provides the TT earthing arrangement.



Once the TT arrangement has been formed with the appropriate earth electrode it is necessary to ensure that this system and any of the pool extraneous-conductive-parts are not connected to the PME earthing system by any 'casual' connection, as this would only serve to create problems.

Once the TT system has been constructed, the relevant information should be supplied to the owners along with suitable and appropriate labelling. It is important to prevent future confusion or 'contamination' of the TT earthing arrangement by persons at a later date that may connect the external system to the household protective conductors in order to improve test results, etc.

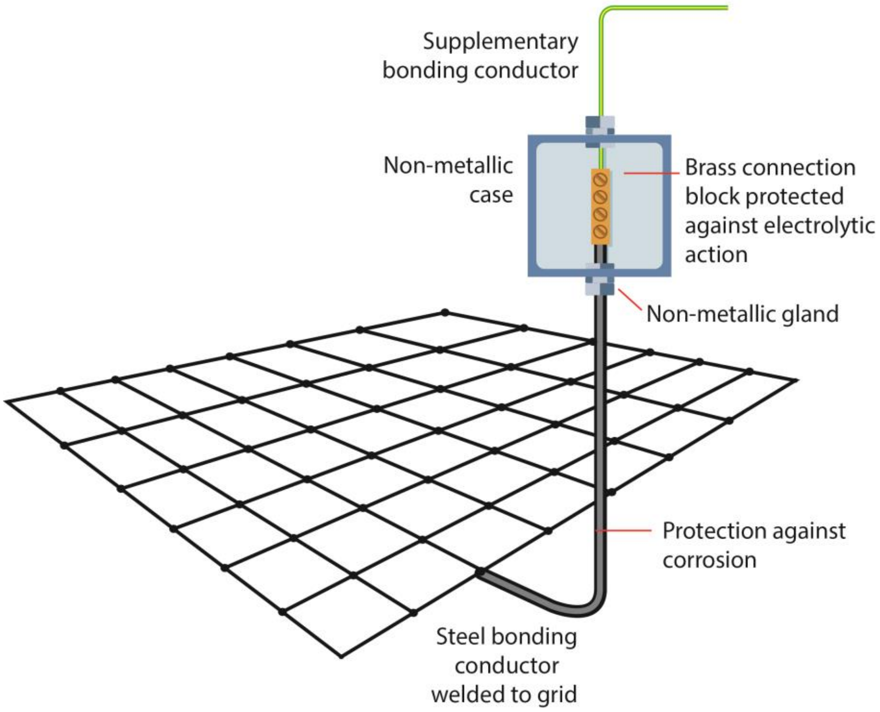
Where a TT system has been installed it is still essential to prevent a difference in potential between exposed-conductive-parts and extraneous-conductive-parts, however, this time any protective bonding that is carried out should be connected to the main earthing terminal for the TT arrangement.

Is welding necessary?

A concern that is raised by the trade is if the concrete reinforcing needs to be bonded, does a welder need to be brought in to weld the mesh together?

This is unnecessary as BS 7671 does not require reinforcing mesh to be welded. What is required is a reliable connection between mesh grids and the point at which any conductor is connected. The confusion is possibly due to a requirement in Energy Networks Association Engineering Recommendation G12/3 calling for a metallic grid to be installed in remote installations served by a PME supply.

What is required is that electrical continuity is maintained by welding or clamps.



What happens in other standards?

Reviewing the requirements for the provision of earth electrodes using the building reinforcing in BS EN 62305-2:2012 *Protection against lightning. Risk management*, it is clear that the lightning protection standards consider electrical continuity to be achieved where there is an overlap in the mesh by 20 x the diameter of the reinforcing bar and the reinforcing mesh is bound together by wire or proprietary clamps. As a result, whilst welding is ideal, there are other methods of ensuring the continuity of the reinforcing bar.

Conclusion

In conclusion to the question of whether or not to bond, the answer should be yes, but take into account the impact of what you are bonding.

Where a PME earthing arrangement is in place, is the protective bonding going to bring about further problems in terms of potential risk relating to discontinuity (failure) of the neutral conductor and the no-fault situation, which is the potential for perceived shocks (tingles from a perfectly normal PME supply). Whilst an electric shock is our concern and should be a ‘never’ event, the potential for ‘tingles’ experienced from a perfectly healthy PME supply system with correct protective bonding in place is cause for concern – and, as far as customer relationships are concerned, probably quite damaging!

Where the property is supplied by a PME earthing arrangement, the person responsible for the design should be aware of all the above factors and consider other approaches. This would usually be to provide a TT supply to the pool and outside services with the appropriate documentation and labelling to ensure that there is no ‘contamination’ of the TT earthing arrangement.

Spotlight: Julie Skirvin, from Otter Controls

Julie Skirvin, SMT Lab Manager at Otter Controls – supplier of controls, safety cut-outs and connectors, largely for the small domestic appliance and automotive industries – contributes to four working groups: CPL 72 Controls for Household and similar use, PEL 23/03 Connectors for portable appliances, CPL 61 Safety of household electrical appliances, CPL 61/07 Heated Appliances Sub-committee and CPL 59 Performance of household electrical appliances.

What is your career background?

I have an ONC in Process Plant and Electrical/Electronics, an HNC in Electrical/Electronic and a Postgraduate Diploma in Manufacturing: Management and Technology. During my 26 years with Otter I have worked in their Applications, Development and SMT Laboratories reporting into Sales, Engineering and Operations respectively.

How did both of those prepare you for standard setting?

I think it helps that I have spent time working with both customer applications and new product development. This enabled me to experience how standards affect how products interface with end users, and development where designers face the challenge of developing new products.

Did you ever think you'd end up on standard-setting committees?

No! In fact the first time I was asked I said no. As I don't have a degree I didn't think I was the sort of person who sat on standards committees.

What is it that drew you towards sitting on such committees?

All through my time at Otter I have worked with/to standards requirements and sometimes you just wonder why certain requirements or tests are in standards. It's great to have the opportunity to discover the background and be able to query them.

How long have you been a member of those committees?

I joined my first BSI committee in 2006, so just over 8 years.

What exactly is involved in sitting on a committee?

Once you've joined a committee, BSI updates you by email with all new documents. I read through the documents and decide if they are of interest to BEAMA (our trade association) or my company. If they are I circulate them for comment. Once I have comments back I either submit a comments sheet to the Committee Secretary or make notes. The UK response is then decided by discussion either by email or at a meeting. The amount of documents and number of meetings vary considerably between committees.

Has it benefited your career?

Working on the committees has allowed me to develop my communication and meeting skills, giving me greater confidence when dealing with groups of people. It has given me a much better understanding of the standards and allowed me to communicate their requirements and justifications to others. This allows me to run the lab in a much more efficient manner.

Would you recommend that others get more involved in standard setting?

Yes, I think it's very rewarding both for individuals and companies.

How would young people go about getting involved – and what is required?

If your company belongs to a trade association that can be a great way of joining in as they can nominate people on to committees in their areas of interest. If not look at the BSI website as they are always looking for input from a wide range of people/interest groups.

The IET also host the BEC Young Professionals Workshop every year. The workshop allows participants to gain an insight into the processes used to develop standards and meet some of the people involved.

What has surprised you the most during your time on a committee?

That writing standards is such a democratic process.

What are the greatest challenges?

I think that keeping standards up to date with new technology is the biggest challenge at the moment. A close second is the fact that it's a global market.

Editor's note: we'll be providing details about the next BEC Young Professionals workshop in further issues of Wiring Matters. For further information about how to get involved with standard setting, please see the BSI website: http://www.bsigroup.com/en-GB/about-bsi/uk-national-standards-body/how-to-get-involved-with-standards/ .