WiringMatters

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18th Edition of BS 7671: send us your feedback

Wiring Matters gives you the details on how you can see and comment on the 18th Edition of the IET Wiring Regulations.

The IET is preparing to publish the Draft for Public Comment (DPC) of the 18th Edition of BS 7671. This is your chance to have your say about the development of the new edition of the Wiring Regulations.

Important dates

Please note, the below dates are expected dates only and are subject to change.

- DPC availability and commenting period: June 2017 – August 2017.
- IET and committees review DPC comments: August 2017 – November 2017.
- Changes approved; final draft produced; reviewed and proofread: November 2017 – April 2018.
- Official JPEL/64 committee sign off: 4th April 2018.
- BS 7671 edition 18 available for purchase: 1st July 2018.

BSI and its role in setting Standards

BS 7671 is a British Standard. It is published jointly by the British Standards Institution (BSI) and the IET. BSI is the UK's National Standards Body (NSB).

Standards are developed by committees of dedicated experts. In the case of BS 7671, there are four committees that feed into the main BSI/IET joint technical committee JPEL/64:

- JPEL/64/A – covers verification and inspection and testing (Part 6 and Appendix 6 of BS 7671) plus any work relating to Parts 1, 2 and 3 of BS 7671.
- JPEL/64/B – covers cable sizing and installation and related matters (some of Parts 4 and 5, Appendices 3 and 4 and some Part 7 items of BS 7671).
- JPEL/64/C – covers earthing installations and related matters (some of Parts 4 and 5 and some Part 7 items of BS 7671).
- JPEL/64/D – covers the remainder of Parts 4 and 5, some Part 7 items and some Appendices of BS 7671).

Together, these groups are responsible for UK input into international and European technical committees IEC/TC 64 and CENELEC/TC 64, which produce the IEC 60364 standards series and the European implementations HS 60364 series. These standards are then implemented here in the UK as BS 7671.

Updates to BS 7671

As technology develops and is used differently, BS 7671 needs to be updated to ensure good practice across the industry. Updates can be in the form of an Amendment or an Edition:

Amendment – alteration and/or addition to previously agreed technical or editorial content of an existing standard.

Edition – a new edition of an existing standard will either be published after several amendments (usually, a maximum of three) have been published or a major revision of the technical content has taken place.

The committees will discuss how sections of BS 7671 may need to be changed to either remain aligned to the international and/or European Standards or take into account national issues Any changes proposed are debated, refined and finalised at JPEL/64.

The updated BS 7671 will then be released in the form of a Draft for Public Consultation (DPC). This is when you will have the opportunity to read the expected changes in BS 7671 and to have your say.

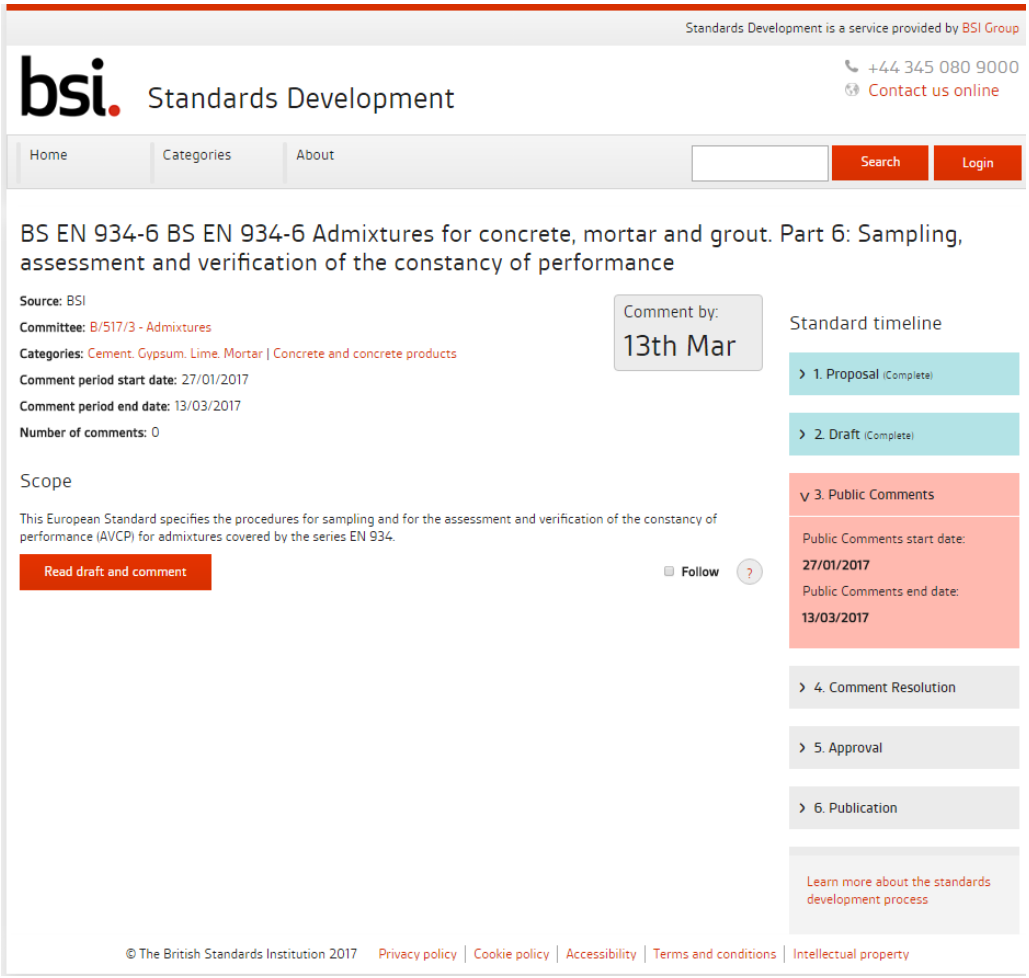
Comments on the standard can be submitted to the Secretariat at any time but will usually be held for consideration at the next Amendment/Edition cycle.

Comment on the DPC of BS 7671

The DPC of the draft 18th edition of BS 7671 will be published on the BSI Standards development portal: https://standardsdevelopment.bsigroup.com/.

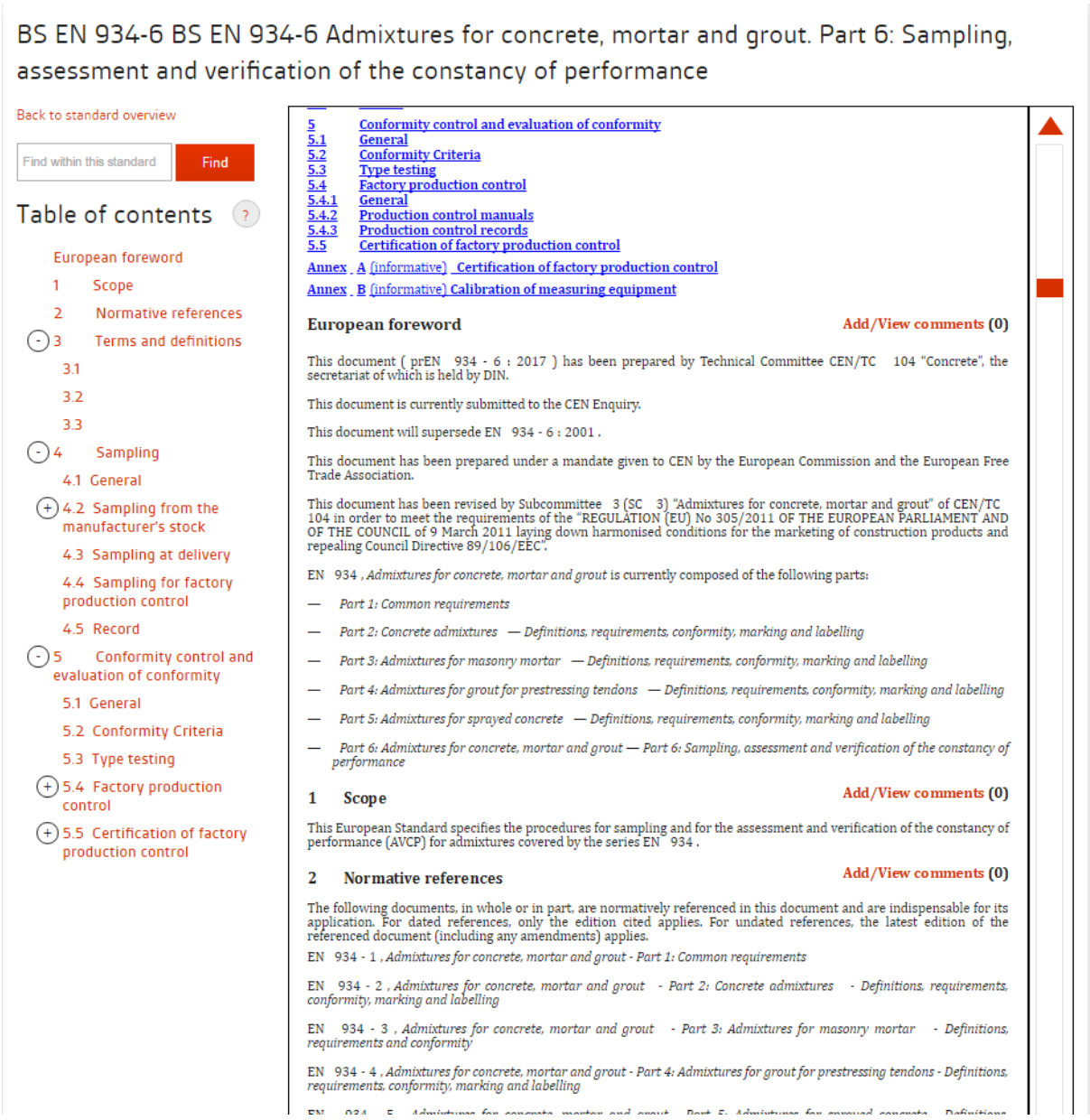
First, register following the on-screen instructions. Once you have successfully registered, you can login in to read and comment on proposed and draft standards, including BS 7671. You can also go into your Account to update information about yourself, change your password and personalize your preferences.

When commenting on draft standards, use the 'Comment on this section' field to make your comments and the 'Proposed changes' field for any clarification and to make a suggestion for improvement.



Example of the comment page

You will be able to view the content of the whole draft document and provide a comment on each section.



Example of the add/view comment fields

There are three types of comments you can add:

- general – general comments on the standard as a whole or comments that are neither technical nor editorial;
- technical – comments on the technical content of the standard; and
- editorial – purely editorial comments such as corrections to spelling or rewording to express the technical point more clearly.

Please note: your comment is more likely to be accepted if a constructive alternative is provided.

When you have finished using the Standards Development Portal, you can safely logout.

Other useful features

You can:

- follow a Standard's progress – register your interest on the Standard's homepage and receive regular updates.
- look at JPEL/64's activity and progress – simply click 'Show Committee Standards Activity' on the BS 7671 page.
- see the development of various documents through the JPEL/64 process: although the documents themselves won't be available for you to view until public comment stage, you can register to follow the development.
- save your comment for future editing (you will be prompted to submit your comment ahead of closure of the DPC).
- remain anonymous throughout the DPC process.

Find out more

You may also want to find out more about becoming a technical committee member.

You can also read more about the benefits of standards.

For further queries and information regarding:

- BSI as the UK National Standards Body – visit the BSI Group website.
- published standards and how to purchase standards – visit the BSI Shop.
- further information about BS 7671 – subscribe to Wiring Matters; it's free. Geoff Cronshaw's most recent article discusses some potential changes to Section 730 of BS 7671.

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The reality of … virtual reality

In this commentary piece, Allan Burns explores the prospect of virtual reality – and what it means for electricians.

Allan Burns is an electrical consultant with a special interest in energy management, the emerging smart grid and a passion for the environment and sustainability. This strong sense of direction stems from being well travelled, a Degree in Human Sciences from UCL and a period as a Charity Fundraising including Friends of the Earth. He is committed to educating customers and end users and his desire to test new technology was reflected by becoming a qualified Secondary Science Teacher. Teaching about renewables gave him the bug and he left teaching to create Ecoelectrical, an environmentally responsible electrical installation company, and Telemental, a design consultancy.

Introduction

Decades ago now, it arguably became the electrician's job to 'hang' the flat-screen TV … ok so far, got plugs, got screws, got back-brace …

Fast-forward to 2016, the invasion of integrated devices is possibly the most defining phenomena of the modern home; many such devices are for our entertainment.

Most modern homes have had an entertainment zone, ranging from a surface with a TV/radio on it that needs a socket-outlet, through time and up the slope of disposable income to that staple of the modern status-statement home, the Cinema Room.

I suspect that the Cinema Room is about to be outmoded. People are going to want to clear out some of those seats and tables to make space to move around.

Why?

Because the relationship with media that the traditional screen has monopolised for a century is about to be transcended by 'VR', aka Virtual Reality/Augmented Reality/Immersive Media. Call it what you want, it is coming. In this article I'm going to lump it all under the name VR.
So how will VR change our home and work spaces?

The first thing to realise is that VR is *immersive* 3D not pop-up 3D, where Jaws lunges at you and you spill your popcorn. With VR 3D you can get up, walk around Jaws and see if he is a she. That's just the start. The potential of what VR can do when you hit its version of the 'red'/'interactive' button is phenomenal. Imagination is the only limit; this article isn't about that, it's about how installers can plan an installation to allow for that.

To get a handle on these questions I went along to the University of Gloucestershire to get some ideas on best strategies for wiring for this future now.

Undergraduate with an enviably bright future Sam Pugh studies and works with VR. Sam is an avid gamer but is also alert to the wider potential of the medium. He's already completed commissions to create VR environments to facilitate work in other University of Gloucestershire Departments including Forensics and Psychology, and has therefore experienced the attraction of practical VR in other fields.

A few considerations installers need to think about

What are you selling?

Cultures and markets have to be ready. No one knows yet what VR is going to be. Who knew back in 1980 what the internet would become? Personally, I won't be talking people into dedicated 'holo-deck' rooms just yet … but maybe we can offer options on the traditional formats of more recognised spaces, like the cinema room, the telly room, maybe the living room. Probably best to keep it out of the dining room. And let's not even think about the toilet. For work premises, the training room would be a good place to start.

Network skills

Network skills are becoming increasingly important to the electrical contractor. More so for the VR suite specifier. Bear in mind that end-user expectation of some VR possibilities like gaming and Skyping are never going to flatten out. More resolution! More speed! These will always be desired. Don't skimp on your Ethernet or optical cabling. The boxes can be upgraded, people expect that; cables must be ripped out, they might not be expecting that.
Sam reckons a fast PC is currently preferable to a MAC in terms of meshing with what's out there but please don't shoot the messenger if you're an Apple nut!

Product knowledge

There is a fierce proprietary battle brewing for dominance all over this market. Do you want to be the person who advises them which technology to invest in? Every set will have its own stable of developers, its own set of possible subscriptions. Some of those might dwindle while others flourish. Electricians will need to decide how to create a finish to *their bit*, how to inform clients where to go to fill that space you designed for them. Don't set yourself up as a VR/AR experience guru unless you have the time and inclination to go the distance with that. It's going to move a lot faster than TV technology and that is tricky enough.

Design

Health and Safety

VR can be disorientating and even nauseating. Worth noting before you create a suite at the top of some stairs, near a balcony over a sitting area or near a door onto traffic – think the outcomes through. There are some dos and don'ts shared amongst the designers, which I won't list here, but suffice to say people will need time and space to adjust into and out of their VR experience.

Cable Topography

The best headsets are still wired to the PC. Batteries and wireless might takeover one day but for now assume that the player needs wires to their head. Plan for that, can you go overhead in order to reduce trip hazard? Sam Pugh at University of Gloucestershire would like to see some sort of sprung tether to keep the wires poised out of the way. Those aren't available on Amazon yet but perhaps they will be soon.

Can you put in ducts to likely outlets, for maximum future-proofing?

Can you create storage nodes in likely places, for example, over the VR zone (probably where HDMI comes in) to allow for bits and bobs to be added if needed? All intra-connectivity may go wireless one day – who knows; so don't break the bank doing this.

Interior Design

Position, position, position! Whatever it's being used for, the participant's position in the VR zone is important and needs to be tracked.

VR headsets use a sort of GPS; they come with sensor-boxes that act like the satellites your SATNAV uses, except that they can't work off solar PV – so make sure you put sockets where they need to be. Best guess is currently to put them in opposite corners. If there are no corners, make your own virtual corners ☺ They mostly use a line-of-sight to the headset – make sure that is understood, before your clients put the aquarium in!

Having transcended the humble screen, we're no longer all sitting facing the same way – what should we do now? Sam reckons the best layout for a VR zone is a triangle consisting of: decent screen, decent sofa and decent *roam-zone*. The dynamic will tend to be a VRaggle (VR gaggle – I just made up a word) of watchers who might want a sofa while they watch the player lunge and gurn about the roam-zone. They'll want to swap, hydrate and ventilate. It will be your job to help them understand and design that space. Will it need a socket-outlet for a wine fridge? Provision for AirCon?

Advise clients where boxes (PC etc.) are likely to stack up, so they can plan to hide them if they want to.

Don't assume everyone will want to shoot space pirates in front of their mates. Remember some people might just want it for Skype, or immersing themselves in images, or training: literally anything. They may not know yet but it's your job to ask the question so good decisions can be made.

What's around the corner

Keep in mind you don't know what is coming. Omid Nikroo at LOXONE UK is a smarthome consultant who did his thesis on VR back in the day, in particular, how to create the physical environment for VR. He believes untethered battery powered VR rigs are round the corner so was keen on setting VR up in wide spaces, great if you have space! If you don't have a spare gymnasium, one option he envisaged was a travelling floor that allowed VR users to get some running in while they were playing. Sci-Fi fantasy, I had a flash of Omid at a Red Dwarf Convention when he said that … when I asked Sam at University of Gloucestershire about this he matter-of-factly showed me the Virtuix Omni Virtual Reality Treadmill http://www.virtuix.com/. Basically: Omid's vision modularised, half running machine,

half toddler trolley – on Kickstarter right now. It won't be cheap but one major benefit is that it will stop people throwing up and you can't put a price on that. Details thin on the ground but I reckon it will need a 13A socket-outlet and maybe run in Ethernet while you're at it, come to think of it make sure you put in some charging points for Omid's battery packs. Get the idea?

Provision for sound

Immersion is the name of the game so headphones are *en vogue* for the ultimate player experience but provision for your VRaggle is needed. Omid reckons Dolby Atmos surround sound is helpful; another reason to put VR in with the entertainment – you can piggy back off its Audio system.

Summary

It's tempting under the billion-dollar onslaught of WiFi and Internet of Things to throw up your hands and let the router and maybe some of those nifty USB plug things stand in place of any considered system design. Let google or Apple work it out …

But should we give up? We have a role and a responsibility to keep thinking and keep advising clients on how to future-proof technology.

New-builders and developers now have opportunity to design for very exciting possibilities, not all of which can be or should be accommodated by a dongle or a *smart*-plug. VR is a prime example, another example is energy management. Devices are multiplying all the time.
The IoT has a lot to offer for the energy-frugal and connection-hungry home-owner but it's never going to be to able crack all the problems; you're still going to need a thick cable if you want to charge your electric car. You're still going to need decent data cables if you want to transmit data fast and privately.

The 'Big Players' would have us all pare down our lives into something they can sell a dongle for. Electrical designers and contractors have arguably already transformed more and further than any of the other players in construction. If we keep thinking and planning ahead, we can enable people to get what they want, not what the Big Players want them to want.
Perhaps someone will write a VR simulation that will allow Joe Bloggs to understand how the energy companies calculate their bills - maybe that's not a bad idea? Dream the impossible, install the future.

Virtual reality – the money behind the vision

Melissa Fremeijer, from International Data Corporation (IDC), tells us that VR hardware spending (i.e. screenless viewers, standalone HMD, and tethered HMD) for consumer use virtually boosted over 2016 reaching a total of US$ 1.17 billion in Western Europe. IDC expects VR hardware spending in the consumer market to grow at a 166% CAGR towards 2020 whilst VR hardware spending for commercial use will grow at a CAGR of 122% reaching US$ 347.3 million in 2020. VR hardware spending for both consumer and commercial usage is expected to reach a total of US$2.47 billion in 2020.

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Electromagnetic resilience: a new approach to EMI

In this article, electromagnetic specialist we first introduces the new(ish) engineering discipline of functional safety; then the very new engineering discipline of risk-managing electromagnetic interference (EMI) to help achieve functional safety.

Functional safety risks associated with the incorrect functioning of electronics

Functional safety is an increasingly important engineering issue that is very different from traditional product safety concerns, such as electric shock, fire, heat, etc.

Most of the safety standards we use don't specifically mention functional safety so, although required for legal compliance with product liability laws and EU safety directives, it is often overlooked, leaving people exposed to uncontrolled safety risks and manufacturers to uncontrolled financial risks. For example, if the electronics controlling a car, plane, train, radiation therapy machine, nuclear power plant, industrial machine/process, etc., malfunctions, the result can have serious safety consequences for people – and serious liability and reputational consequences for the manufacturers of said electronics.

Almost every aspect of our lives now relies on the correct functioning of electronics, usually microprocessors running software programs. Where electronic malfunctions could increase safety risks, we say that it presents functional safety risks.

Unfortunately, for at least the last 30 years it has been impossible to fully test even a modest microprocessor or software program, because:

- their complexity creates so many possible states that their system could get into that they can't all be tested in any reasonable timescale; and

- digital systems are discontinuous and non-linear, so testing any percentage of the states that a system could be in cannot predict anything about the untested states.

The result of the above is that all digital systems can malfunction despite any amount of testing.

Safety and product liability laws and regulations in the UK generally require the equipment, system or installation not to expose an ordinary user or a third party to a risk of death at a rate of greater than one in a million per year. This limit applies over the entire lifetime of the equipment, which could in some cases exceed 30 years.

Higher risks than this are generally permitted in cases where the manufacturer shows that the cost of further reducing the risk would significantly outweigh the value of the lives thereby saved (up to a maximum risk limit). These safety risk numbers come from a wide range of free guidance documents issued by the UK's Health and Safety Executive (HSE).

Standards for functional safety

The problem of not being able to thoroughly test digital systems was first recognised in the 1970s. So, by the 1980s, a huge international effort was underway to try to establish suitable functional safety engineering techniques – in system, hardware and software design, and in

its verification and validation – to ensure that safety risks could be demonstrated to be acceptably low despite the intractable problems with testing multiple system states.

The first international standard on functional safety, IEC 61508 *Functional safety of electrical/electronic/programmable electronic safety-related systems*, was published in 2000, and a number of application-related functional safety standards have since been based upon it, including:

- IEC 61511 *Safety instrumented systems for process industry* (in USA: ANSI/ISA S84)
- IEC 62061 *Safety of machinery*
- IEC 62278/EN 50126 *Railways – specification and demonstration of reliability, availability, maintainability and safety*
- IEC/EN 50128 *Software, railway control and protection*
- IEC/EN 50129 *Railway signalling*
- IEC 61513 *Nuclear power plant control systems*
- RTCA DO-178B *North American avionics software*
- RTCA DO-254 *North American avionics hardware*
- EUROCAE ED-12B *European flight safety systems*
- ISO 26262 *Automobile functional safety*
- DEF STAN 00-56 *Accident consequence* (UK military)

IEC 61508 and its family of functional safety standards deal with the impossibility of testing a sufficient proportion of a digital system's states by, first, determining the level of risk that is acceptable. This level is then used as the basis for the appropriate application of a range of well-proven techniques and measures (T&Ms) in the design, verification and validation of the systems. The hardware and software that comprise all these T&Ms are justified in detail in a 'Safety Case', alongside an independent assessment of all of the afore-mentioned items and, finally, any iteration necessary to satisfy the assessor.
Where a control system is complex it is normal to identify the functions that are only concerned with managing the functional safety risks, removing them into a separate safety-related system (SRS). This SRS is less complex and thus more amenable to using the above process to reduce safety risks to acceptable levels.

It is important to understand that the discipline of functional safety applies to the entire facility, including the management of its personnel (see Figure 1). The acceptable safety risk level is achieved by the combination of several risk-reduction methods, so the electronic systems do not have to shoulder the whole burden of managing the risk by themselves. However, IEC 61508 and the standards developed from it only provide requirements for the SRS itself.

A powerful technique in functional safety is to determine one or more 'safe states' that the equipment can be switched into by the SRS when it detects the potential for a hazard to occur. For example, opening a machine guard causes the machine's SRS to stop the machine quickly enough to avoid injury.

However, IEC 61508 also includes T&Ms suitable for applications in which all of the functional safety requirements have to be provided by electronic systems, and for electronic life-support systems that might have no safe states to be switched into, so must continually operate at least well enough to prevent death or serious injury.

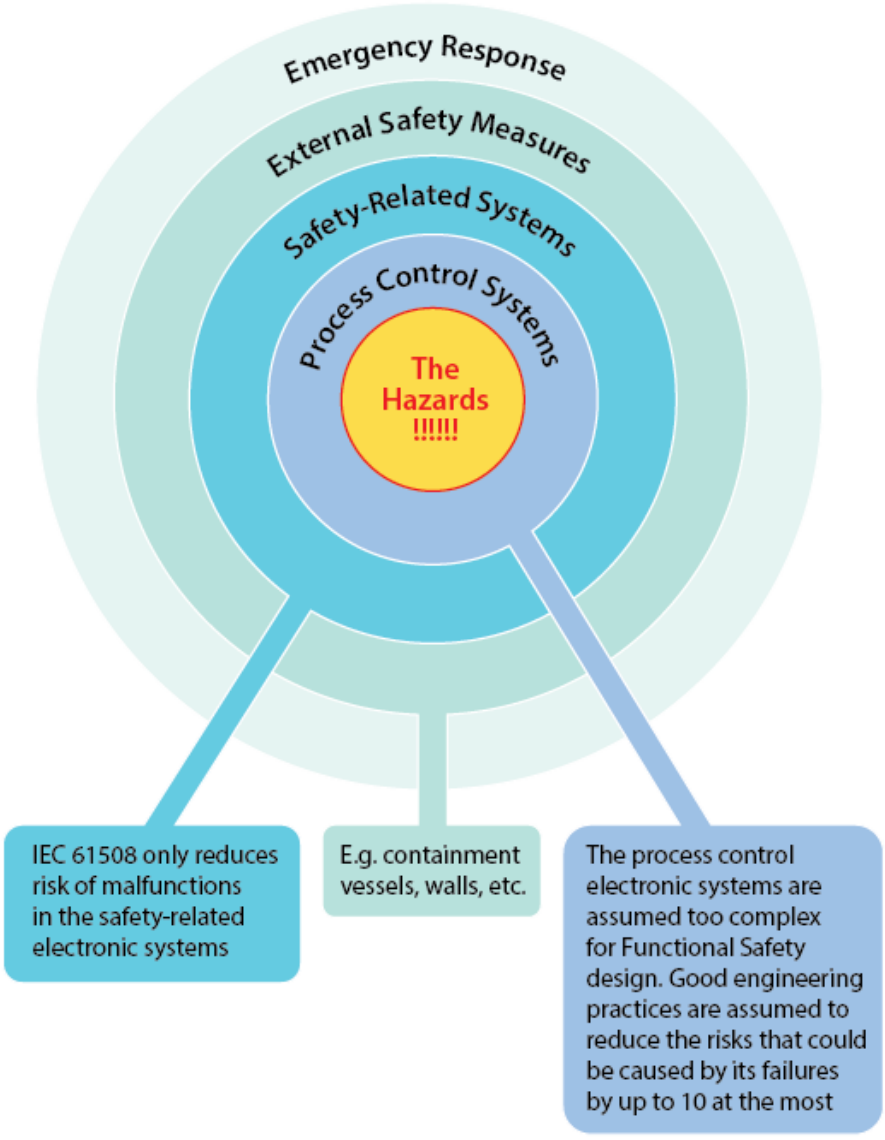

Figure 1: Example of the functional safety of an industrial processing plant

Managing functional safety risks due to electromagnetic interference (EMI)

All electronics can suffer from errors, malfunctions and/or failures due to electromagnetic interference (EMI), so EMI must be taken into account when complying with functional safety.

When applying IEC 61508 or its family of functional safety standards, it is typical to allocate one-tenth of the acceptable risk level to EMI. So, for example, if a digital system must maintain a risk of less than one death per million per year over its complete lifecycle, then the risk of EMI causing it to suffer an error, malfunction or failure that could lead to a death must be less than one in 10 million per year.

Electromagnetic compatibility (EMC) is traditionally assured by laboratory testing and, where functional safety risks are concerned, it is traditional to apply the standardized immunity tests at higher levels. However, although this approach has been recognized as inadequate since 2004, it is still generally relied upon. The result is that people are being exposed to uncontrolled functional safety risks and manufacturers exposed to uncontrolled financial risks, due to EMI.

Immunity testing is inadequate on its own because, as previously discussed, it is physically impossible to test all possible states of a digital system.

Further, because functional safety risks must be low enough over the whole lifecycle, proving that EMI will not cause excessive functional safety risks must also take into account the effects of the following on equipment's electromagnetic characteristics:

- corrosion, aging, wear, contamination, etc.
- electrical faults (for example, a broken filter ground wire).
- foreseeable use/misuse (for example, leaving a shielding door open, replacing a shielded cable with a less-well-shielded type).
- mechanical stresses and strains that alter the impedances of electrical bonds, EMC gaskets, etc., degrading the performance of shielding and filtering.
- the very wide range of variations in the characteristics of real-life EMI when compared with very simplified EMC laboratory tests.
- different types of EMI occurring simultaneously or in some critical time sequence.
- reasonably foreseeable combinations of all of the above independent variables.

Even if it was possible to test all the states of a digital system, taking the items in the above non-exhaustive list into account shows that attempting to prove functional safety compliance over the lifecycle by EMI immunity testing alone would result in an impractically large test plan.

Instead of attempting to rely on immunity testing, we need to use the IET's new 'electromagnetic resilience' approach. This builds on the existing expertise in the EMC testing and functional safety communities and is summarised in Figure 2.

IEC 61508 describes many T&Ms for use in design, verification and validation to reduce risks caused by errors, malfunctions, faults, etc. in hardware and software to the degree required to comply with functional safety, and functional safety designers and assessors have become very experienced in applying them.

These T&Ms operate on the digital data and other signals, or on the electrical power supplies, and were never intended to deal with EMI. However – because EMI can only affect data, signals and/or power supplies – many of IEC 61508's design T&Ms are very effective in dealing with the effects of EMI.

Accordingly, the IET's new *Code of Practice on Electromagnetic Resilience* (due to be published in early 2017) details which IEC 61508 T&Ms are good for dealing with EMI, and how to improve their benefits for electromagnetic resilience.

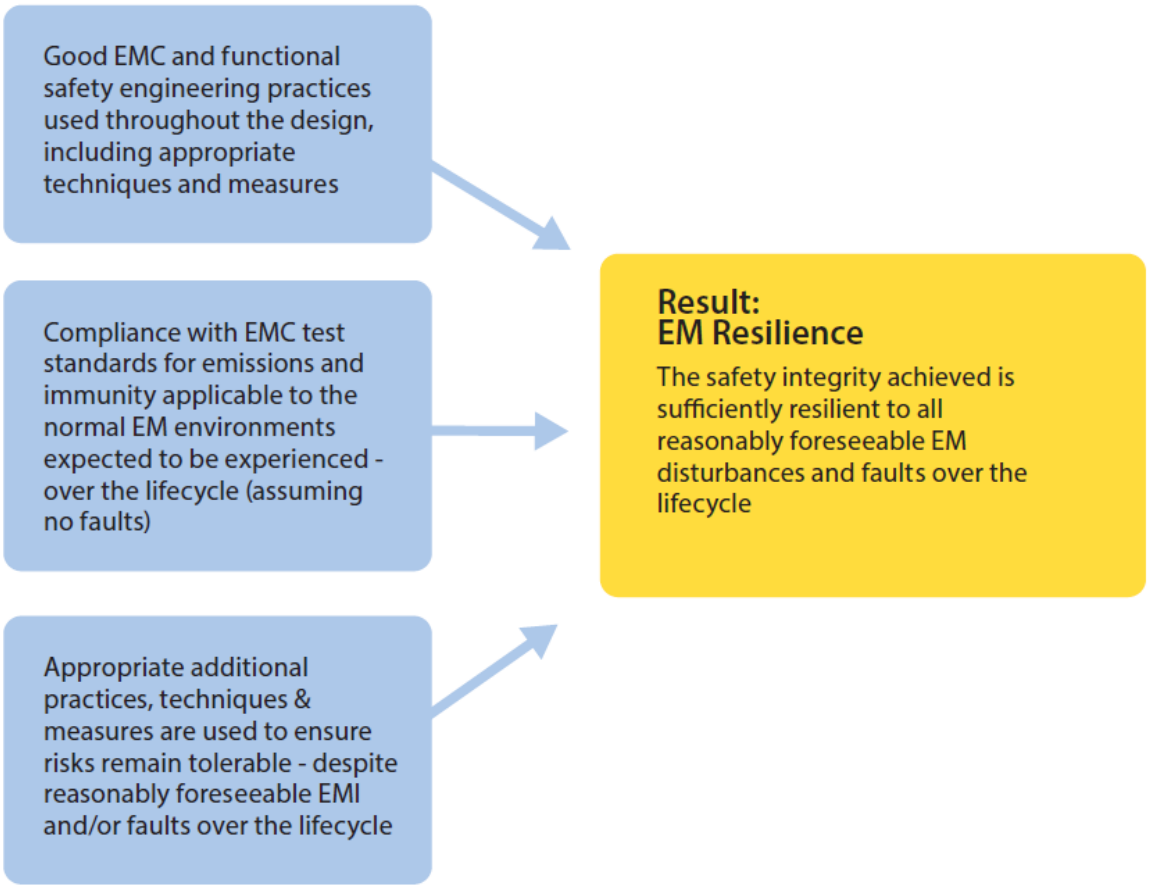

Figure 2 Overview of the IET's electromagnetic resilience approach

The IET's new *Code of Practice on Electromagnetic Resilience* is now available for pre-order.

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Interview with Vic Tuffen: smart metering

Wiring Matters interviews the author of the IET's Guide to Metering Systems: Specification, Installation and Use *on the ins and outs of smart metering.*

What is the size of the metering market in the UK and how much is it expected to grow?

It is not an exaggeration to say that the potential metering market in the UK is probably as big as it is ever going to be. That is because the UK has started the replacement of all the electricity and gas primary meters with smart meters. There are about 26 million electricity meters and 23 million gas meters to be changed in homes and small businesses across the UK and the replacement is planned to be completed by the end of 2020. This has had a gradual start but over the next 18 months it will ramp up to meet the targets. At the same time there are several hundreds of thousands of larger commercial and industrial installations of various sizes and configurations that are also being changed for advanced systems. These provide the same facilities as smart meters but in a way that is more business focused.

In addition to that, there is a growing market in the installation of secondary and check meters. Businesses are becoming acutely aware of the need to monitor and control their energy use. Being able to more accurately establish how much energy is being used is essential if a process of targeting and monitoring is adopted to manage energy savings. This can be done by the strategic use of secondary meters.

There is also a growing market for heat and water meters. More and more people are using water meters instead of relying on the rateable value of their house to govern their water costs and the interest in District Heating Schemes has created a growing demand for heat meters.

What is the difference between Smart Meters and the types of meters that used to be installed?

The way in which the amount of electricity used is measured is the same in a smart meter as it is in a normal solid state whole current electricity meter. Where smart meters differ is that they have been designed to provide additional functionality. Of course smart meters will provide near real-time information on how you are using both gas and electricity in your home. In-home displays use a variety of means of showing this information in a graphical way but the upshot is you can see how much you have used and how much it has cost and it will show comparisons with other time periods. In some cases it will give you a warning if you are using comparatively high amounts of energy which should encourage you to review your usage.

Another benefit that we are already beginning to see is the introduction of new tariffs. For example, your cost of energy may differ depending on what time of day you use it or, indeed, what day it is being used.

One of the key requirements for smart meters is the ability to communicate remotely, with information and instructions being passed both to and from the meter. This has enabled the introduction of automatic meter reading which will mean that meters do not have to be manually read any more and should spell the end of estimated meter readings. It will also mean that customers will be able to switch between traditional credit tariffs and a new pay-as-you-go one because the meter can be

switched to pre-payment mode remotely. In addition, the inclusion of a valve in each gas meter does mean that with all the appropriate precautions, it is possible to isolate a meter remotely.

Smart meters are manufactured to meet the Smart Metering Equipment Technical Specifications (SMETS). Meters that are currently being installed meet the SMETS1 requirements. It is hoped that the introduction of smart meters will make supplier switching easier but this is dependent on the equipment meeting the requirements of interoperability. This is a cornerstone of the SMETS2 requirements and will ensure that if a consumer switches, the new supplier will be able to adopt the smart meter equipment seamlessly in their home, irrespective of who has manufactured it.

This is one of the key differences between SMETS1 and SMETS2 meters. As SMETS1 meters have not been designed to communicate with the new smart metering systems, they prescribe communication methods which are particular to the suppliers who are using them which can mean that they are not interoperable.

How will the Smart Metering System work?

The construction of the national infrastructure and organisation for the smart metering system is now nearing completion. The next milestone is in the middle March when full SMETS2 functionality is expected to be available. This will enable the installation of SMETS2 meters. The infrastructure can be split into two discreet areas: the Home Area Network (HAN) and the Smart Meter Wide Area Network (SM WAN).

The Data Communications Company (DCC) was established to enable the development and implementation of the Communication Service Providers (CSP) in three regional bands and the Data Services Provider (DSP). The DCC system users are the energy suppliers, electricity and gas networks and other authorised system users who purchase data services from the DCC. Using this network the system users can get data from the HANs (like meter readings or pre-payment fees) and in turn send data to the HANs like tariff changes or software updates.

The HAN comprises of the Communications Hub which is supplied by the DCC and provides the communications functionality in the home for the SM WAN and acts as a type of wireless router for the HAN. The HAN also includes the smart electricity meter, smart gas meter and in-home display. The HAN uses the Zigbee communications protocol to link the smart equipment elements together. This enables the smart meters to provide usage data to the IHD.

Does an electrician need any special skills/training to install an electric meter?

Where secondary meters are being installed all electrical wiring must comply with the latest edition of BS 7671, so meters must be installed by people who are suitably qualified and experienced. Primary meters can only be installed by trained operatives employed by companies who are approved under the Meter Operators Code of Practice Agreement (MOCOPA). This gives them the authority to remove the Distribution Network's cut-out prior to working on the meter and resealing it on completion, with a unique and traceable seal. There is a specific training course for smart meter installers which results in them gaining an NVQ level 2 qualification.

How can regular meters work with learning thermometers (such as Nest)?

The smart meter HAN uses the Zigbee protocol as its communication platform and essentially creates a new private wireless network within your home. One of the main challenges to the development program has been the sensitivity about security of the data and the system. As a result, the smart metering systems have been designed to be very secure and only approved devices can be connected to the network. Whilst the plan was always to allow customer provided devices to be connected, at the time of writing, this is not yet possible but may be in the future.

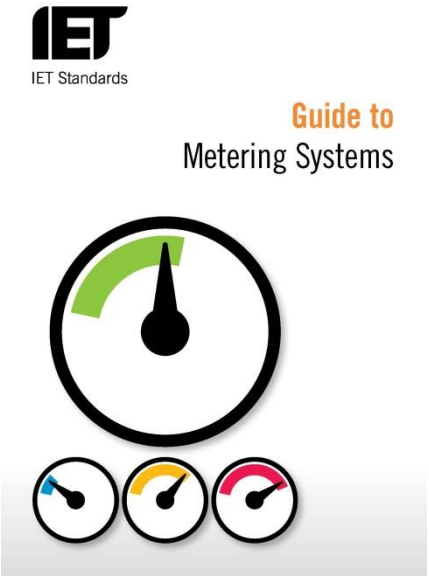
The current crop of smart heating controls like NEST or HIVE use different communications platforms so whilst they will easily connect to your mobile phone and heating system they will not connect or directly interact with the smart meter systems.

Is it worth having both installed?

Yes, definitely. Of course they have different functions and work independently but using them together does actually provide what we call closed loop control. It's a bit like driving your car. When you press the accelerator you see the effect on the speedometer and the fuel gauge. With your smart heating controller you can make a change to the settings on your heating system using your mobile phone and soon afterwards you will see the effect on your energy use on your in-home display.

Do you see further developments in the technology of meters in the next five years?

In my opinion the most significant and far reaching changes, in many aspects of the way we live our lives and do business, will be the increasing prevalence and importance of the Internet of Things (IoT). I can't foresee any further technological developments particularly in metering over the next few years but the desire to further expand the levels of technology connectivity shows no signs of abating.



Anybody who has an Amazon Echo will know that more and more applications become available every week and it won't be long before I will be able to ask it how much electricity I have used this morning and how much it cost and perhaps whether I could have got it cheaper from another supplier. Maybe within the next five years Alexa will also switch suppliers for me!

For further information please find the previous Wiring Matters article on smart meters.

For a more in-depth look at metering the IET's *Guide to Metering Systems* is available to purchase.

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Section 730: onshore units of electrical shore connections for inland navigation vessels

In this article, Geoff Cronshaw writes about a new standard HD 60364-7-730, which was published by CENELEC in August 2015, and the impact this may have for you in the future.

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 equally apply 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. This is 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 and 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 three-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 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 dissimilar metals on the electro-chemical series are within proximity, the detrimental effect of galvanic couples can be exacerbated. 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, which are connected on a longer-term basis to shore supplies, believed by some observers to be associated with the connection of the vessels' 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 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:

(i) underground cables;
(ii) overhead cables or overhead insulated conductors;
(iii) 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;
(iv) mineral-insulated cables with a thermoplastic protective covering;
(v) cables with armouring and serving of thermoplastic or elastomeric material; and
(vi) 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:

(i) 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
(ii) armoured cables with a thermoplastic or elastomeric covering.

Other cables and materials that are at least as suitable as those listed under (i) or (ii) 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. Socket-outlets with a rated current up to 63 A shall be individually protected by an RCD that provides additional protection and that has a rated residual operating current not exceeding 30 mA.

The RCD selected shall disconnect all live conductors, i.e. phases and neutral.

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. They are 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

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. 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.
Socket-outlets shall be located as close as practicable to the berth to be supplied.
No more than four socket-outlets shall be grouped together in any one enclosure.
Each socket-outlet shall supply only one electric circuit of a vessel.
Socket-outlets shall be placed at a height of not less than 1 m above the highest water level. 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.
Socket-outlets shall be placed in an enclosure in accordance with BS EN 15869-2.

Conclusion

Important: this article only gives an overview of electrical shore connections for inland navigation vessels. For more information refer to HD 60364-7-730. These requirements are at CENELEC level and may or may not be included in BS 7671 in the future.

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

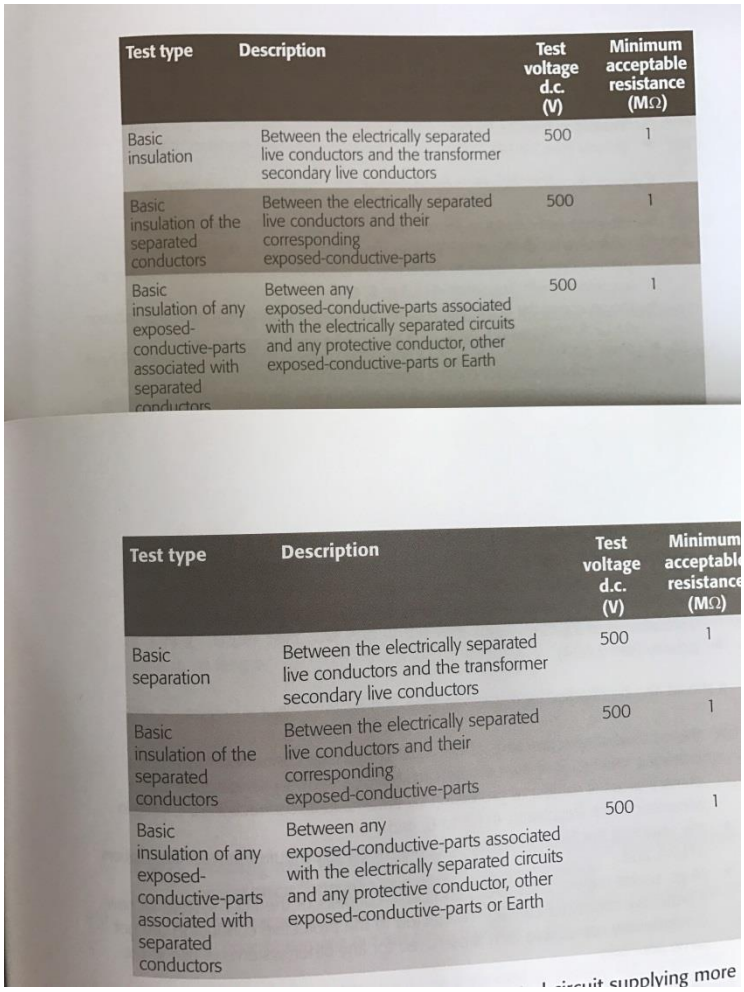
Counterfeit alert

We have recently become aware that a counterfeit Guidance Note 3 Inspection & Testing is in circulation. The book was purchased from an Amazon Marketplace seller and features a wide range of errors, including font and colour discrepancies and text errors.

We have also been made aware that there might be counterfeit copies of BS 7671 (the IET Wiring Regulations) in circulation.

Please be aware that you can be held liable for any issues in work arising from adherence to incorrect versions of the IET publications. We strongly recommend that you purchase your books directly from the IET's approved sellers.

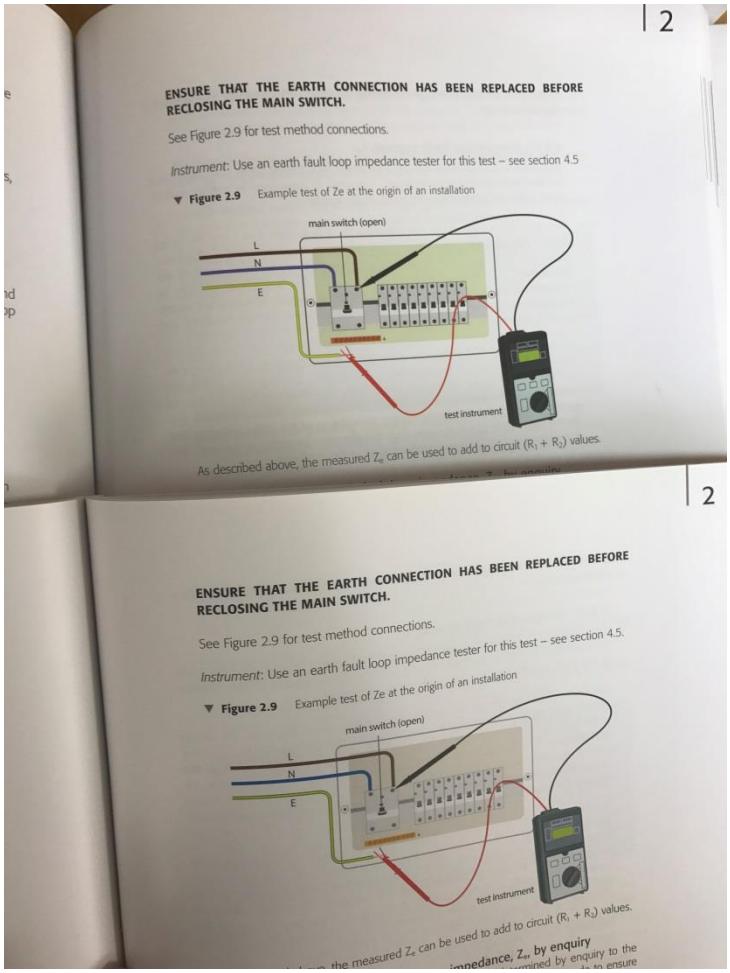
If you have any information about counterfeits, or any queries about a book you have purchased, please contact us: books@theiet.org



Test type	Description	Test voltage d.c. (V)	Minimum acceptable resistance (MΩ)
Basic insulation	Between the electrically separated live conductors and the transformer secondary live conductors	500	1
Basic insulation of the separated conductors	Between the electrically separated live conductors and their corresponding exposed-conductive-parts	500	1
Basic insulation of any exposed-conductive-parts associated with separated conductors	Between any exposed-conductive-parts associated with the electrically separated circuits and any protective conductor, other exposed-conductive-parts or Earth	500	1

Test type	Description	Test voltage d.c. (V)	Minimum acceptable resistance (MΩ)
Basic separation	Between the electrically separated live conductors and the transformer secondary live conductors	500	1
Basic insulation of the separated conductors	Between the electrically separated live conductors and their corresponding exposed-conductive-parts	500	1
Basic insulation of any exposed-conductive-parts associated with separated conductors	Between any exposed-conductive-parts associated with the electrically separated circuits and any protective conductor, other exposed-conductive-parts or Earth	500	1

Text discrepancy on page 47: 'Basic insulation' in the top left-hand cell should read 'Basic separation', as per the genuine copy below.



Page 59 – Discolouration of images; the top image is darker then the genuine copy, below.

Additional recommendations (back of book) – font discrepancies and poor binding when compared with the genuine copy, below.