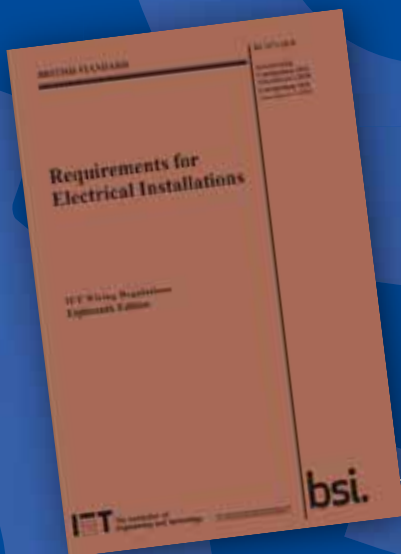




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**BS7671:2018
+ AMENDMENT 2 : 2022**

**AMENDMENT 2 AND THE DESIGN AND
INSTALLATION OF RESIDENTIAL CONSUMER UNITS**

SAFETY IS NOT A GAME



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1

Introduction.

Amendment 2 of the Eighteenth edition of the IET Wiring Regulations (BS7671:2018+A2:2022), came into effect on 28th March 2022 and may be implemented immediately.

Amendment 1 (BS7671:2018+A1:2020) remains current until its withdrawal on 27th September 2022.

The release of Amendment 2 has introduced some fundamental changes which impact on the design and installation of a Residential Consumer Unit.

This document sets out to identify and review the 6 key areas affected by the new amendments, as follows:

- Arc Fault Detection Devices (AFDD's)
- Surge Protection Devices
- Selection of RCD Type
- On-site RCD Testing
- Labelling of consumer Units
- Insulation Resistance Testing

ARC fault protection devices (AFDDs).



■ Chapter 42 Protection against fire caused by electrical equipment

Regulation 421.1.7 has been redrafted. It is now a requirement to protect final circuits supplying socket-outlets with a rated current not exceeding 32A using AFDD's, within certain premises (see below).

For all other premises the regulation recommends the use of AFDD's on final circuits supplying socket-outlets with a rated current not exceeding 32A.

The new regulations are as follows:

421.1.7

Arc fault detection devices conforming to EN62606 shall be provided for single phase AC final circuits supplying socket outlets with rated current not exceeding 32A in:

- Higher risk residential buildings
- Houses of multiple occupancy (HMO)
- Purpose built student accommodation
- Care homes

NOTE 1: Higher Risk Residential Buildings are assumed to be residential buildings over 18m in height or in excess of six storeys, whichever is met first. It is anticipated that in many areas, higher risk residential buildings will be defined in legislation which can be subject to change over time, as well as in risk management procedures adopted by fire and rescue services. Current legislation should be applied.

For all other premises, the use of AFDDs conforming to BS EN62606 is recommended for single phase AC final circuits supplying socket outlets not exceeding 32A.

Where used, AFDDs shall be placed at the origin of the circuit to be protected.

Overview

The scope of AFDD's now changes FROM "recommended in AC final circuits", TO, "shall be provided for single phase AC final circuits supplying sockets not exceeding 32A," specifically in buildings where risk to life is greater, either due to the building construction or by its occupational use.

In a typical residential application, this would apply to final circuits such as the power Ring Mains, Kitchen final circuits, and also any socket final circuit in a Garage Board if one is fitted.

Amendment 2 also "**recommends**" the use of AFDDs on AC single phase final circuits with sockets not exceeding 32A in all other premises.

Guidance on the language used within BS7671 has been included within Amendment 2, to provide definitions of key words, including the term 'recommended'. BS7671 defines recommendation as: 'Among



Further information on AFDDs can be found in the Lewden P4 Combined AFDD/RCBO Technical Guide

several possibilities one is recommended as particularly suitable, without mentioning or excluding others”.

When installing AFDDs, they must be located at the origin of each final circuit to be protected, which is effectively within the main Consumer Unit.

The optimum solution is to use an RCBO based consumer unit, upgrading the relevant RCBOs to AFDD/RCBOs.

High integrity Dual RCCB or Split Load consumer units can be utilised, however, any cost advantage of using these solutions will be reduced as the number of circuits protected by the RCCB's reduces.

3

Surge protection devices (SPDs).



■ Regulation 443 Protection against transient overvoltages of atmospheric origin or due to switching

Regulation 443.4 Overvoltage control

This regulation covers where protection against transient overvoltages is required and has been significantly redrafted.

Regulation 443.4 has been deleted and replaced by Regulations 443.4.1 and 443.4.2.

These new regulations stipulate the separate requirements for:

- I. Transient overvoltages due to indirect lightning strokes
- II. Equipment overvoltages.

The Risk Assessment method detailed in 443.5 has now been deleted.

The new regulations are as follows:

443.4.1

Transient over voltages due to the effects of indirect lightning strokes

Protection against transient over voltages shall be provided where the consequence caused by the over voltage could result in:

- Serious injury to, or loss of human life
- Failure of a safety service, as defined in Part 2
- Significant financial or data loss

For all other cases, protection against transient over voltages shall be provided unless the owner of the installation declares it is not required due to any loss or damage being tolerable, and they accept the risk of damage to equipment and any consequential loss.

NOTE: Part 2 "Definitions", defines a Safety Service, as "an electrical system for electrical equipment provided to protect or warn persons in the event of a hazard, or essential to their evacuation from a location".

443.4.2

Transient over voltages caused by equipment

Protection against over voltages shall be considered in the case of equipment likely to produce switching over voltages or disturbances exceeding the applicable rated impulse voltage of equipment according to table 443.2, e.g. where inductive or capacitive equipment such as motors, transformers, capacitor banks, storage units, or high current loads are installed.

Overview

Transient overvoltages are now clearly defined as those of atmospheric origin, and those caused by equipment within the installation.

For protection against **indirect lightning strokes**, the installer is still required to assess whether the consequences of an overvoltage (as detailed in 443.4.1) could result in one of the three defined results, which would make protection mandatory.

443.4.1 also states that in **all other cases**, protection **shall** be provided unless the owner declares that such protection is not required due to any loss being tolerable.

Therefore, outside of the three defined areas, SPD's must be fitted, unless expressly excluded by the owner of the installation.

When referring to **overvoltages caused by equipment**, the installer must evaluate whether any equipment within the installation can produce switching overvoltages which could adversely affect other load equipment within the installation.

This has to be based upon the impulse voltage withstand capability of the equipment, as defined by its Overvoltage Category as not ass detailed in 443.6, including Table 443.2.

4

Residual current devices (RCDs).



■ Regulation 531.3 – Residual current devices (RCDs)

The use of RCBOs to protect final distribution circuits has been further strengthened with the inclusion of a new clause 531.3.2 (ii). This specifically identifies the use of RCBOs in residential premises as a consideration for limiting the risk of unwanted tripping:

Regulation 531.3.3 provides clarity on the various types of RCD available and identifies how each type should be selected dependent upon the load equipment characteristics. This now clearly defines where Type AC RCD's can be utilised.

The new regulations are as follows:

531.3.2 Unwanted Tripping

Residual current protective devices shall be selected and erected such as to limit the risk of unwanted tripping. The following should be considered:

- (ii) *the use of RCBOs for individual final circuits in residential premises. See also section 314 (Division of Installation).*
- (iii) *in order to avoid unwanted tripping by protective conductor currents and/or earth leakage currents, the accumulation of such currents downstream of the RCD shall not be more than 30% of the rated residual operating current.*

531.3.3 Types of RCD

RCD type AC shall only be used to serve fixed equipment, where it is known that the load current contains no DC components.

NOTE: *Examples of fixed equipment with a load current containing no DC components can include but not be limited to electric heating appliances, and/or simple filament lighting neither containing electronic components.*

Overview

The addition of the new clause 531.3.2.(ii) places greater emphasis on the use of RCBOs on individual final circuits to avoid unwanted tripping, by providing greater sub-division of RCD protected circuits as required within section 314.

Utilising RCBOs on individual final circuits also provides the most effective solution to the requirements of 531.3.2.(iii). This limits the accumulated PE currents to a maximum of 30% of the rated residual operating current, which equates to a maximum of 9mA on a 30mA RCD.

In comparison, using a Dual RCCB board would require that the total accumulated leakage current from all of the final circuits connected to the RCCB do not exceed 9mA.

This requires an understanding of the potential leakage currents of any equipment connected to each of the protected circuits, some of which may be unknown during the initial installation, as well as any subsequent upgrades where further circuits are added onto the RCD or new equipment added to the installation.

Type AC RCDs are now only permitted for use on circuits serving fixed equipment where it is known that the load cannot generate any dc component, for example electric heating appliances or simple filament lighting.

This further promotes the use of Type A devices as the minimum standard, mandating them on final circuits such as those providing power to socket outlets or LED lighting.

5

On-site testing of RCDs.

■ Chapter - 64 (Initial Verification)

This chapter defines the testing required on completion of an installation, to verify that the requirements of BS7671 have been met prior to being placed into service

Amendments to Section 643.7 & 643.8, have further clarified the requirements for testing RCDs within an installation as below:

Regulation 643.7

Protection by automatic disconnection of the supply

Previously, effectiveness for 643.7 was verified by testing in accordance with Table 3A in appendix 3. This table has now been deleted.

The new regulations for verification of **RCDs within TN and TT systems** are as follows:

Compliance with Regulation 411.4 (TN Systems) & 411.5 (TT Systems) shall be verified by:

(2) verification of the characteristics and/or the effectiveness of the associated protective device. This verification shall be made:

For RCDs by visual inspection and testing.

The effectiveness of automatic disconnection of supply by RCD's shall be verified using suitable test equipment according to BS EN 61557-6 (see Regulation 643.1) to confirm that the relevant requirements of Chapter 41 are met, taking into account the operating characteristics of the device.

NOTE Regardless of RCD Type, effectiveness is deemed to have been verified where an RCD disconnects within the time stated below with an alternating current test at rated residual operating current ($I\Delta n$)

- For general non-delay type, 300ms maximum
- For delay 'S' type RCD, between 130ms minimum and 500ms maximum

Regulation 634.8 additional protection

Previously, effectiveness under 634.8 was verified where the RCD disconnects within 40ms when tested at a current equal to or higher than five times its rated residual operating current.

This has now been aligned with 634.7 and the new regulations are as follows:

The verification of the effectiveness of the measures applied for additional protection is fulfilled by visual inspection and testing. Where RCDs are required for additional protection, the effectiveness of automatic disconnection of supply by RCD's shall be verified using suitable test equipment according to BS EN 61557-6 (see Regulations 643.1) to confirm that the relevant requirements of Chapter 41 are met.

***NOTE:** Regardless of RCD Type, effectiveness is deemed to have been verified where an RCD disconnects within the time stated below with an alternating current tested at rated residual operating current ($I\Delta n$):*

for general non delay type, 300ms maximum.

Overview

The revised text in both clauses align the requirements for both regulations which now state that the only testing required for general non-time delayed RCDs, is to be carried out using an alternating current at the rated residual operating current.

Therefore, the only test required regardless of the Type of RCD (AC, A, F & B), it is only required to test under the "AC" parameters of the RCD, with the Test current set at $1I\Delta n$, with a maximum disconnection time of 300ms.

Identification & notices.

■ Regulation 514 – Identifications and notices

514.12.1 Periodic inspection and test notice

The periodic inspection and testing instruction notice no longer has to conform to a minimum font and label size, however, the text remains unchanged. Revised examples of these labels can now be found in figure 11A of Appendix 11.

514.12.2

RCD test label

The RCD Test Label testing no longer has to conform to a minimum font and label size.

The text has been revised. Revised examples of these labels can now be found in figure 11B of Appendix 11.

The new text reads as follows:

This installation, or part of it, is protected by a device which automatically switches off the supply if a fault develops. Test six monthly by pressing the relevant test button(s) which should operate the device. Afterwards, manually switch on the device. If the device does not operate, or indicates a fault, seek expert advice.

514.16 Notice

presence of SPDs in an installation

This is a new regulation, requiring for a notice that the installation includes the presence of an Surge Protection Device (SPD).

The new regulations reads as follows:

514.16.1 The presence of SPDs in an installation shall be indicated by an information notice at or near the relevant distribution boards(s).

Omission of inspection and test labels

A new clause within 514.12.1 / 514.12.2 / & 514.12.16 allows for these labels to be omitted from the consumer unit if the electrical installation certificate has been completed and issued, as follows;

The requirement of this regulation need not be applied for domestic (household) premises or similar installations where certification for initial verification, complete with guidance for recipients as detailed in appendix 6 has been issued to the person ordering the work.

514.14.1

Warning notice: non-standard colours

This regulation included a caution Label noting that the installation had cabling colours designated within two versions of BS7671.

This label has now been deleted.

Overview

There has been much discussion regarding the aesthetic appearance of Consumer units installed in hallways where they have been covered in the stickers mentioned above.

The new text regarding Domestic installations, allows for the stickers above to be omitted WHERE the documentation provided (certifying either the initial installation or minor works carried out at a later date), provides guidance on the inclusion of RCD's and SPD's as well as inspection and Test requirements.

This places the onus on this guidance passing to and being read by the occupant.

7

Insulation resistance testing.

■ Section 643.3 – insulation resistance

This regulation contains 3 sections:

- (i) 643.3.1 defines the tests to be carried out on the final circuit cabling.
- (ii) 643.3.2 details the minimum values of insulation resistance required
- (iii) 643.3.3 makes provision for where electronic devices included within the circuit may influence the results or be damaged by the testing itself.

The key revisions are as follows:

643.3.1.

This regulation lists the three Insulation Resistance tests required across live conductors and live conductors and the PE:

643.3.1 The insulation resistance shall be measured between:

- (i) Live conductors, and*
- (ii) Live conductors and the protective conductor connected to the earthing arrangement. During this measurement, line and neutral conductors may be connected together.*

643.3.2

The minimum values of insulation resistance as detailed in Table 64 remain unchanged, with circuits having a nominal operating voltage up to 500VAC requiring a minimum insulation resistance of $1\text{M}\Omega$ irrespective of upon the test voltage applied.

However, the following text has been deleted:

Where surge protection devices (SPDs) or other equipment are likely to influence the verification test, or be damaged, such equipment shall be disconnected before carrying out the insulation resistance test. Where it is not reasonably practical to disconnect such equipment the test voltage for the particular circuit may be reduced to 250V DC, but the insulation resistance shall have a value of at least $1\text{M}\Omega$.

This has now been covered by the amended text in 643.3.3.

643.3.3

Has been redrafted to encompass all connected equipment, where it is likely to influence the test results or be damaged by the test.

The following text has been deleted:

Where the circuit includes electronic devices which are likely to influence the results or to be damaged, only a measurement between the Live conductors connected together and the earthing arrangement shall be made.

And replaced with:

Where connected equipment is likely to influence the measurement or result of the test, or to be damaged the test shall be applied prior to the connection of such equipment in accordance with Table 64.

Following connection of the equipment, a test at 250V DC shall be applied between live conductors and the protective conductor connected to earthing arrangement. The insulation resistance shall have a value of at least $1\text{M}\Omega$.

NOTE: *Manufacturer's instructions may recommend some equipment to be disconnected during 250V DC insulation resistance tests as it may influence the results of the test.*

Overview

An insulation resistance test must be carried out on all fixed wiring within a new installation, without exception.

Testing is required between live conductors, and between live conductors and the protective conductor PE, with the allowance that the L to PE / N to PE testing can be carried out with the live conductors connected together (L&N to PE). (643.3.3.1).

For circuits operating at a nominal voltage up to 500VAC, this test must be made at 500VDC, achieving a minimum resistance value of $1\text{M}\Omega$ (643.3.2).

643.3.3 stipulates that when testing circuits where connected equipment is likely to influence the test results, or be damaged by the test itself, 500VDC testing should be carried out with the equipment disconnected.

Following connection of the equipment, a further IR test at 250VDC is then required, between Live conductors and the protective conductor (L&N to PE as per clause (ii) of 643.3.3.1), again achieving a minimum resistance value of $1\text{M}\Omega$.

This test can be omitted if the equipment manufacturer recommends in their instructions that the device must also be disconnected at 250V DC as their device may influence the results of the test.

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