17th EDITION REQUIREMENTS FOR THE TESTING OF RCDs

by Jon Elliott

The 17th Edition of the Wiring Regulations (BS 7671: 2008) will introduce a number of new requirements for the installation of RCDs, therefore it is timely to look at the requirements within the 17th Edition for verification of RCDs. The continuing effectiveness of these RCDs needs to be confirmed periodically. This article discusses the verification required where RCDs are used to provide automatic disconnection of supply in the event of a fault and additional protection.

It should be stated at this point that the 17th Edition does not introduce any significant changes in the requirements for the testing of RCDs even where they are installed to provide automatic disconnection in the event of a fault.

Use of RCDs to achieve automatic disconnection in case of a fault

411.3.2.1 requires (in most cases) that a protective device shall interrupt the supply to a line conductor of a circuit or equipment in the event of a fault of negligible impedance between said line conductor and an exposed-conductive-part or a protective conductor for the circuit or equipment within the appropriate required disconnection time.

A disconnection time of 5 seconds for distribution equipment and final circuits of rating exceeding 32A is permitted by 411.3.2.3. Similarly, a disconnection time of 1 second for distribution equipment and final circuits of rating exceeding 32 A is permitted by 411.3.2.4.

411.3.2.2 states that the maximum disconnection times of Table 41.1 shall be applied to final circuits not exceeding 32 A.

Table 41.1 gives the maximum disconnection times for final circuits not exceeding 32 A of varying nominal voltages forming part of an installation having either TN or TT system earthing. These disconnection times may be met by the use of fuses, circuit breakers (formerly known as MCBs) or RCDs.

411.4.9 states that where an RCD is used to meet the requirements of 411.3.2.2, that is, to provide the required disconnection time, the maximum values of earth fault loop impedance in Table 41.5 may be applied.

The maximum permissible earth fault loop impedances (Zs) to ensure RCD operation for non-time delayed RCDs protecting final circuits not exceeding 32 A are given in Table 41.5, a new table introduced in the 17th Edition, which is reproduced below.

Where an RCD is employed to achieve the disconnection time required by Table 41.1, it is necessary to satisfy ourselves that the maximum earth fault loop impedance (Zs) stated for a particular sensitivity of RCD in Table 41.5 is not exceeded in the circuit to which they provide protection. This is in effect the same procedure that we applied in earlier editions where fuses or circuit breakers were used to achieve the necessary disconnection time and indeed continue to apply for fuses and circuit breakers in the 17th Edition.

Regardless of which type of protective device is used to achieve the disconnection times required by Table 41.1, whether fuse, circuit breaker or RCD, there is no requirement to confirm that the required disconnection time can be achieved by testing the protective device. Rather, we confirm that the earth fault loop impedance of the protected circuit does not exceed the relevant tabulated maximum earth fault loop impedance for the type / sensitivity of the protective device intended to provide the required disconnection time.

Rated residual operating current (mA)	Maximum earth fault loop impedance Zs (ohms)			
	$50\ V < U_0 \leq 120\ V$	$120\ V < U_0 \leq 230\ V$	$230V < U_0 \leq 400\ V$	$U_0 > 400\ V$
30	1667*	1667*	1533*	1667*
100	500*	500*	460*	500*
300	167	167	153	167
500	100	100	92	100

Table 1: Maximum earth fault loop impedance (Zs) to ensure RCD operation in accordance with Regulation 411.5.3 for non-delayed RCDs to BS EN 61008-1 and BS EN 61009-1 for final circuits not exceeding 32 A

17th Edition requirements for testing of RCDs
The 17th Edition has the following requirements in terms of verification of installed RCDs:

- **612.8.1** requires the effectiveness of automatic disconnection of supply by RCD to be verified using test equipment meeting the requirements of BS EN 61557-6 *(Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures. Residual current devices (RCD) in TT, TN and IT systems)*. This is to confirm that the relevant requirements of Chapter 41 (*Protection against electric shock*) are met.

BS EN 61557-6 has requirements for the following tests to be applied to RCDs:
- Non-tripping (50%) test
- Tripping (100%) test
- 5 IΔn (500%) test

- **612.13.1** requires the effectiveness of the integral test facility of an RCD to be verified.

- **415.1.1** states that where an RCD having an IΔn of 30 mA or less is installed to provide additional protection, its operating time should not exceed 40 ms at a residual current of 5 IΔn.

Recommended test procedures
Although the following tests are not required by BS 7671: 2008 they are a method of establishing that the device meets the requirements of Chapter 41.

Remember, in order for reliable results to be obtained when performing these tests, any loads should be disconnected from the circuits and/or outlets under test.

Non-tripping test.
The purpose of this test is to confirm that an RCD of any type or trip rating is not overly sensitive and is a measure intended to enable unsuitable RCDs to be identified and removed from service. The continued presence of overly sensitive RCDs tends to reduce user confidence in such devices and may encourage the adoption of potentially dangerous practices such as the "bridging-out" of RCDs in order to avoid unwanted tripping.

Test procedure - *With a leakage current equal to 50% of the rated residual operating current (IΔn) applied, the RCD should not operate.*

Tripping current test
The purpose of this test is to confirm that the residual

operating current of the protective device is less than or equal to the rated residual operating current. This is a measure of the continued effectiveness of the device to work as required by BS 7671 and in accordance with its product specification when installed for the purpose of providing automatic disconnection in the event of a fault. It does not demonstrate its suitability in terms of providing additional protection. The test should be performed in both the positive and negative half-cycles.

Test procedure -

- ***General purpose RCD to BS EN 61008 and RCBO to BS EN 61009***
  With a leakage current flowing equivalent to 100% of the rated residual operating current (IΔn) of the RCD, operation should occur within 300 ms.

- ***"S" type RCD to BS EN 61008 (incorporating an intentional time delay)***
  With a leakage current flowing equivalent to 100% of the rated residual operating current (IΔn) of the RCD, operation should occur within a time range from 130 ms to 500 ms.

- ***General purpose RCD to BS 4293 and RCD protected socket-outlets to BS 7288***
  With a leakage current flowing equivalent to 100% of the rated residual operating current (IΔn) of the RCD, operation should occur within 200 ms.

- ***General purpose RCD to BS 4293 incorporating an intentional time delay***
  With a leakage current flowing equivalent to 100% of the rated residual operating current (IΔn) of the RCD, operation should occur within a time range from 50% of the rated time delay plus 200 ms to 100% of the rated time delay plus 200 ms.

Test to confirm suitability for use to provide additional protection

The purpose of this test is to confirm the continued suitability of an RCD having a rated residual operating current (IΔn) not exceeding 30 mA to provide additional protection under no-fault conditions (in the 16th Edition, this was known as supplementary protection against direct contact). The test should be performed in both the positive and negative half-cycles.

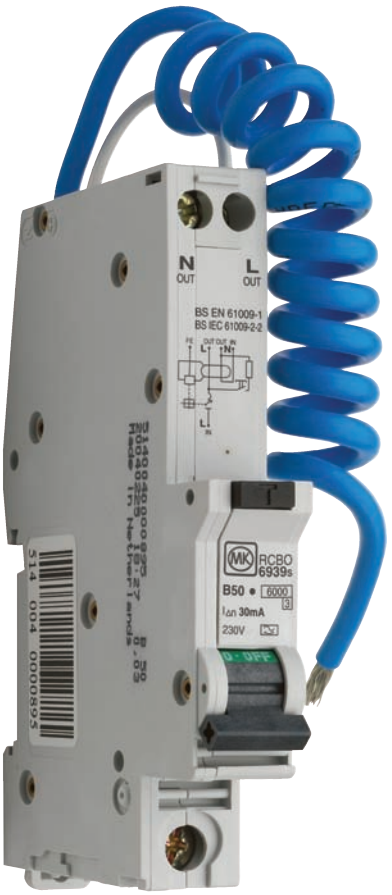
Test procedure - *With a leakage current flowing equivalent to 500% of (i.e. 5 times) the rated residual operating current (IΔn) of the RCD, operation should occur within 40 ms.*

Confirmation of the effectiveness of the integral test facility

RCDs have an integral test device to simulate the passing through the detecting device of a residual current. This makes possible periodic testing of the ability of the residual current device to operate.

However, it should be remembered that operation of the integral test button merely confirms the continuing functioning of the electrical and mechanical components of the RCD. It does not confirm that the device is capable of operating in accordance with the specification of the relevant product standard or, indeed the requirements of BS 7671.

Test procedure - *With the supply to the RCD switched on and with the RCD in the "on" position, the button marked "T" or "Test" on the RCD is pressed. The RCD should switch off. 514.12.2 recommends that the integral test button of an RCD is pressed quarterly (every 3 months).*



Courtesy of MK

Summary

RCDs should be tested at 50%, 100% and, if providing additional protection 500% of their rated residual operating current (IΔn). In addition, the integral test device should be operated quarterly.

Where an RCD is employed to achieve the disconnection time required by Table 41.1 it is necessary to confirm that the maximum earth fault loop impedances (Zs) stated for a particular sensitivity of RCD in Table 41.5 are not exceeded in the circuit to which they provide protection.

More in depth descriptions of both RCD and earth fault loop impedance testing procedures are given in IEE Guidance Note 3 *Inspection and testing*. A revised version reflecting the changes brought about by the advent of the 17th Edition will be available in July 2008. ■