

# 18 A BITESIZED LOOK AT SOME NEW REGULATIONS FOR ELECTRICAL INSTALLATIONS



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BS7671:2018 Requirements for Electrical Installations was published on July 1st 2018. It will be fully effective as of January 1st 2019 but it can be used immediately.

However, installations designed after January 1st 2019 must comply with the requirements of 18th Edition of the IET Wiring Regulations.

## **CHANGES**

There are a great number of differences between the 17th and 18th Editions. In this document we look at some of the changes. There are new regulations, revised regulations, new chapters, and restructured sections e.g. Inspection and Testing.

## **EXTENDED SCOPE**

The scope has been extended to include an extra category catering for electrical shore connections and inland navigation vessels. Section 730 contains the particular requirements for this type of special installation/location. Chapter 46 is new, Chapter 53 has been rewritten. Part 6 is restructured and the regulations for inspection and testing move to new chapters and get new numbers.

## **DEFINITIONS**

There are new definitions, and a few existing definitions that have been amended. For example, "Departure" is a new definition. Departure is explained as an intentional decision to not fully comply with BS7671, this must be accompanied by a declaration from the designer that the safety levels achieved are not less than full compliance with BS7671 would provide. Some further examples of changes are highlighted within this document.





## ENERGY EFFICIENCY

Appendix 17 (in its first appearance) makes recommendations for the design construction and assembly of the installation for optimising efficiencies in the use of electricity. It's an informative Appendix so it's not a requirement.

## SCHEDULE OF TEST RESULTS

The generic schedule of test results for domestic type (100A) installations has been revised. A new column is included for recording the operation of AFDD test buttons. Other new columns include RCD operating current, maximum permitted  $Z_s$ , IR test voltage. Plus the RCD trip time columns have been reduced from two to one.

**Note:** This document is not a substitute for BS7671:2018. The IET wiring regulations should always be used for all aspects of electrical installation design, selection, erection and verification. In this document we look at some of the headline changes including extended use of RCDs, requirements for overvoltage protection, arc fault detection devices etc for purposes of information only.





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# ONLY USE APPROVED PARTS

## MANUFACTURERS' ASSEMBLIES AND DEVICES

Chapter 13 requires good workmanship and proper materials to be used in the erection and verification of installations and requires designers and installers to take account of manufacturers' instructions.

### 536.4.203

Devices and components used in low voltage assemblies e.g. Consumer Units, Distribution Boards etc. must only be those that have been declared suitable for that purpose by the manufacturer of the assembly.

**NB** this is also referred to in the schedules of inspection.

Or put another way: use manufacturer approved parts, don't mix brands of devices or control items. If in doubt ask the manufacturer of the assembly to confirm compatibilities.

**Footnote:** If a deviation from manufacturer instructions is introduced then the person introducing the deviation becomes the manufacturer.



# METER TAILS CLIPS AND FIXINGS


Regulation 522.8.5 requires every cable to be installed to avoid any undue mechanical strain and to make sure that there is no strain on the conductors and connections.

This particular requirement has an advisory note which informs installers that consumer unit meter tails are included in this requirement.

By the way, this is in addition to any other requirements to provide protection to tails at the point of entry into metal consumer unit enclosures etc.

Meter tails may need to be fixed/clipped in order to avoid such strain.





# WIRING SYSTEMS

## NON COMBUSTIBLE FIXINGS – THROUGHOUT

Wiring systems throughout the installation (as well as escape routes) must be supported by fixings, or in carrier systems such as appropriate types of steel tray, or trunking etc. that will protect systems against premature collapse during fire. Previously this applied to escape routes only.

Non-metallic clips are not permitted as the only method for support of cables and wiring systems. This is explained in a new regulation (521.10.202) that replaces the previous requirement which applied in escape routes.

This has become a general requirement to overcome difficulties identifying defined escape routes in certain types of premises.

# ADDITIONAL PROTECTION BY 30mA RCD

## EXTENDED REQUIREMENTS – LIGHTING AND SOCKETS

### LIGHTING CIRCUITS

Additional protection by use of a 30mA RCD is now required for all lighting circuits in domestic household premises – New regulation 411.3.4, this applies to all cable types and installation methods and there are no exceptions mentioned.

### SOCKET CIRCUITS

Additional protection by use of a 30mA RCD is now required for all socket outlets with ratings up to and including 32A. This used to be applied to sockets up to and including 20A rating (411.3.3).

The requirement for additional protection by use of a 30mA RCD for equipment (rated up to and including 32A) for use outdoors remains unchanged – 411.3.3.

Designers should also look at regulations regarding unwanted tripping e.g. 314.1 and 531.3.2

Exceptions are not permitted in dwellings

An exception may be permitted elsewhere provided a documented risk assessment has been carried out to establish that additional protection is not necessary.





# UNWANTED TRIPPING OF RCDs

## NEW CONSIDERATIONS

There are new considerations for designers to use when using RCDs and avoiding unwanted tripping. One option is using individual RCD/RCBO for each circuit.

Alternatively to help to avoid unwanted tripping of RCDs from PE currents leaking through the protective conductor during normal (non-fault) operating conditions, the accumulated leakage current should be less than 30% of the RCD rating e.g. 30% of 30mA – 531.3.2.

RCDs with a short time delay may be appropriate in some circumstances, and co-ordination of devices is necessary.

Designers will have to take account of PE currents when dividing the installation into the necessary number of circuits. This is in addition to the requirements in Chapter 31.

Chapter 31 requires every installation to be divided into the necessary number of circuits required to reduce the possibility of unwanted tripping from non fault conditions e.g. protective conductor currents – 314.1 (v). Fewer items of equipment on more individually protected RCD circuits will greatly assist meeting this requirement.

# TYPES OF RCD

## AN AID TO SELECTION

Differing types of RCD are available; this section relates to the various types, for example reference is made to Type AC RCDs which are for general use.

Reference is also made to Type A-F-& B RCDs which also detect pulsating DC residual current, type B RCDs (often specified on PV installations or variable speed drives), and certain criteria are also provided on device behaviour when in the presence of DC components. Generally speaking as follows:

**Type AC** – general purpose use

**Type A** – where smooth DC to 6mA exists

**Type F** – where smooth DC to 10mA exists

**Type B** – where smooth DC to 0.4 times rated operating current, or 10mA, whichever is higher.

The appropriate RCD must be selected for each application see 531.3.3.

This section is expanded considerably to aid designers with the selection of appropriate devices for particular applications.

Also Part 7 (Section 722) includes specific requirements for EV Type A or B may be required and in Section 712 Solar photovoltaic (PV) power supply systems Type AC or Type B may be required.



# SELECTIVITY BETWEEN RCDs

## APPROVED METHODS

Where selectivity between RCDs is required (536.4.1.4 applies) verification can be made by one of the prescribed methods below:

### Desk Study

### Use of appropriate software tools

### Carrying out tests to the relevant product standards

### Obtaining manufacturer's declaration

References are also made to selectivity between RCDs being “given” when the upstream device is a time delayed device and when the operating current of the upstream device is rated at 3 times that of the downstream device.

Section 536 now covers co-ordination of electrical equipment for protection, isolation, switching and control, and covers coordination of devices under fault and overload conditions, including co-ordination between devices. Table A53.1 lists relevant devices and device functions.

The requirements also cover aspects of continuity of supply along with other considerations that shall not adversely affect the safety of the installation.

**Note:** The verification options above are also applicable to selectivity between OCPDs – see section 536.





# CARAVAN PARKS

## FIXED CONNECTIONS AND RCDs

Section 708 only applies to caravan parks and similar locations as listed within its scope. The requirements for additional protection are now contained under a new regulation number (708.415.1) that sets out the requirements for individual 30mA RCD protection for every socket outlet and states that each circuit that is intended to be the fixed connection of supply to a mobile or park home is to be individually protected by a 30mA RCD.

It is also a requirement that the RCDs disconnect all live conductors. NB live conductor includes the neutral.

Additionally every socket outlet and fixed supply connection to a mobile or park home (or similar accommodation) must be protected by an overcurrent protective device that disconnects Live and Neutral conductors.





# SAFE ISOLATION ORDINARY PERSONS

## Isolation and switching

A new chapter (46) has been introduced to cover this aspect of the design of electrical installations. It covers a variety of topics including non automatic local and remote isolation and switching, it also requires each item of equipment for isolation and switching to comply with the relevant parts of Chapter 53.

### 462.1.201

Requires a means of isolation (a main linked switch or circuit breaker) at the origin of every installation and reiterates the requirement that where a main switch is intended to be operated by ordinary persons, e.g. in domestic household premises, the main switch must interrupt both live conductors (L&N) of a single phase supply.

Every circuit should have a means of isolation for all live conductors (except for circumstances described in 461.2).

Provision may be made for isolation of a group of circuits only if service conditions allow. NB 314.1 (ii) states that every installation shall be divided into circuits to facilitate safe inspection, testing and maintenance.

Isolation devices should be so designed and/or installed to prevent inadvertent reclosure e.g. by provision of a locking facility etc.

Chapter 46 includes requirements for Isolation, Functional Switching and Emergency Switching Off.





# MAXIMUM DISCONNECTION TIMES

## CIRCUITS WITH SOCKET OUTLETS

### 411.3.2.2

The maximum disconnection times in Table 41 were applicable to all final circuits up to and including 32A.

This has been amended in the 18th Edition so that the times given in Table 41 now apply to circuits up to and including 63A with one or more socket outlets and 32A for circuits with fixed (current using) equipment.

This change brings quicker disconnection times for circuits with socket outlets as a general requirement.

The disconnection times have not actually changed, but the application of the time now relates to higher rated circuits with sockets.

Further considerations of 411.4.4, 411.5.3 and 411.6.5 are also referred to.

A new regulation group, 419 has also been added for circumstances where it is not feasible for the protective device to interrupt the supply in accordance with the above, see 419.2 and 419.3.

# TRANSIENT OVERVOLTAGE PROTECTION



# TRANSIENT OVERVOLTAGE

## THE REQUIREMENTS

Protection against transient overvoltages is now required in a number of specified situations (443.4) i.e. where such overvoltages could result in:

**Serious injury or loss of life**

**Interrupted public services**

**Interrupted industrial and commercial activity**

**Damage to cultural heritage**

**A large number of individuals at the same location being affected**

For other circumstances a risk assessment must be carried out to determine if protection against transient overvoltage is necessary (see following information).

Designers should note that if they do not do a risk assessment, protection against transient overvoltage must be provided.

An exception may apply for individual dwellings if the total value of the electrical installation and electrical equipment fails to justify the provision.

Designers and installers should consider provision of surge protection devices to protect against transient overvoltages from atmospheric or switching origins.







# TRANSIENT OVERVOLTAGE RISK ASSESSMENT METHOD

The risk assessment method is only used when the requirements of 443.4 do not apply.

The risk assessment calculation is based upon a formula that uses values that are given in Table 443.1 and on values related to geographical locations shown in fig. 44.2, which is a map of the UK.

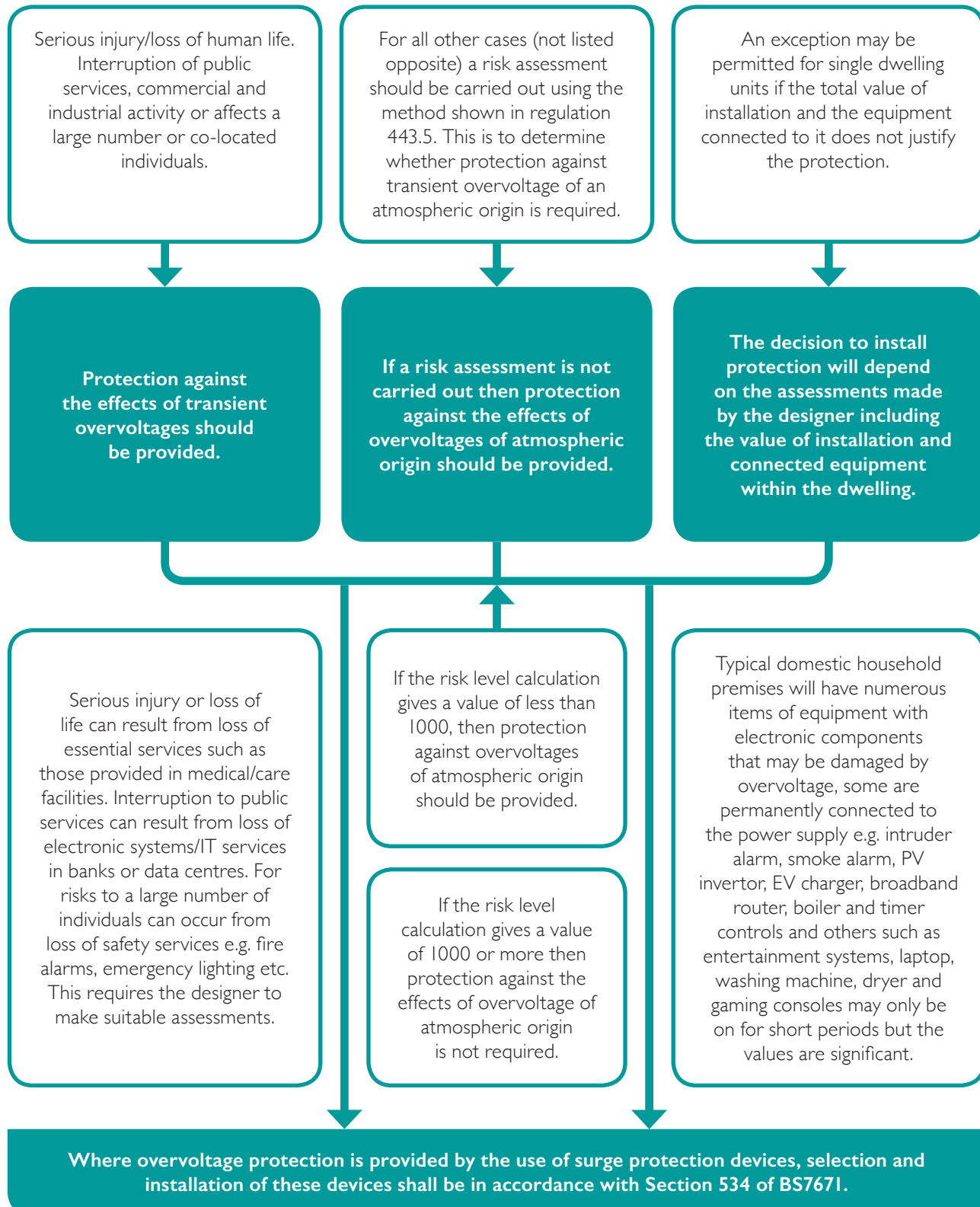
These values are used with figures that are determined by the lengths of supply cables to the origin of the installation.

**The equation is  $CRL = f_{env}/(L_p \times N_g)$**

If the calculated risk level is 1000 or less then protection against transient overvoltage of atmospheric origin is required.

If a risk assessment is not carried out then protection against transient overvoltage should be provided.

# PROTECTION AGAINST TRANSIENT OVERVOLTAGES



# TRANSIENT OVERVOLTAGE DEVICES FOR PROTECTION

This section (534.4) gives guidance on the selection of device types and locations where the devices should be installed, if required by section 443. For example:

## Structures with Lightning Protection

Where SPDs are required in structures equipped with an external lightning protection system Type 1 SPDs should be installed at the origin of the electrical installation.

## Structures without Lightning Protection

Where SPDs are required in structures that are not equipped with an external lightning protection system or do not require protection against effects of direct lightning, Type 2 SPDs should be installed at the origin of the electrical installation.

Within the installation Type 2 or Type 3 devices should be installed adjacent to the equipment to be protected, or in distributions boards.

Helpfully fig. 534.2 gives some examples of locations and types of protective device.



# PROTECTION AGAINST THERMAL EFFECTS AND ARC FAULT DETECTION DEVICES (AFDDs)





# PROTECTION FOR SAFETY

## FUNDAMENTAL PRINCIPLES - ARCING AND BURNING

There are requirements in Chapter 13 (Fundamental Principles) that deal with the protection for safety of people, property and livestock against the dangers from arcing or burning, combustion and ignition, flames and smoke, particularly where a fire hazard could be propagated from an electrical installation to other nearby fire compartments.

Risk of injury may result from:

### **Excessive temperatures and fires.**

### **Arcing or burning.**

Protection against thermal effects is required.

Electrical installations should be designed and installed so as to minimise the risk of ignition of flammable materials from electric arc or high temperature and there should be minimal risk of burns to persons or livestock. See 131.1, 131.3, 131.3.2.

# PROTECTION AGAINST THERMAL EFFECTS INSULATION FAULTS AND ARCING

There are requirements in Chapter 42 for people, property and livestock to be protected against harmful effects of fire, and there are requirements to ensure that installations are arranged so that the risk of ignition of flammable materials due to high temperature or electric arc is minimized. See 420.1, 421.1.

Protection is required against flames and smoke where a fire hazard could be propagated from an electrical installation to other nearby fire compartments, and where fire may be caused by electrical equipment.

Harmful effects of heat or fire may arise from several sources including overcurrent, insulation faults, arcs, sparks and high temperature particles.

Where a particular risk of fire exists, electrical equipment for such locations should be selected and erected so that its normal temperature and foreseeable temperature during a fault cannot cause a fire. This can be achieved by the construction of the equipment and by additional protective measures taken during erection of the installation/equipment. 422.1.2. For full details refer to Chapter 42.



# CHAPTER 42

## ARC FAULT DETECTION DEVICES

The regulations require protection against thermal effects that may occur as a result of arcing or burning, overcurrent, insulation faults, arcs, sparks and high temperature particles.

The use of Arc Fault Detection Devices conforming to BS EN62606 is a recommended method for providing additional protection against fire caused by arc faults in AC final circuits.

If used, AFDDs shall be placed at the origin of the circuits to be protected i.e. in the consumer unit or distribution board.

Examples of locations where such devices can be used include:

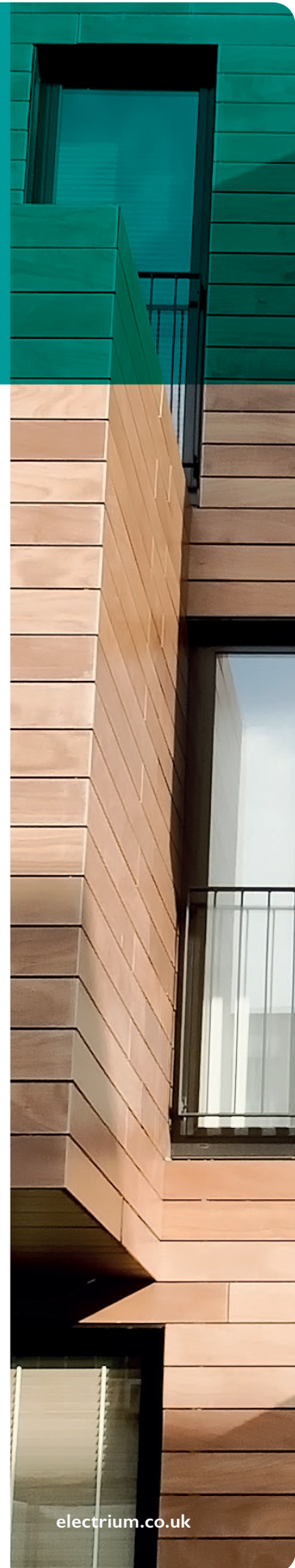
Premises with sleeping accommodation such as dwellings, hotels etc

Locations with a risk of fire, because of the nature of activity involves flammable materials

Wooden buildings and structures made from combustible materials

Fire propagating structures e.g. high rise buildings

Locations with irreplaceable goods: archives, museums etc



A photograph of a man and a young child sitting together at a desk, looking at a laptop. The man is on the right, leaning over the child on the left. The child is pointing at the laptop screen. The image has a teal overlay on the top half.

# CHAPTER 53

## ARC FAULT DETECTION DEVICES

Chapter 53 has been completely rewritten and now includes a new regulation which advises designers and installers where AFDDs are to be located within the installation.

(532.6) Arc fault detection devices where specified, should be installed at the origin of the final circuits being protected (e.g. in consumer units and distribution boards) on AC single phase circuits not exceeding 230V.

AFDDs shall comply with BS EN 62606. Coordination of AFDDs with overcurrent protective devices should be ensured, and the designer and installer should take account of the device manufacturer's instructions.





# APPENDIX 6 CERTIFICATION AND REPORTING ARC FAULT DETECTION DEVICES

AFDDs are now included in the schedule of inspections and on the schedule of test results within Appendix 6.

In the schedule of inspections, under the section dealing with consumer units and distribution boards there is a reference to check for the AFDD six monthly test notice, similar to what is already common practice for RCDs and RCBOs.

Also in the schedule of test results form there is a new tick box on AFDDs which allows the installer to record operation of the manual test button on the AFDDs. Again this is similar to RCDs and RCBOs.

**Footnote:** The AFDD product standard states that “an AFDD shall be provided with a manual or automatically initiated test function (or both) that checks the arc detection circuit.”

Automatic test function shall be performed at every switch on and every day, automatic testing is not required to open the contacts. Manual testing via test button shall trip the device.

# DEVICES FOR PROTECTION AGAINST THE RISK OF FIRE

## AFDDs AND RCDs

RCDs are included in BS7671 for protection against the risk of fire. 532 refers to the locations mentioned in Chapter 42 where a particular risk of fire exists, and requires preventative protective measures against the risk of fire to be provided.

A risk evaluation should be conducted by assessors who are competent in suitable fire risk assessments.

Where RCDs are used for protection against the risks of fire the operating current of the RCD should not be more than 300mA, and the RCD must be installed at the origin of the circuit.

It should be noted that although RCD technology is very reliable and efficient at detecting and disconnecting leakage faults to earth/CPC, including those associated with insulation faults, and RCDs are included within BS7671 as devices for the protection against fires, RCDs are unable to detect serial arcs, or certain parallel arc faults.

Designers and installers should take account of the characteristics of each type of device available, and pay particular attention to the characteristics and operating currents i.e. RCDs are designed to not trip at 50% of their rated tripping current (as the RCD half times test demonstrates).

Arc fault detection devices to BS EN 62606 are recommended as a way of providing additional protection against fires caused by arc faults.

AFDDs that also include integral MCB and RCD technology should be installed in accordance with the requirements of BS7671 for MCBs and RCDs and in particular the requirements for selectivity and disconnections times should be met, tested and recorded as part of the initial verification process.



# PROTECTION DEVICES



**MINIATURE RCBOs WITH SWITCHED NEUTRAL AS STANDARD**



**ARC FAULT DETECTION DEVICES WITH MINIATURE RCBO TECHNOLOGY INCLUDED**



**SURGE PROTECTION DEVICES**



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