WiringMatters

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Special Edition 2015

BRITISH STANDARD

BS 7671:2008

incorporating
Amendment 1:2011
Corrigendum 2013
Amendment 2:2013
Amendment 3:2015

Requirements for Electrical Installations

IET Wiring Regulations
Seventeenth Edition

IET

bsi.

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CHANGE TO REQUIREMENTS FOR RCD PROTECTION OF CABLES CONCEALED IN WALLS OR PARTITIONS

A change to the requirements of Regulation Group 522.6, relating to RCD protection of cables concealed in walls or partitions, forms part of BS 7671:2008+A3:2015 (Seventeenth Edition of the IET Wiring Regulations), which was published on 1 January 2015 and comes into effect on 1 July.

Reference to 'under the supervision of a skilled or instructed person' has been removed from the regulations concerned.

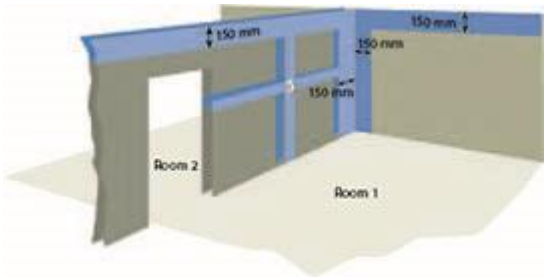
Consequently, the requirement to provide RCD protection to cables concealed in a wall or partition will apply to all installations, except where one of the other permitted methods of protection is employed (such as the use of cables having an earthed metallic covering or cables enclosed in an earthed metal conduit). The RCD must have a rated residual operating current ($I_{\Delta n}$) not exceeding 30 mA and an operating time not exceeding 40 ms at 5 $I_{\Delta n}$.

As at present, the revised requirements apply to cables at a concealed depth of less than 50 mm from the surface of a wall or partition and, irrespective of depth, if the cable is in a partition constructed of metallic parts other than fixings (such as nails or screws).

There is still an exception for cables forming part of a SELV or PELV circuit.

Cables must still be installed within the 'safe' zones illustrated in Figure 1, except where they have one of the other permitted methods of protection mentioned above, or they form part of a SELV or PELV circuit.

Figure 1 – Zone prescribed in Regulation Group 522.6



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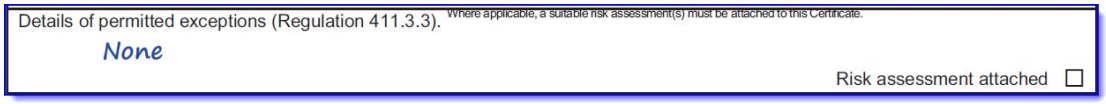
CHANGES TO MODEL FORMS OF CERTIFICATION AND REPORTING IN BS 7671

As part of BS 7671:2008+A3:2015 (IET Wiring Regulations Seventeenth Edition), which was published on 1 January 2015 and comes into effect on 1 July, some changes have been made to the model forms of certification and reporting in Appendix 6 of BS 7671. This article summarises the main changes.

Electrical Installation Certificate

A new section has been added on the first page of the Electrical Installation Certificate for details to be recorded of any permitted exceptions to Regulation 411.3.3 (see Figure 1). This relates to where additional protection for one or more socket-outlets rated at 20 A or less by an RCD has been omitted on the basis that a documented risk assessment has determined that such protection is not necessary. This exception may be used only for an installation other than in a dwelling. Where the exception is used, a copy of the risk assessment must be attached to the certificate as required by Regulation 411.3.3.

Figure 1 – New section regarding permitted exceptions

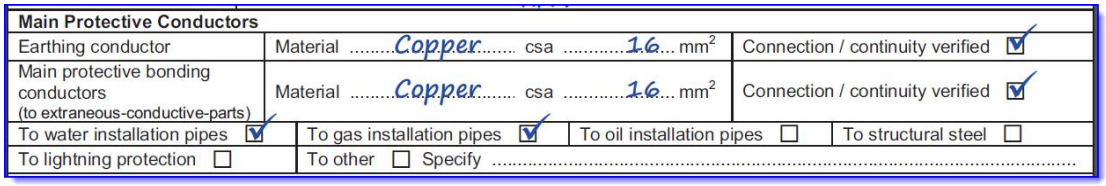

Details of permitted exceptions (Regulation 411.3.3). Where applicable, a suitable risk assessment(s) must be attached to this Certificate.

None

Risk assessment attached ☐

The section where details of the main protective bonding conductors of the installation are to be recorded has been expanded (see Figure 2). This now includes separate tick boxes for main bonding conductor connections to water installation pipes, gas installation pipes, oil installation pipes, structural steel, lightning protection and any other parts (as referred to in Regulation 411.3.1.2) to which such connections have been made.

Figure 2 – Changes to section for details of main bonding connections



Main Protective Conductors			
Earthing conductor	Material ..Copper.. csa ..16.. mm²		Connection / continuity verified ☑
Main protective bonding conductors (to extraneous-conductive-parts)	Material ..Copper.. csa ..16.. mm²		Connection / continuity verified ☑
To water installation pipes ☑	To gas installation pipes ☑	To oil installation pipes ☐	To structural steel ☐
To lightning protection ☐	To other ☐ Specify		

In the notes of guidance for recipients, a change has been made to the note that points out that, for safety reasons, the installation will need to be inspected at appropriate intervals. Instead of referring to ‘a competent person’, the note now refers to ‘a skilled person competent in inspection and testing of electrical installations’. The change has been made in order to describe more clearly the qualities that should be possessed by the person chosen to carry out such periodic inspections.

A new note of guidance has also been added to tell the recipient that the certificate is valid only if accompanied by the Schedule of Inspections and the Schedule(s) of Test Results.

Schedule of Inspections for the Electrical Installation Certificate

The existing Schedule of Inspections for the Electrical Installation Certificate has been deleted. It is replaced by (a) and (b) below, one of which (as applicable) is to be used as the basis for the Schedule of Inspections to accompany the certificate.

a. For installations in domestic and similar premises with up to 100 A supply, a model schedule of inspections for new installation work in such premises.
b. For installations not covered by (a), a list of examples of items requiring inspection during initial verification of new installation work.

(a) and (b) contain a greater number of items than were included in the existing Schedule of Inspections (deleted by Amendment No. 3), many of which are quite detailed or particular. This gives (a) and (b) the advantage of being more like checklists. A few examples of items in (a) and/or (b) are:

- items relating to the electrical intake equipment, such as the service cable, service head, distributor's earthing arrangement and metering equipment.
- items relating to parallel or switched alternative sources of supply.
- items relating to consumer units or distribution boards, such as:
    - adequacy of access and working space for items of electrical equipment including switchgear (132.12);
    - presence of linked main switch(s) (537.1.4, 537.1.5, 537.1.6);
    - suitability of enclosure(s) for IP and fire ratings (416.2, 421.1.6, 421.1.201); and
    - confirmation that all conductor connections are correctly located in terminals and are tight and secure.
- items relating to circuits, such as:
    - adequacy of conductors for current-carrying capacity with regard to type and nature of the installation;
    - segregation/separation of Band I (ELV) and Band II (LV) circuits, and electrical and non-electrical services (528);
    - cables correctly erected and supported throughout including escape routes, with protection against abrasion (521, 522); and
    - provision of additional protection by RCD not exceeding 30 mA (with a list of possible applications).

Minor Electrical Installation Works Certificate

In Part 3 (Essential Tests) of the Minor Electrical Installation Works Certificate, the fields for insulation resistance test readings to be inserted have been changed from 'Line/neutral', 'Line/earth' and 'Neutral/earth' to 'Live-Live' and 'Live-Earth'.

Also in Part 3, the amount of detail required to be inserted in relation to the testing of an RCD has been increased, such that the operating time at 5 $I_{\Delta n}$ (as well as at $I_{\Delta n}$) is included, as is confirmation that the test button of the device operates satisfactorily.

In Part 4 (Declaration), a field has been added for details to be recorded of any permitted exceptions to Regulation 411.3.3 relating to the omission of RCD protection to socket-outlets. As mentioned above in relation to the similar field in the Electrical Installation Certificate, this exception may be used only for an installation other than in a dwelling. Where

the exception is used, a copy of the risk assessment must be attached to the certificate as required by Regulation 411.3.3.

Electrical Installation Condition Report

In Section D (Extent and limitations of inspection and testing) of the Electrical Installation Condition Report, text has been added to the effect that an inspection should be made within an accessible roof space where other electrical equipment is present.

Section J (Particulars of installation referred to in the report) now includes separate tick boxes for main bonding conductor connections to water installation pipes, gas installation pipes, oil installation pipes, structural steel, lightning protection and any other parts (as referred to in Regulation 411.3.1.2) to which such connections have been made.

In Section K (Observations), the column headed 'Further investigation required (yes/no)' has been deleted. However, it is still possible to state that further investigation is required in relation to an observation, by means of additional classification code, 'FI (Further investigation required)', which is now recognised in Section K.

Note 9 of the notes for the person producing the report has been revised with regard to where the inspection has revealed an apparent deficiency that could not be fully identified due to the extent or limitations of the inspection. The note points out that if a further investigation may reveal that the deficiency warrants the award of classification code C1 (Danger present) or C2 (Potentially dangerous), a recommendation of further investigation required (Code FI) should be recorded at Section K (Observations). It should be appreciated, however, that an FI classification should not be recorded if the investigation could only be expected to lead, at worst, to the award of C3 classification (Improvement recommended) in relation to the observation.

Notes 7 and 8 of the notes of guidance for recipients have been revised with regard to the person who undertakes any necessary remedial work in relation to a deficiency revealed by the inspection. Instead of referring to 'a competent person', the notes now refer to 'a skilled person competent in electrical installation work'. The change has been made to the notes in order to describe more clearly the qualities that should be possessed by the person chosen to carry out such remedial work.

Note 9 of the notes of guidance for recipients has been revised for the same reason as Note 9 of the notes for the person producing the report, mentioned earlier; that is, in relation to further investigation.

Note 10 of the notes of guidance for recipients has been revised with regard to the person who undertakes re-inspection of the installation at appropriate intervals. Instead of referring to 'a competent person', the note now refers to 'a skilled person competent in inspection and testing of electrical installations'. The change has been made in order to describe more clearly the qualities that should be possessed by the person chosen to carry out such periodic inspections.

Some additions and modifications have been made to the Condition Report Inspection Schedule Guidance for the Inspector, and to the Condition Report Inspection Schedule for Domestic and Similar Premises with up to 100 A Supply. The result is that these schedules, which are essentially checklists, are more comprehensive than they previously were.

In the Condition Report Inspection Schedule for Domestic and Similar Premises with up to 100 A Supply, the column headed ‘Further investigation required (yes/no)’ has been deleted. Also, the text in the schedule relating to the use of recommendation codes has been revised to take account of the introduction of the new Code FI (Further investigation required), mentioned earlier.

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REQUIREMENT FOR FIRE RESISTING SUPPORTS TO WIRING SYSTEMS IN ESCAPE ROUTES

BS 7671:2011+A3:2015 (IET Wiring Regulations Seventeenth Edition), which was published in January 2015 and comes into effect on 1 July, will include a requirement that wiring systems in escape routes shall have fire-resisting supports. The requirement is included in a new regulation (Regulation 521.11.201), which is reproduced below.

521.11.201 Wiring systems in escape routes shall be supported such that they will not be liable to premature collapse in the event of fire. The requirements of Regulation 422.2.1 shall also apply, irrespective of the classification of the conditions for evacuation in an emergency.

NOTE 1: Non-metallic cable trunking or other non-metallic means of support can fail when subject to either direct flame or hot products of combustion. This may lead to wiring systems hanging across access or egress routes such that they hinder evacuation and firefighting activities.

NOTE 2: This precludes the use of non-metallic cable clips, cable ties or trunking as the sole means of support. For example, where non-metallic trunking is used, a suitable fire-resistant means of support/retention must be provided to prevent cables falling out in the event of fire.

The term 'wiring system', which is used in the regulation, is defined in BS 7671 as 'an assembly made up of cable or busbars and parts which secure and, if necessary, enclose the cable or busbars.' Thus the term covers cables (and busbars) together with any containment system for them, such as conduit, trunking and cable tray.

Reason for the new regulation

The purpose of Regulation 512.11.201 is to improve the safety of firefighters and others in escape routes under fire conditions. Wiring systems that drop and hang across escape routes due to failure of a means of support in fire conditions have the potential to entangle persons. In recent years, a number of firefighters have died as a result of being entangled in this way.

Non-metallic cable clips, cable ties, conduit or cable trunking

As pointed out in Note 2 to Regulation 521.11.201, the requirements of the regulation effectively rule out the use of non-metallic cable clips, cable ties and conduit or cable trunking as the sole means of support for the cables in escape routes. The cables must be secured at appropriate intervals by proven metal supports that have adequate fire resistance, and that are fixed to non-combustible substrate of the building.

Metal cable management systems

Although the notes to Regulation 521.11.201 refer to non-metallic trunking (amongst other types of non-metallic cable support), the regulation itself applies equally to wiring systems that include, for example, a metal cable management system, such as a steel conduit, trunking or cable tray or a metal casing of a busbar trunking system.

Metal cable management systems in escape routes must not rely for support on anything liable to fail prematurely in the event of fire, as the collapse of such a cable management system could hinder or prevent escape in some way, even if not by entanglement.

Type of circuit, system or electrical service

It should also be noted that the requirements of Regulation 521.11.201 apply for all types of circuit, systems and electrical service that encroach on escape routes, irrespective of rated voltage. These might include (amongst others):

a. distribution circuits;
b. final circuits;
c. safety services*; and
d. data and communications services.

* For fire alarm and emergency lighting systems, BS 5859 and BS 5266, respectively, also include recommendations and/or requirements about the fire resistance of cable supports and cables.

Application of Regulation 422.2.1

A further requirement of Regulation 521.11.201 is that the requirements of Regulation 422.2.1 shall also apply, irrespective of the classification of the conditions for evacuation in an emergency. Regulation 422.2.1 contains various provisions for safety in the event of a wiring system being affected by fire.

What constitutes an escape route?

An escape route is a route designated for escape to a place of safety in the event of an emergency.

Escape routes may include not only defined routes such as corridors, stairways and hallways, but also open areas through which escaping persons might reasonably be expected to need to pass on their way to a place of safety.

For premises covered by The Regulatory Reform (Fire Safety) Order 2005 (FSO), which applies in England and Wales, the designation of the escape routes is part of the risk assessment that the FSO requires the 'responsible person' to carry out and keep up to date. Similar legal requirements apply in Scotland and Northern Ireland.

Wiring Matters interviewed Charlie Pugsley, London Fire Brigade investigator, about the fire-related changes made by Amendment No. 3.

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REDUCTION IN MAXIMUM VALUES OF EARTH FAULT LOOP IMPEDANCE IN BS 7671

Editor's note: references to the 'current' version of BS 7671 relate to BS 7671:2008(2011), i.e. the 'green cover' Regulations. This version is current until 30 June 2015. On 1 July 2015, BS 7671:2008+A3:2015 comes into effect.

One of the changes being introduced by BS 7671:2008+A3:2015 (IET Wiring Regulations Seventeenth Edition), which was published in January and comes into effect on 1 July, is a reduction of maximum values of earth fault loop impedance (Z_s) in Tables 41.2, 41.3, 41.4 and 41.6.

Reason for the reduction

The reason for the reduction in the maximum Z_s values is the introduction of the 'minimum voltage factor' given in Technical Report PD CLC/TR 50480:2011 *Determination of cross sectional area of conductors and selection of protective devices*.

Minimum voltage factor

The minimum voltage factor (C_{min}) takes account of the fact that the voltage of the electricity supply to an electrical installation varies depending on time and place, changing of transformer taps and other considerations.

For example, for a low voltage supply given in accordance with The Electricity Safety, Quality and Continuity Regulations 2002 as amended (ESQCR), variations of up to 10 % above or 6 % below the declared voltage at the declared frequency are permitted, unless otherwise agreed in writing by the distributor, the supplier and the consumer (regulation 27(3) of the ESQCR refers).

The minimum voltage factor (C_{min}) always has a value less than 1. C_{min} is applied as multiplier to the nominal line voltage to Earth (U_0) when determining maximum values of earth fault loop impedance (Z_s).

Amendment No. 3 to BS 7671:2008 gives C_{min} the value of 0.95 where the low voltage supply given in accordance with the ESQCR.

One might wonder why 0.95 was chosen rather than 0.94, given that the ESQCR permits the supply voltage to be as much as 6 % below the declared value, as already mentioned. However, 0.94 was thought to be unrealistically low, and Technical Report PD CLC/TR 50480:2011 gives C_{min} the value of 0.95 for the worst-case condition in a low voltage installation.

Tables of maximum earth fault loop impedance

As a result of the C_{min} value of 0.95 mentioned above, all maximum values of Z_s in Tables 41.2, 41.3, 41.4 and 41.6 of BS 7671 have been correspondingly reduced by Amendment No. 3 to 0.95 times (or 5 % lower than) those in the current version of BS 7671.

For example, for a 32 A type B circuit-breaker to BS EN 60898 or the overcurrent characteristics of a 32 A type B RCBO to BS EN 61009-1, Table 41.3 in Amendment No. 3 gives the maximum Z_s value of 1.37 ohms at a nominal voltage (U_0) of 230 V. This compares with 1.44 ohms in the same table of the previous version of BS 7671.

Protective devices and voltages that are not covered in the tables of maximum earth fault loop impedance

Where it is necessary to find the maximum value of Z_s for a protective device not covered in Tables 41.2, 41.3, 41.4 and 41.6 or for a nominal voltage (U_0) other than 230 V, the formula given in Appendix 3 of BS 7671 (as revised by Amendment No. 3) can be used. Examples of protective devices not covered by the tables are fuses of higher current ratings and moulded-case circuit-breakers (MCCBs).

The revised version of the Appendix 3 formula, as given in Amendment No. 3, is reproduced below:

$$Z_s = (U_0 \times C_{min}) / I_a$$

where:

U_0 is the nominal a.c. rms line voltage to Earth.

C_{min} is the minimum voltage factor to take account of voltage variations depending on time and place, changing of transformer taps and other considerations.

NOTE 1: For a low voltage supply given in accordance with ESQCR, C_{min} is given the value 0.95.

I_a is the current causing operation of the protective device within the specified time.

Measured values of Z_s

When Z_s values are measured at ambient temperature, account needs to be taken of the increase in resistance of the conductors with increasing temperature due to load current, as explained in Appendix 14 of BS 7671, before the measured values can be checked for compliance against the maximum values of Z_s referred to in BS 7671.

Appendix 14 has been revised by Amendment No. 3 to BS 7671:2011.

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CHANGES TO REQUIREMENTS FOR RCD PROTECTION OF SOCKET-OUTLETS

Editor's note: references to the 'current' version of BS 7671 relate to BS 7671:2008(2011), i.e. the 'green cover' Regulations. This version is current until 30 June 2015. On 1 July 2015, BS 7671:2008+A3:2015 comes into effect.

A new, revised version of Regulation 411.3.3, relating to RCD protection of socket-outlets, forms part of BS 7671:2008+A3:2015 (IET Wiring Regulations Seventeenth Edition), which was published in January 2015 and comes into effect on 1 July. The current and new versions of the regulation are shown side by side below. By comparing the two versions, it can be seen that the new version:

a. requires RCD protection to be provided for all socket-outlets rated at not more than 20 A, not just those that are for general use by ordinary persons (see indent (i));
b. continues to require RCD protection to be provided for mobile equipment rated at not more than 32 A (see indent (ii));
c. no longer permits the omission of RCD protection for socket-outlets that are for use under the supervision of skilled or instructed persons (see indent (a) in the current version);
d. permits the omission of RCD protection for socket-outlets other than in an installation in a dwelling, if a documented risk assessment determines that the RCD protection is not necessary (see indent (a));
e. includes a new note that refers the reader to Appendix 2, item 10 in respect of risk assessment (see NOTE 3 and the information given later in this article); and
f. continues to permit the omission of RCD protection for a specifically labelled or otherwise suitably identified socket-outlet that has been provided for a connection of a particular item of equipment (see indent (b)).

The RCD protection required by the regulation is additional protection in accordance with Regulation 415.1 (i.e. by RCDs having a rated residual operating current ($I_{\Delta n}$) not exceeding 30 mA and an operating time not exceeding 40 ms at a residual current of 5 $I_{\Delta n}$).

Current version	New version
411.3.3 Additional protection In a.c. systems, additional protection by means of an RCD in accordance with Regulation 415.1 shall be provided for: (i) socket-outlets with a rated current not exceeding 20 A that are for use by ordinary persons and are intended for general use, and (ii) mobile equipment with a current rating not exceeding 32 A for use outdoors.	411.3.3 Additional protection In a.c. systems, additional protection by means of an RCD in accordance with Regulation 415.1 shall be provided for: (i) socket-outlets with a rated current not exceeding 20 A, and (ii) mobile equipment with a current rating not exceeding 32 A for use outdoors. An exception to (i) is permitted:

An exception to (i) is permitted for: (a) socket-outlets for use under the supervision of skilled or instructed persons, or (b) a specific labelled or otherwise suitably identified socket-outlet provided for connection of a particular item of equipment. NOTE 1: See also Regulations 314.1(iv) and 531.2.4 concerning the avoidance of unwanted tripping. NOTE 2: The requirements of Regulation 411.3.3 do not apply to FELV systems according to Regulation 411.7 or reduced low voltage systems according to Regulation 411.8.	(a) where, other than for an installation in a dwelling, a documented risk assessment determines that the RCD protection is not necessary, or (b) for a specific labelled or otherwise suitably identified socket-outlet provided for connection of a particular item of equipment. NOTE 1: See also Regulations 314.1(iv) and 531.2.4 concerning the avoidance of unwanted tripping. NOTE 2: The requirements of Regulation 411.3.3 do not apply to FELV systems according to Regulation 411.7 or reduced low voltage systems according to Regulation 411.8. NOTE 3: See Appendix 2, item 10 in respect of risk assessment.

Removal of the exception for socket-outlets for use under the supervision of skilled or instructed persons

Unlike the current version of Regulation 411.3.3, the new version does not permit the omission of RCD protection to a socket-outlet just because the socket-outlet is for use under the supervision of skilled or instructed persons.

The exception for socket-outlets for use under the supervision of skilled or instructed persons was removed because:

a. it was no longer seen as having any relevance, given the development in the application of RCDs to the general requirements of BS 7671 over recent years; and
b. there had been reports of the exception being abused, such as RCD protection to socket-outlets at a school being omitted on the basis that they were to be used under the supervision of a person instructed by the head teacher.

Documented risk assessment

Omitting RCD protection for any socket-outlet on the basis of a risk assessment is a serious matter and must never be done lightly. Such omission is not permitted for an installation in a dwelling; it is permitted only for an installation in some other type of location (see indent (a) of the new version of Regulation 411.3.3).

The risk assessment would have to be carried out in accordance with The Management of Health and Safety at Work Regulations 1999 (SI 1999 No 3242) (MHSW), which applies in England and Wales, or the corresponding Statutory Regulations in other parts of the United

Kingdom. The MHSW is referred to in NOTE 3 of the new version of Regulation 411.3.3 by means of its reference to item 10 of Appendix 2 of BS 7671.

MHSW puts the responsibility for carrying out risk assessments onto (as applicable) every employer and every self-employed person. The risk assessment relates to the health and safety of employees and self-employed persons while at work, and the health and safety of other persons arising out of, or in connection with, the conduct by the employer/self-employed person or his undertaking (MHSW regulation 3 refers).

In order for the omission of RCD protection to any socket-outlet on the basis of risk assessment to be permitted by Regulation 411.3.3, the risk assessment must determine that the RCD protection is not necessary. The risk assessment must be documented and a copy of it must be attached to the Electrical Installation Certificate or (where applicable) Minor Electrical Installation Works Certificate covering the installation of the socket-outlet.

The person who prepared the risk must be prepared to justify his or her conclusion that RCD protection was not necessary, possibly in a court of law, especially if someone was killed or injured as a result of the RCD protection being omitted.

The electrical installation designer must equally be prepared to justify his or her own decision to accept the finding of the risk assessment and omit the RCD protection to the socket-outlet(s) from his or her design.

Specifically labelled or otherwise suitably identified socket-outlet

The exception in indent (b), relating to the omission of RCD protection for specific socket-outlets, is included in both the current and new versions of the regulation.

It is stressed that the exception may only be applied for a socket-outlet that has been provided for the connection of a particular item of equipment. The socket-outlet must be labelled or otherwise suitably identified so that users will be clearly informed that the socket-outlet is intended only for plugging in that particular item of equipment and for no other purpose. Unless the electrical installation designer is convinced that the socket-outlet cannot reasonably be expected to be used for other purposes, RCD protection for that socket-outlet should not be omitted.

In the vast majority of cases, it should not be necessary to omit RCD protection for a socket-outlet. For compliance with Regulation 531.2.4, a socket-outlet should be connected to an RCD that serves a sufficiently small number of other socket-outlets or items of equipment, so that any protective conductor current that may be expected in normal service will be unlikely to cause unwanted tripping of the RCD.