

AVOIDING DANGER AND INCONVENIENCE CURRENT DEVICES

A residual current device (RCD) should not be used in an installation in such a way that its operation would be liable to cause danger or inconvenience.

An example of such inappropriate use of an RCD is shown in the diagram in Figure 1. As can be seen from the diagram, an earth fault in any of the circuits supplied from the distribution board, or in equipment supplied by the circuit, would cause the RCD to operate. This would result in a loss of supply to all of the circuits, possibly causing inconvenience or even danger, for example the risk of a person falling down stairs, having been plunged unexpectedly into darkness.

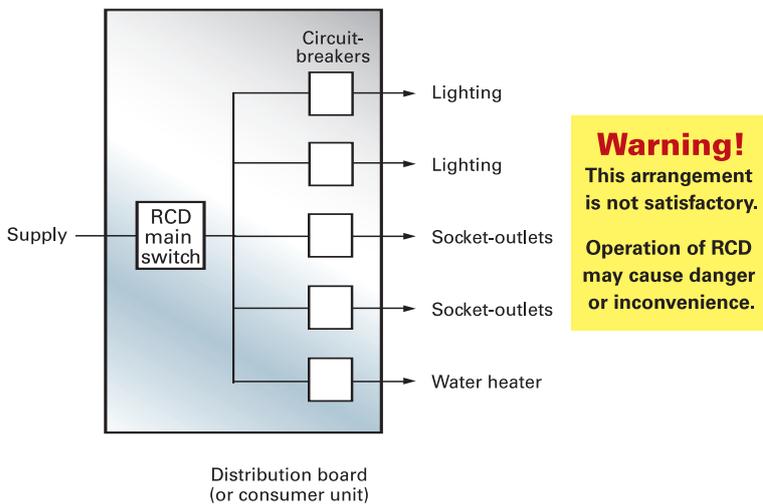


Fig 1 An example of inappropriate use of an RCD which may result in danger or inconvenience

Regulation 314-01-01 of BS 7671 requires, amongst other things, that:

'Every installation shall be divided into circuits as necessary to avoid danger and minimise inconvenience in the event of a fault.'

Furthermore, Regulation 314-01-02 requires that:

'A separate circuit shall be provided for each part of an installation which needs to be separately controlled for compliance with the Regulations or otherwise to prevent danger, so that such circuits remain energised in the event of failure of any other circuit of the installation, and due account shall be taken of the consequences of the operation of any single protective device.'

Most installations include socket-outlets rated at 32 A or less which may reasonably be expected to supply portable equipment for use outdoors. Such socket-outlets are required by Regulation 471-16-01 to be provided with supplementary protection against direct contact by means of an RCD having a rated residual operating current ($I_{\Delta n}$) not exceeding 30 mA and an operating time not exceeding 40 ms

when type-tested at a residual current of 5 times $I_{\Delta n}$. The electrical installation designer may be tempted to meet this requirement by employing an arrangement such as that shown in Figure 1. However, to do so would result in a non-compliance with the requirements of Regulations 314-01-01 and 314-01-03, already mentioned, due to the possibility of danger or inconvenience being caused in the event of the RCD operating.

A way of avoiding such danger or inconvenience would be to provide RCD protection for the socket-outlet circuits individually or, possibly, as a group. In the case of an installation in a dwelling, this can usually be achieved by the use of a split-load consumer unit employing an RCD having an $I_{\Delta n}$ not exceeding 30 mA protecting the applicable circuits only, as shown in Figure 2.

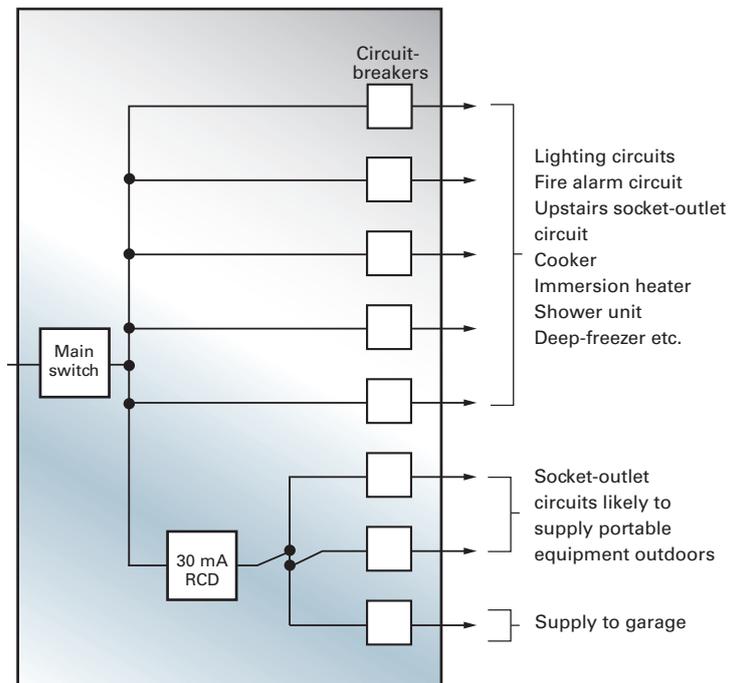


Figure 2. Split-load consumer unit with 30 mA RCD for socket-outlets likely to supply portable equipment outdoors

FROM INAPPROPRIATE USE OF RESIDUAL

Where the installation forms part of a TT system, RCD protection will almost certainly be required to every circuit of the installation, in order to satisfy the requirement of Regulation 413-02-20 for protection against indirect contact. Regulation 413-02-20 requires the following condition to be met:

$$R_A I_a \leq 50 \text{ V}$$

Where:

R_A is the sum of the resistances of the installation earth electrode and the protective conductor connecting it to the exposed-conductive-parts, and

I_a is the current causing automatic operation of the device within 5 s. (Where the protective device is an RCD, I_a is the rated residual operating current $I_{\Delta n}$).

However, for an RCD used for the purpose of Regulation 413-02-20, the rated residual operating current ($I_{\Delta n}$) does not necessarily have to be as low as 30 mA. In fact, such a low value of $I_{\Delta n}$ could, if the RCD protects all or a substantial part of the installation, result in

unwanted operation of the RCD due to the aggregate amount of protective conductor current from the circuits supplied through the device (e.g. resulting from 'earth leakage' current from electronic equipment or heating elements).

Figure 3 and Figure 4 below show typical arrangements for the use of RCDs in an installation forming part of a TT system in a dwelling. Each of the two arrangements is intended to provide both protection against indirect contact (Regulation 413-02-20) and supplementary protection against direct contact for socket-outlets (Regulation 471-16-01). The arrangements are also intended to avoid the loss of the supplies to all outgoing circuits of the consumer unit in the event of an earth fault in one of the circuits, in order to comply with the relevant requirements of Regulations 314-01-01 and 314-01-02, referred to above.

The 100 mA RCD in Figure 4 is of the time-delay type, in order to provide discrimination with the 30 mA RCD (that is, so that the 100 mA RCD will not trip as a result of an earth fault in a circuit supplied through the 30 mA RCD).

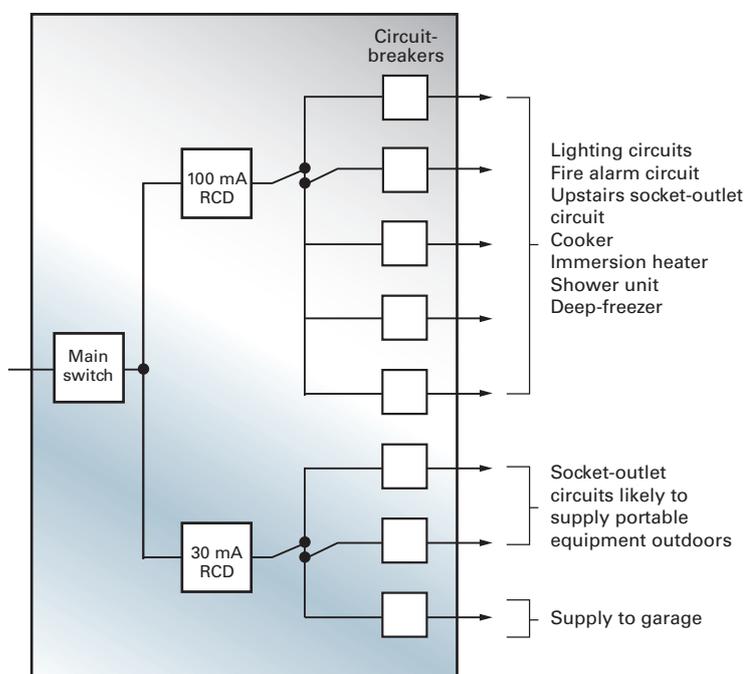


Fig 3. Split-load consumer unit with 30 mA RCD for socket-outlets likely to supply portable equipment outdoors and 100 mA RCD for other circuits

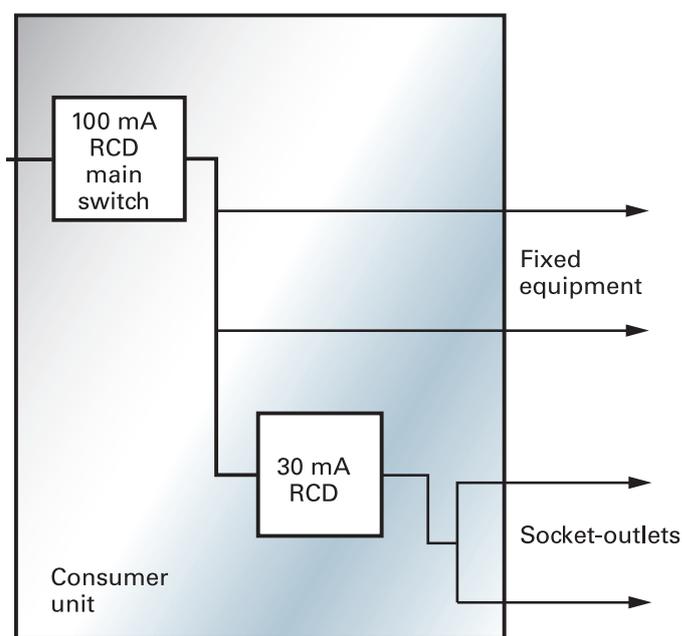


Fig 4. Split-load consumer unit with overall 100 mA time-delay RCD protection and 30 mA RCD for socket-outlets likely to supply portable equipment outdoors