WiringMatters

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

Fighting the influx of counterfeit electrical goods

It's that time of year again where thoughts turn away from grey skies and early, dark nights and on to the more festive moments that punctuate the winter ahead.

And as ever, Christmas will see the usual spending on electronic goods, with buyers often pursuing the cheapest possible option.

We've previously written about taking care with lighting and making homes festive. This year we turn to counterfeit electrical goods – a growing problem across the UK. According to a report* into fake products by the European Parliament, more than five million counterfeit goods had been seized by customs authorities during 2015, a worrying increase of 15 % over the previous year. In addition, more than a quarter of these were electrical goods, the majority of them from China.

Take iPhone chargers for example. These can be made in China for as little as 3p and bought on the internet for less than £1. As different devices require different levels of charge, using a generic charger risks putting too much energy into a device, which in turn can cause the battery to overheat. Branded or 'original equipment' – chargers, being designed specifically for each device, pose a much lower risk.

There are a number of precautions you can take, and advise your family, friends, colleagues and customers to take, such as only purchasing from reputable suppliers, checking the packaging and labelling. It is also worth checking whether:

- the package has been tampered with;
- all the regulatory information is present;
- there are any misspellings – which can be a real giveaway;
- the feel of an item or the extension cord raises your suspicions; and
- the product has a kitemark – its absence should be cause for alarm; likewise look out for a poor imitation of the genuine mark.

They may look like the real deal but fake goods pose a safety risk as they often contain faulty parts, are of poor quality and are, in most cases, dangerous. Most common are chargers for mobile phones – Hawkesworth has failed over 12,000 chargers and AC adaptors due to them being flawed and/or fake. Laptops, computers, heating appliances, air conditioning units and kettles are also products that have been failed – in fact we have failed anything that requires a plug!

There are a number of giveaways that any electrical engineer will be able to use to tell fake appliances from the real deal. Comprehensive testing, including a polarity check, will identify the tell-tale signs of potentially hazardous faults such as physical damage, non-standard cable joints, loose connections, missing screws, overloading of sockets or over-heating.

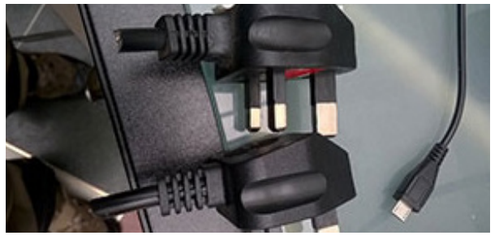
There are other obvious signs for spotting dodgy electrical appliances, like Earth pins that are partly or fully insulated. Earth pins should never be insulated – only the Live and Neutral.

Facilities managers

Winter often sees an influx of electrical goods into the office space – anything from heaters to Christmas lights, all of which might be bought cheaply by staff and brought into the office without realising they could pose a hazard.

To address safety concerns surrounding counterfeit appliances and protect their workforce, facilities managers should adopt a rigorous regime of checking electrical items. Regular maintenance, inspection and testing can expose hazardous electrical goods and minimise the risk of potential harm to people and damage to property, which could run into millions of pounds.

This can be achieved either in-house, by organising practical electrical training for members of staff and purchasing testing equipment. Alternatively, the services of an experienced PAT testing company can be procured, which can import good practice by offering a more robust approach to risk assessment to ensure you comply with Health and Safety legislation.



It is often the case that companies want to complete their electrical maintenance internally, however, they often do not get around to carrying out this task or put it on the back burner due to time constraints.

To fulfil their responsibilities for the safety of staff and students, particularly in the halls of residence, some of the most historic universities in the country are outsourcing their electrical maintenance requirements to specialist companies – particularly for out-of-hours-solutions to minimise disruption and help with the smooth running of the university.

For example, carrying out PAT is considered a vital element for ensuring a safer environment by St Andrews, one of the UK's most revered learning institutions. Halls of residence must comply with the Government's Houses in Multiple Occupation (HMO) regulations requiring frequent testing of electrical appliances.

At varying intervals around 40,000 PAT tests are carried out on St Andrews' 40 residential buildings in Fife, including student-owned appliances, on electrical equipment ranging from hair straighteners and driers, phone chargers, kettles, blenders and toasters to vacuum and floor cleaners, electric drills, extension leads, heaters, air conditioning units, laptops, televisions and even musical instruments such as electric guitars. Static items such as photocopiers, printers, fax machines and desktop computers are also checked.

The advantages of efficient testing are numerous but ultimately a cost-effective, reliable and systematic approach ensures legislative compliance and provides a safer environment for all users of a factory, office, college or university.

Thank you to Hawkesworth for their contribution to this article.

With over 24 years' experience in PAT testing for a range of sectors, North Yorkshire-based Hawkesworth is fully accredited to ISO9001/ISO14001 and BS OHSAS 18001 and can provide out of hours' services at no extra cost, as well as unique ID labels backed up by full asset register and certification.

*Source: The Parliament Magazine
www.theparliamentmagazine.eu/articles/news/counterfeit-electrical-goods-have-genuine-safety-risks

Interview with Geoff Cronshaw

Wiring Matters interviews the IET's Geoff Cronshaw on his role on JPEL/64.

You've worked in the electrotechnical industry for over 40 years. How long have you been secretary to JPEL/64?

I have been secretary to JPEL/64 approaching 14 years now and I have found it a very interesting role.

What does this work involve?

This is a busy role supporting JPEL/64 and involves the distribution of many International and European documents, planning and organizing meetings, preparing agendas, participating in the technical debates, taking and issuing minutes, preparing responses to IEC and CENELEC enquiries, and carrying out the many actions agreed at the meetings.

This past year seems to have been all about the DPC process for the 18th Edition of BS 7671. How much work did this involve for you?

This is an exceptionally busy time for JPEL/64. Not only has the Committee to carry on with its work of agreeing votes and comments on the many International and European documents but is also heavily involved in preparing the new national standard (the 18th Edition).

JPEL/64 and the Sub-Committees are busy at the moment considering all the comments received on the DPC and making a decision on each of the comments. The DPC then has to be revised to take into account all the agreed changes, which is a lengthy process.

You authored a few articles for Wiring Matters about the changes to Section 7. Of all the proposed changes to the 18th Edition, which most interest you?

I think the proposed Part 8 on Energy Efficiency is the most interesting. This is a completely new part. The worldwide need to reduce the consumption of energy means that we have to consider how electrical installations can provide the required level of service and safety for the lowest electrical consumption. Part 8 enables a client to specify the level of energy efficiency measures applied to an electrical installation. The new part covers several energy efficient areas, such as lighting, metering, cable losses, transformer losses, power-factor correction, and harmonics.

Which proposed changes might bring the most practical change to how electricians work?

Some of the simplest changes may have the most impact for the average electrician's work, such as the proposed change to Regulation 522.11.201 with a new Regulation 521.10.201. This requires cables to

be adequately supported against premature collapse in the event of fire throughout the installation and not just escape routes. Also, the proposed changes to Regulation 411.3.3 concerning RCD protection for socket outlets.

What lies ahead in 2018? Will JPEL/64 be focused only on the 18th Edition, or will they also already be debating other changes that might come out at a much later point?

International and European Standards are continually being developed to keep pace with new and emerging technologies. There are a number of areas of IEC 60364 (the standard that BS 7671 is based on) which are under development. For example the area of solar photovoltaic (PV) power supply systems, and electric vehicle charging.

You're also Secretary of JPEL/18. What does this committee do?

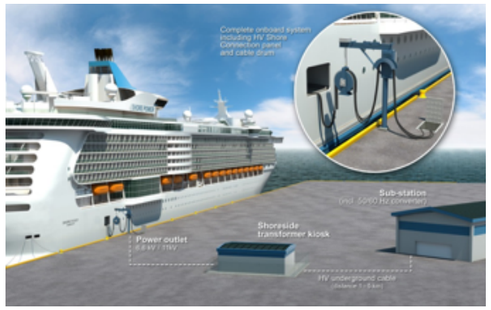


Image courtesy of ABB: www.abb.com

JPEL/18 is the National Committee responsible for electrical installations of ships and of mobile and fixed offshore units. The Committee is actively involved in the area concerning high and low voltage shore connection systems with the aim to reduce the amount of pollution in the port area. DC distribution in marine electrical installations is another new area of development made possible by modern electronics. Many of the electrical loads on board a ship are DC and this is the reason for the development of DC architecture in marine electrical installations. The whole of the Electrical installations standards for Mobile and Offshore structures (IEC 61892) is currently being revised. Also there is considerable development work on subsea equipment.

What has been your highlight of 2017 so far?

I think the development work involved in preparing the 18th Edition which has involved scheduling all the latest international and European standards in the 60364 series for consideration by the National Committee in order to keep pace with new and emerging technologies.

Interview with Steven Devine

Wiring Matters interviews Steven Devine on his role as an author and a member of a JPEL/64 Sub-Committee.

You're working on a book about calculations for students. What motivated you to write on this topic?

During my time teaching I struggled to find the right book to recommend to students. Some didn't have enough information while others contained so much information that they were more likely to cause confusion than help learners, especially in their first year or two of their qualification. Another assumption that is commonly made is that students will have a GCSE grade C or equivalent qualification in Maths prior to enrolling on an electrical qualification. This is not always the case as some colleges will allow students to complete maths qualifications in parallel with an electrical qualification.

I wanted to put something together for students that contained just the right amount of information, not too much but enough to help them through their electrical qualifications with concise step-by-step guidance that is easy to understand.

You used to lecture students on electrotechnical courses at Cambridge College. What was the hardest topic to teach?

Electrical principles has always been a difficult subject to teach. Many students don't expect that they require a good understanding of Maths when they embark on a career in the electrical industry. When they are introduced to the calculations they are required to be familiar with it can sometimes be a little overwhelming. The progression from Level 2 to Level 3 presents some real challenges for students especially with regards to mathematical ability.

From feedback from students over the years, what is the hardest part of the course to learn?

Understanding the Wiring Regulations. BS 7671 contains so much information and covers such a broad variety of low voltage electrical installation work that it is very difficult to absorb and retain the information within the document. The key is to understand how to extract the information that you need, when you need it. To do this you need to have experienced working in the industry in a variety of environments. Many students don't get the opportunity until they have gained their qualifications making it difficult to learn about the practical application of the IET Wiring Regulations as a student.

A lot of students will have recently started their first year in electrotechnical studies. What would be your top three tips?

1. Don't miss a day. It may seem obvious but when you miss even one day at college you will have to catch up. Many colleges and training centres don't have the necessary resources to help students that fall behind. And think about your peers, the more time a lecturer spends helping you catch up because you have missed lessons

the less time they have for the other students. Your peers may be your colleagues one day so you'll want to stay in their good books.

2. Get the right resources. There are a huge number of resources available such as books, websites, guide videos etc. Many of these resources are outdated, provide information that is beyond the scope of your qualification, expensive and sometimes just poor quality. Make sure that you get the guidance that is right for the course that you are doing and don't go crazy and buy ten books that you will never read. The IET produce a great selection of publications designed specifically for electrical students and they are always kept up to date with the latest requirements for qualification.

3. Work experience. The electrical industry is vast with so many career opportunities available. The only way that you will really know which one suits you is to get out there and have a look at what is available. Careers range from electricians working predominantly on domestic properties to high voltage linesman or even standards and compliance where the requirements of the industry are shaped. This career can take you around the world and back and you will still learn something new every day, or at least every week!

You also act as Secretary on one of the Sub-Committees of JPEL/64. What work is involved in that – what is the day-to-day work like?

Before I began working for the IET I heard rumours that the committee members responsible for the Wiring Regulations sat around drinking whisky, smoking cigars, dreaming up new regulations. Although I knew that this wasn't true I had no idea what it was really like. I have to say that I was extremely pleased to find that the national committee members are some of the most intelligent and experienced people I have ever met. Not only does the committee have people that understand electrical science and principles inside out, it has members who have served their time as apprentices worked in all varieties of the electrical industry for decades and are now using their knowledge and practical experience to contribute to the development of the Wiring Regulations. I act as secretary for the national sub-committee for protection against electric shock (JPEL/64/C). It is my responsibility to manage the work of the sub-committee and to ensure that any new requirements and proposals are presented at meetings for members to consider.

Another area of the work that I do involves sitting on IEC Maintenance Teams (MTs) as UK expert. Working on the international MTs requires me to contribute to the development of international electrical installation standards. The committees I sit on deal with protection against electric shock, devices for protection against overcurrent, devices for protection against short-circuit and devices for protection against thermal effects. This work does involve quite a lot of travel as the MT meetings take place all over the world.

Now to the part of my job I am most passionate about – producing resources for students. Since joining the IET I have been working on a number of resources such as the Student's Guide suite of publications and a series of Student's Guide videos that are available on the IET.tv channel. I also visit colleges running Student's Guide Roadshows where we invite speakers from various areas of the electrical industry to offer insight and knowledge to students and lecturers.

You've previously published the Student's Guide to the IET Wiring Regulations. Do students need to be very familiar with the Wiring Regulations or can they wait until they start working?

As part of electrical qualifications students are expected to have a basic understanding of the fundamental requirements of the Wiring Regulations. As I mentioned earlier, the important thing is to know how to find the information that you need. Learning your way around the Wiring Regulations and the various sections is really important when studying and especially when working in the industry. BS 7671 is a non-statutory document but if you are ever questioned about your installation methods, the requirements in the Wiring Regulations is what people will have expected you to follow.

We're expecting the 18th Edition to the Wiring Regulations to publish next year. Do students need to be aware of this, and to be aware of the changes?

Absolutely. The Wiring Regulations is the most important document for any electrician and when working in the electrical industry or studying to pursue a career in the electrical industry, it is essential that you understand the current requirements for electrical installations and when they are expected to change. Luckily for electricians, The Wiring Regulations is one of, if not the, cheapest standards available in the UK. If we say that the average electrician earns between £150 and £200 per day then the cost of around £80 for a new version of BS 7671 every three or four years is a drop in the ocean. Many students will pay more than that annually to keep up to date with the latest expansion packs for online gaming.

If so, are there any changes you think might be of high importance to students?

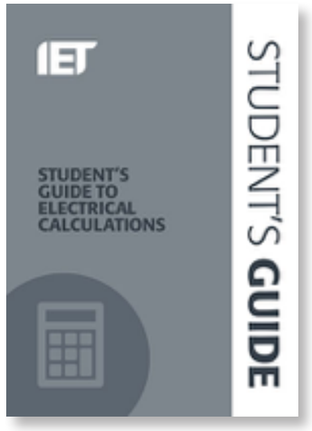
Any changes are important for students to be aware of as they may have an impact on commonly adopted methods of installations and selectivity of products and equipment. Things that are important to be aware of in the future are requirements for RCD protection, cable supports and especially electric vehicle charging points which are on the increase as government continues to drive for cleaner more efficient methods of transport.

Do you think the role of electricians is changing, what with smart meters, energy efficiency, energy storage etc? Or is it the same basic principles, just applied differently?

The basic principles will always apply as they are fundamental to providing energy to installations. However, our world is rapidly changing and the basic electrical installation is becoming a thing of the past. With specialised control gear for LED lighting, SMART homes where almost everything is integrated and connected the modern electrician not only needs to know how to wire up an intermediate lighting system they also need to know what smart products are on the market how to install/programme them and most importantly how to best advise the customer on what systems are most suitable for their home and lifestyle. The world of the electrician is becoming a complex mixture of basic electrical installations, electronic devices and software that enable you to control heating, lighting and even allows you to run your bath at your preferred temperature simply by swiping through menus on your smart phone. The Star Trek era is upon us!

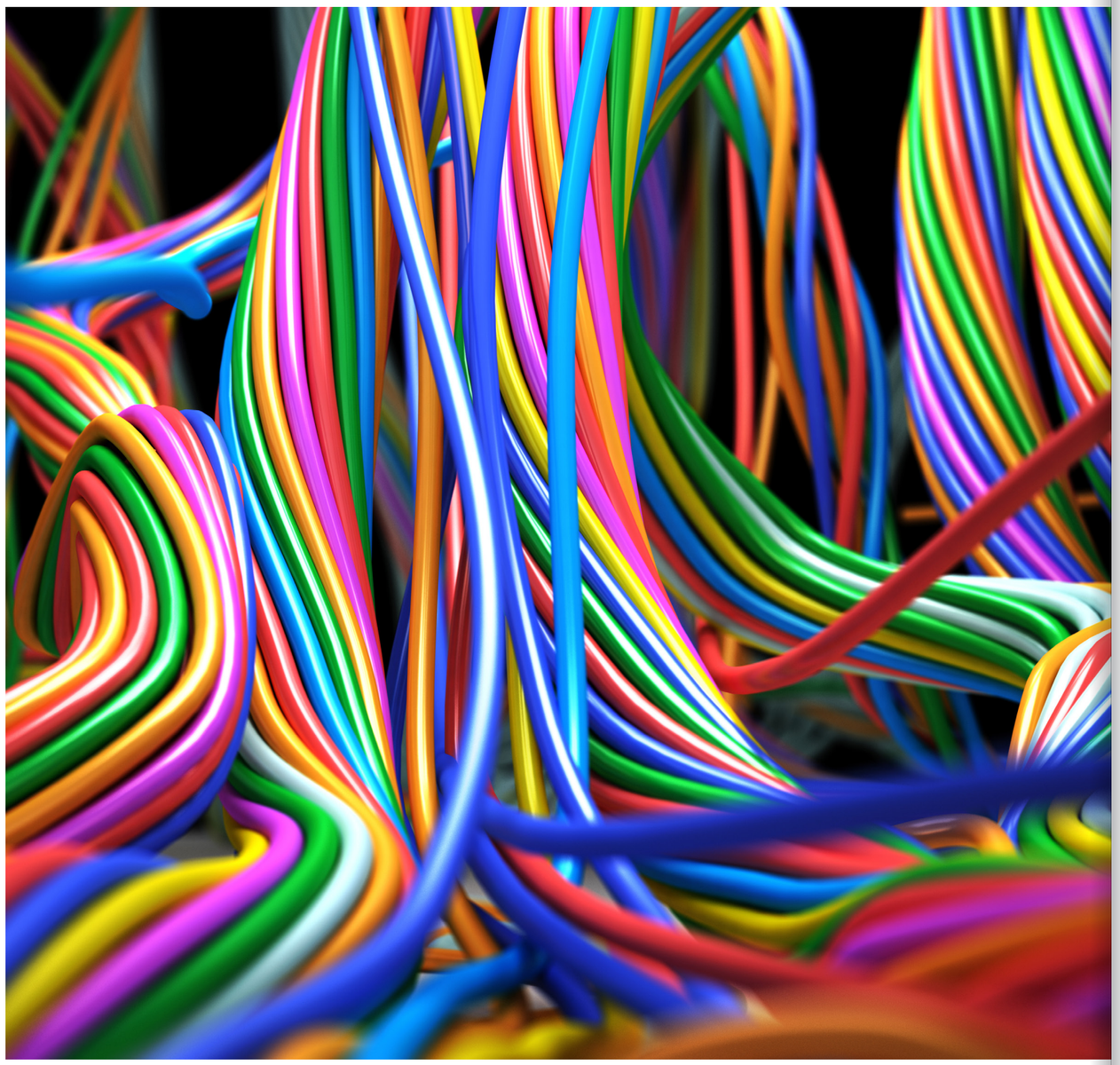
Do you still do any electrical work? For example, do you have any electrical DIY projects in your own home?

Yes lots! Maybe I'll finish them one day...



For further information about the Student's Guide to Electrical Calculations, see here.

RCDs: everything an electrician should know



Electricians do the best they can every day they go to work – and we want to leave a job safer than when we found it. But what if despite our best efforts, we actually made things worse without realising it? This article seeks to answer this question!

Quick history

Historically, two basic types of earth-leakage circuit-breaker (ELCB) were recognised by BS 7671: what we know to be a current-operated type or residual current device (RCD) and the even older voltage-operated type. Today, only the current-operated type is recognised and used.

So, if we look back in time before the 17th Edition came out in 2008 (BS 7671:2008), the 16th Edition and previous editions, the more experienced (older) sparks will remember when ELCB devices were referred to by one of the following terms:

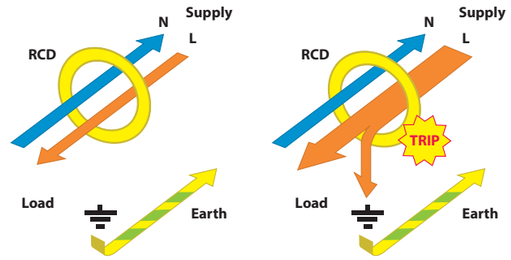
- protection against indirect contact – now called fault protection;
- supplementary protection against direct contact – now called basic protection;
- protection against fire and thermal effects; and
- additional protection.

In fact, when we adopted current operated devices (RCDs) to BS 4293, the trip times were much quicker than modern devices, although they may not comply with BS EN standards. BS 4293 was withdrawn in 2000 and manufacturing of these devices should have ceased in 2005. The device was replaced by BS EN 61008.

One of the negatives in using the older mechanical devices were that they could seize up. Modern devices are either electronic or electromagnetic.

What is an RCD?

They are devices installed within an electrical system unit to provide protection to the wiring, fixed appliances and persons using the installation. Protection is achieved by constantly monitoring the electric current flowing through one or more circuits that an RCD is used to protect. If it detects electricity flowing down an unintentional path, such as via a person or faulty appliance down to earth, then the RCD will switch off the circuit very quickly, reducing the risk or death, injury or fire.



The device monitors the ingoing and outgoing current flow and trips when an imbalance occurs as illustrated above.

RCDs are defined by three main characteristics:

- the rating in amps;
- the rated residual operating current of the protective device in amps, known as the IΔn (pronounced 'I delta N'); and
- the instantaneous trip that occurs or an intentional time delay to permit discrimination*. Such devices are called 'S' or Special/Selective.

***Note:** the term 'discrimination' is proposed to be replaced by 'selectivity' in the upcoming 18th Edition of BS 7671 (BS 7671:2018).

We find ourselves now using the term ‘RCD’ to cover a range of devices found within an electrical installation. They include:

- residual current device – RCD found in older devices to BS 4293;
- residual circuit current breakers – RCCB to BS EN 61008;
- residual current breaker with overload – RCBO to BS EN 61009 found in consumer units;
- circuit breaker with RCD fitted – CBR larger industrial application;
- SRCD – socket outlet incorporating an RCD to BS 7288;
- FCURCD – fused spur with RCD integrated; and
- PRCD – a device that contains a portable RCD within the plug.

As can be seen above, RCDs have merged into other many different products and protective devices although the principles of protection remain the same.

Most domestic electricians use, and are familiar with, RCD main switches for circuits or RCBOs in today’s world.

So what’s the concern?

Once we’ve got through the vast array of different manufacturer-branded devices we are left believing we are fully compliant with the regulations! Well, maybe not …

As we all know the MCBs we use come in differing ‘types’– by this I mean Type B (domestic use), C (commercial installations) or D (industrial large loads). The information on these ‘types’ is found in Appendix 3 of BS 7671 and is formally known as ‘time/current characteristics of overcurrent protective devices’.

That’s first principles I hear you say: I use a Type B or C MCB all the time, I’ll stick with them!

So far so good, we all know this well by now.

However, if you look at Chapter 13 of BS 7671 you will find that it contains copious warnings about external influences on an installation to help you ensure that what you do does not make an installation unsafe or compromised. Regulations 132.5, 132.7, 132.11, 133.3, 133.4 and Appendix 5 are a must-read for any electrician; more importantly, there is no reason not to comply fully with Chapter 13 Fundamental Principles.

Appendix 5 External Influences contains lots of items that can affect an electrical installation.

So, do you think with all the onslaught of modern technology and the drive for smart homes, we are adequately considering and taking all precautions required in terms of our methods of protection?

The issue at hand – what do I need to know?

With all the modern technology that is now installed into domestic installations, would you ever have thought that DC current could be a real issue for you?

Within an installation today it is not rare to find the following:

- switch mode power supplies – found in all electronic devices to convert AC to DC;
- solar PV panels;
- electric vehicle charging;
- USB socket outlets; and
- smart home and data networks.

All of these have one thing in common: DC current and voltage.

DC has a tendency to leak to earth. When it does, it immediately becomes an AM7 external influence under the categories in Appendix 5. If this does happen, your RCD, in whatever form you use, will NOT perform to the requirements of the standard it is made to. In a nutshell, it becomes less safe –the greater the DC current the bigger the effect.

So what if I told you your RCD was a Type AC or a Type A or F? Confused? Don’t be: there is another use for the term ‘type’– it applies to the RCD device itself and its performance. They are known as Type AC, A, B, F, and more recently a B+ has turned up on the market.

AC: this device ensures tripping for residual AC currents whether sudden or rising; this is standard in most domestic installations. The marking for this is shown below.

A: this device ensures tripping for all types of AC currents and pulsating DC currents that may appear within an installation. The marking for this is shown below.

F: this device ensures tripping for all types of AC currents and pulsating DC currents that may appear within an installation. It also ensures no unwanted tripping and detection of high frequency faults up to 1KHz. The markings for this are shown below.

B: this device ensures tripping for residual AC currents, pulsating DC currents and smooth DC currents, whether applied suddenly or rising. The markings for this are shown below.

B+: this device ensures tripping for residual AC currents, pulsating DC currents and smooth DC currents, whether applied suddenly or rising. It also ensures no unwanted tripping and detection of high frequency faults up to 20 kHz. The markings for this are shown below.

The challenges ahead

So why do I need a ‘type’ B or B+ RCD?
They are needed to protect:

- micro generators or small scale electricity generators (SSEG) including:
  - solar photovoltaic (PV);
  - electric vehicle (EV) charger points; and
  - wind turbines/generation.
- three phase rectified supplies.

Did you know?

IEC 62109-1 specifies requirements for inverters (changing DC to AC) used in photovoltaic systems that states clearly that only Type B RCDs should be used in such systems because Type A or Type AC RCDs cannot provide appropriate protection. This is due to the leakage we talked about above and the fact that some inverters have only simple separation. The DC current leaks and renders the RCDs in standard boards as inoperable. They don’t teach you that in college, do they!

Electricians should now be looking in more depth and preparing for the future where possible; if the client thinks they will have an electric vehicle and solar PV panels in future then make sure you accommodate this.

Domestic installations are now swamped with DC-producing equipment and I have seen homes with 8-10 socket-outlets per room with USB chargers within all those outlets.

Lastly, ask yourself the following:

- what type RCD would I want in my home of the modern era?
- do I recognise or look for these symbols when inspecting existing installations/systems?
- how do I know that what we have chosen to install is safe?
- if a USB charger goes faulty what happens to my protection?
- what type device would you choose?
- what is the legal duty of care placed upon me?
- is the split-load consumer unit I bought fit for the work I need to carry out?
- is there any special testing I need to do or test kit?
- how do the new devices proposed in BS 7671:2018 called ‘arc fault detection devices’ fit in to all this?

Hopefully, this article goes a way to addressing questions that you may have had on RCDs or at least set you on a path to gaining a better understanding.

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