Automatic disconnection.

This method of protection shall be achieved by—

(i) provision of a system of equipotential bonding in which exposed conductive parts are connected to a protective earthing conductor; and

(ii) disconnection of the fault by a protective device.

NOTES:

1 Automatic disconnection of supply may also be required for protection against overcurrents, in accordance with Clause 1.5.9 and Clause 2.5.

2 Clause 5.6 contains requirements for equipotential bonding.

3 Section 2 contains requirements for the disconnection of a fault by a protective device.

(b) *Touch-voltage limits* In the event of a fault between a live part and an exposed conductive part that could give rise to a prospective touch voltage exceeding 50 V a.c. or 120 V ripple-free d.c., a protective device shall automatically disconnect the supply to the circuit or electrical equipment concerned.

NOTE: Lower touch-voltage limits are required for special electrical installations or locations according to the relevant clauses of Sections 6 and 7.

(c) *Earthing system impedance (earth fault-loop impedance)* The characteristics of protective devices and the earthing system impedance shall be such that, if a fault of negligible impedance occurs anywhere in the electrical installation between an active conductor and a protective earthing conductor or exposed conductive part, automatic disconnection of the supply will occur within the specified time.

NOTE: Clause 5.7 contains further requirements and Appendix B provides guidance regarding earth fault-loop impedance.

d) *Disconnection times* The maximum disconnection time for 230/400 V supply voltage shall not exceed the following:

(i) 0.4 s for final subcircuits that supply—

(A) socket-outlets having rated currents not exceeding 63 A; or

(B) hand-held Class I equipment; or

(C) portable equipment intended for manual movement during use.

(ii) 5 s for other circuits including submains and final subcircuits supplying fixed or stationary equipment.

NOTE: Maximum disconnection times will vary for other voltages and installation conditions. Appendix B provides further guidance regarding disconnection times.

touch voltage limits (Auto disconect)

State the main reason why the overall impedance of an earth fault loop must be low.

subcircuit.

maximum disconnection time permitted for MCB

to reduce the loop impedance to below that permitted value.

(e) *Supplementary equipotential bonding* Bonding of extraneous conductive parts and their connection to the earthing system may be used to reduce the earth fault-loop impedance, in order to ensure that the disconnection time of the protective device is sufficient to satisfy the requirements of Clause 1.5.5.3.(b) to (d).

NOTE: This provision does not preclude other measures, such as selection of an alternative protective device that has a lower automatic operating current (Ia) within the required disconnection time, e.g. an RCD.

1.5.5.4 *Protection by the use of Class II equipment or by equivalent insulation*

(a) *General* Protection against the occurrence of dangerous voltages on accessible conductive parts of electrical equipment in the event of a fault in the basic insulation may be achieved by one of the following means:

(i) Equipment having double or reinforced insulation (Class II equipment).

(ii) Switchgear assemblies having total insulation in accordance with AS/NZS 3439.1.

(iii) Equipment having basic insulation with appropriate supplementary insulation applied during installation.

(iv) Equipment having uninsulated live parts with

(MEN system)
commencing at the point of the fault, state the parts of the earth fault loop circuit through wich the fault current flows?

- The protective earthing conductor.
- The earth bar/MEN Link / neutral bar.
- The main neutral.
- The distribution neutral.
- The transformer star point.
- The transformer winding.
- The distribution active.
- The mains active conductor.

GK

(e) *Supplementary equipotential bonding* Bonding of extraneous conductive parts and their connection to the earthing system may be used to reduce the earth fault-loop impedance, in order to ensure that the disconnection time of the protective device is sufficient to satisfy the requirements of Clause 1.5.5.3.(b) to (d).

NOTE: This provision does not preclude other measures, such as selection of an alternative protective device that has a lower automatic operating current (Ia) within the required disconnection time, e.g. an RCD.

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(i) Equipment having double or reinforced insulation (Class II equipment).

(ii) Switchgear assemblies having total insulation in accordance with AS/NZS 3439.1.

(iii) Equipment having basic insulation with appropriate supplementary insulation applied during installation.

(iv) Equipment having uninsulated live parts with appropriate reinforced insulation applied during installation.

Where the means of Item (iii) or (iv) is used, the additional insulation and the intended use of the electrical equipment shall provide a degree of safety equivalent to Item (i) or (ii).

NOTES:

1 Coatings, such as paint, varnish, enamel, or similar products, are not considered appropriate insulating covering for the purpose of this Clause.

2 In accordance with Clause 1.5.14, where damage to double insulation may be reasonably expected, precautions should be taken to ensure protection. Such precautions may include earthing the enclosure or RCD protection.

Constructional requirements Where protection is dependent on a separate covering or enclosure providing supplementary insulation the following shall apply:

(i) Any insulating covering shall not contain any screws or bolts made of insulating material if there is a risk of impairment of the insulation by the replacement of such screws or bolts by metal screws or bolts.

(ii) Where lids or doors in any insulating enclosure can be opened without the use of a tool or key, conductive parts shall be located behind an insulating barrier that provides a degree of protection not less than IPXXB or IP2X and which shall be removable only by use of a tool.

where the protection disconection time
re circuitecin be greater 0.45 but not
iceed 5 seconds.

- The main switch.
- The protective device.
- The final sub-circuite active.
- The flexible cord active.

Four electrical hazards the impedance of a Low voltage installation mainneutral is of a higher value than that of the main earth.

1- A touch voltage hazard between conductive parts and the mass of earth.

2- protective devices may not operate under fault condition.

3- Fire hazard at any high resistance joint in the main neutral.

4- Risk of shock in neighbouring Properties.

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1.5.5.5 *Protection by electrical separation*

Protection by electrical separation is intended, in an individual circuit, to prevent shock current through contact with exposed conductive parts that might be energized by a fault in the basic insulation of that circuit.

Live parts of a separated circuit shall not be connected at any point to earth or to another circuit.

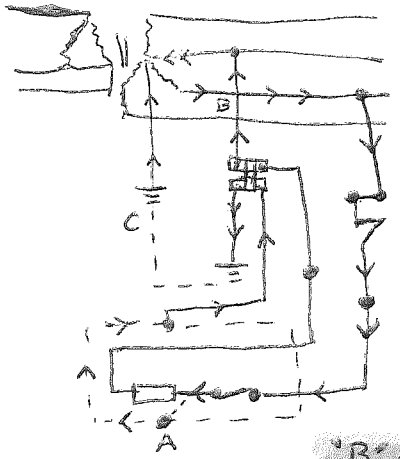
Any protective bonding conductor associated with a separated circuit shall not be connected at any point to earth.

NOTE: Clause 7.4 contains requirements for protection by electrical separation.

1.5.6 Additional protection by the use of RCDs

1.5.6.1 *Basic protection*

RCDs are not recognized as a sole means of basic protection (in normal service) but may be used to augment one of the means set out in



1- The dotted line represent the frame of the appliance. What does 'A' represent?
An active(phase) to frame fault on the appliance.
2- what do the paths represented by the arrows on the figure show?
It is considered to be the earth fault loop with the lowest impedance.
3- Why in the path from 'A' through 'B' considered more important than the path from 'A' through 'C'?
It is considered to be the earth fault loop with the lowest impedance.

GK

(a) The nominal voltage shall not be capable of exceeding the limits for extra-low voltage (50 V a.c. or 120 V ripple-free d.c.) and the source of supply is arranged so that it cannot exceed these values.

(b) Circuits shall be electrically segregated from each other and from circuits at higher voltages.

(c) Live parts of SELV circuits shall not be connected to earth or to protective earthing conductors that are part of other circuits or to other live parts.

(d) Live parts of PELV circuits shall be protected from direct contact by barriers or insulation unless the voltage does not exceed 25 V a.c. or 60 V ripple-free d.c. in dry areas where a large contact area with the human body is not expected or 6 V a.c. or 15 V ripple-free d.c. in all other areas.

NOTE: Clause 7.5 provides specific deemed to comply requirements for the arrangement of ELV circuits.

1.5.8 Protection against thermal effects in normal service

Electrical installations shall be arranged so that there is no risk of ignition of flammable materials because of high temperature or electric arc in normal service. During normal operation of the electrical equipment there shall be no risk of persons or livestock suffering burns.

The selection and installation of electrical equipment shall be such that the temperature characteristics of the electrical equipment, properly installed and operated, do not adversely affect the electrical equipment, the electrical installation itself or any other installation, whether electrical or otherwise.

Adequate ventilation shall be provided where heat is generated in normal operation in order to maintain operating temperatures below the rated or specified limits.

NOTES:

1 Account should be taken of the influence that temperature might have on the operational or characteristic values of the electrical equipment.

2 Further information on thermal effects associated with the installation of electrical equipment is given in Clause 4.2.

1.5.9 Protection against overcurrent

Protection shall be provided against injury or property damage because of excessive temperatures or electromechanical stresses caused by any overcurrents likely to arise in live conductors.

Protection may be provided by one of the following methods:

(a) Automatic disconnection on the occurrence of an overcurrent, before this overcurrent attains a dangerous value, taking into account its duration.

(b) Limiting the maximum overcurrent to a safe value and duration.

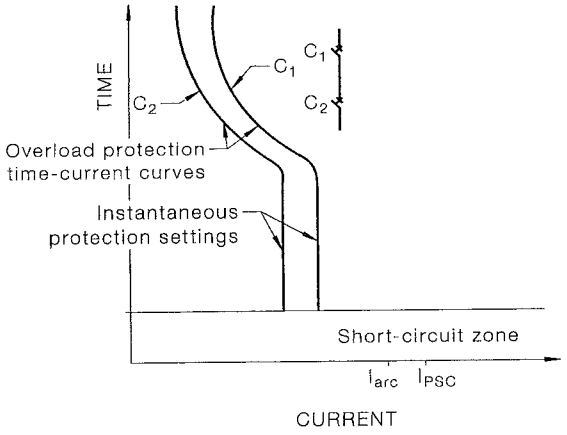


FIGURE 2.11 CIRCUIT-BREAKER CURVES—GENERAL EXPLANATION, SETTINGS AND ZONES

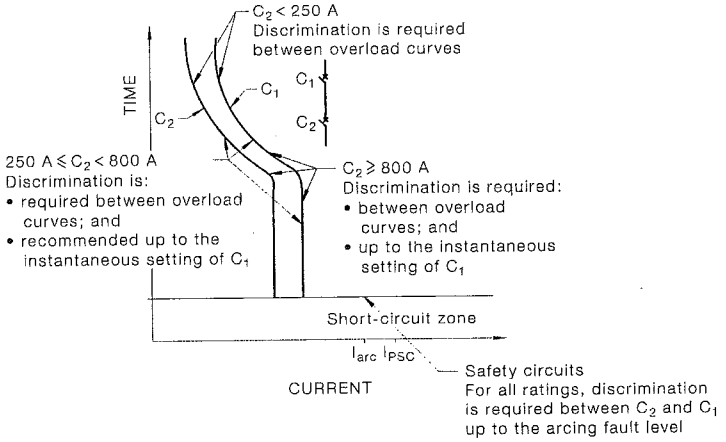


FIGURE 2.12 CIRCUIT-BREAKER CURVES WITH DISCRIMINATION REQUIREMENTS

(RCCBs) are installed, what other type of electrical protection is also required to be installed? - girea reason for answer.

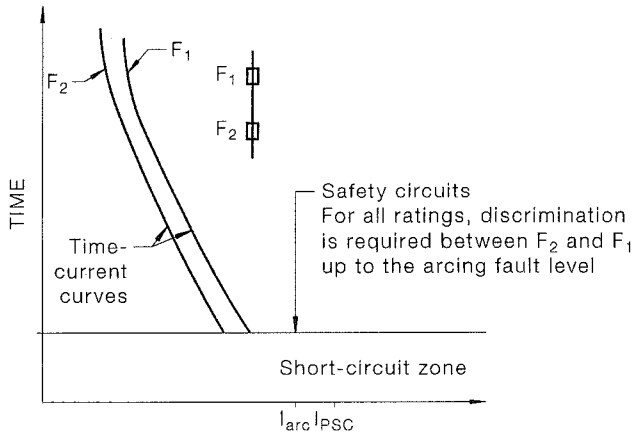


FIGURE 2.13 FUSE CURVES WITH DISCRIMINATION REQUIREMENTS

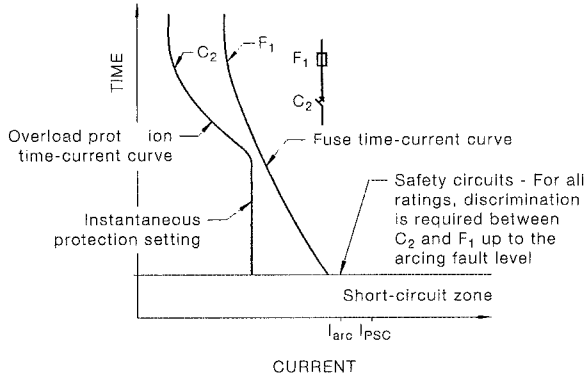


FIGURE 2.14 FUSE AND CIRCUIT-BREAKER CURVES WITH DISCRIMINATION REQUIREMENTS

MCBs or HRC fuses (for overcurrent and short-circuit protection) because RCCBs do not have this type of function.

GK

2.6 ADDITIONAL PROTECTION BY RESIDUAL CURRENT DEVICES

2.6.1 General

The use of fixed setting RCDs with a rated operating residual current not exceeding 30 mA, is recognized as providing additional protection in areas where excessive earth leakage current in the event of failure of other measures of protection or carelessness by users could present a significant risk of electric shock.

NOTE: The use of RCDs is intended only to augment other measures of basic protection.

RCDs do not provide protection against faults between live conductors nor do they provide protection against voltages imported into the electrical installation earthing system through the supply system neutral conductor.

The use of such devices is not recognized as a sole means of protection and does not obviate the need to apply the protective measures specified in Clause 2.4.

Additional protection shall be provided, where required by Clause 2.6.3, to automatically disconnect the supply when an earth leakage current reaches a predetermined value.

NOTES:

1 The requirements in these rules are for RCDs with a maximum sensitivity of 30 mA (can be either 10 mA or 30 mA).

2 RCDs with a sensitivity of 30 mA are designed to operate before fibrillation of the heart occurs.

3 RCDs with a sensitivity of 10 mA are designed to operate before muscular contraction, or inability to let go occurs. Muscular contraction can result in inability to breathe. Infants may be more prone to this risk.

The use of a 10 mA RCD may be considered in areas of increased risk, such as circuits supplying outdoor equipment, bathrooms and areas such as kindergartens. However, the standing leakage from appliances may cause unwanted tripping of 10 mA RCDs and more circuits may be required.

A 10 mA socket-outlet RCD (SRCD), in addition to a 30 mA RCD at the switchboard, is also an option.

2.6.2 Selection and arrangement of devices

2.6.2.1 *General*

Any device for the provision of additional protection shall be capable of interrupting the part of the circuit protected by the device when an earth leakage current is above a predetermined value.

The load current rating of an RCD shall be not less than the greater of the following—

(a) the maximum demand of the portion of the electrical installation being protected by the device; or

(b) the highest current rating of any overload protective device on the portion of the electrical installation being protected.

No earthing or protective bonding conductor shall pass through the magnetic circuit of an RCD.

RCDs shall be so selected, and the electrical circuits so subdivided, that any earth leakage current that may be expected to occur during normal operation of the connected load or loads will be unlikely to cause unnecessary tripping of the device.

NOTES:

1 To avoid unwanted tripping because of leakage currents and transient disturbances, care should be taken to ensure that the sum of the leakage currents of electrical equipment on the load side of an RCD is significantly less than its rated residual current. RCDs may operate at any value of residual current in excess of 50% of the rated residual current.

It is recommended that the loading of the circuit should be such that the leakage current does not exceed one-third of the tripping current.

2 To avoid excessive leakage current causing unwanted tripping where socket-outlets are protected by one RCD having a rated residual current not greater than 30 mA, consideration should be given to the number of socket-outlets protected and the nature of electrical equipment likely to be connected to the socket-outlets.

2.6.2.2 *Type of RCD*

RCDs shall be fixed setting RCDs complying with AS/NZS 3190, AS/NZS 61008.1 or AS/NZS 61009.1 and intended for use in fixed installations.

In New Zealand, an RCD shall, in addition to complying with Clause 2.6.2.1, be of a type where tripping is ensured for residual alternating current and residual pulsating direct current. NZ

In Australia, an RCD shall be of the type that tripping is ensured when the waveform is sinusoidal. A

NOTES:

1 The possible waveform of a fault current to earth can affect the operation of an RCD and shall be taken into account for the selection of the type of RCD.

2 The following types of RCD exist:

(a) Type AC RCD (marked with the symbol ~) for which tripping is ensured for residual sinusoidal alternating currents.

(b) Type A RCD (marked with the symbol ≂) for which tripping is ensured—

(i) as for type AC; and

(ii) for residual pulsating direct currents.

(c) Type B RCD (marked with the symbol ⩰) for which tripping is ensured—

(i) as for Type A; and

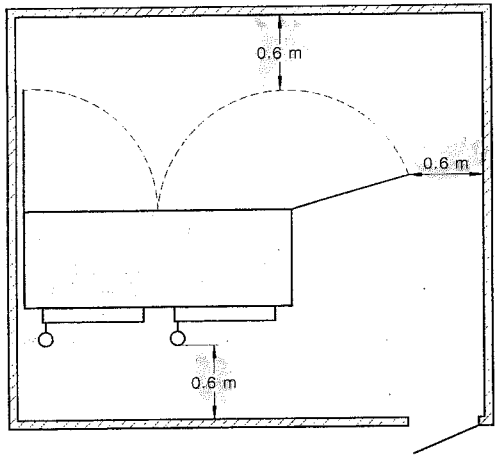


FIGURE 2.17 ACCESS TO SWITCHBOARDS—SWITCHBOARD WITH ONE END AGAINST WALL

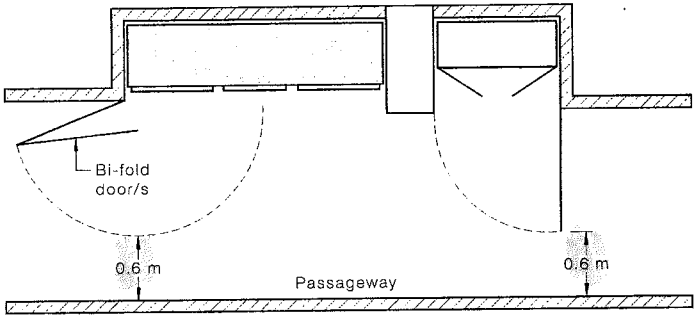


FIGURE 2.18 ACCESS TO SWITCHBOARDS—SWITCHBOARDS WITH DOORS THAT OPEN INTO ACCESSWAYS OR NARROW PASSAGEWAYS

NOTES: (to Figure 2.18)

1 Building and constructional parts must not obstruct access to switchboard (see Clause 2.9.2.2).

2 Clause 2.9.2.2 requires cupboard doors to be capable of being secured in the open position to prevent workers being inadvertently pushed towards the switchboard.

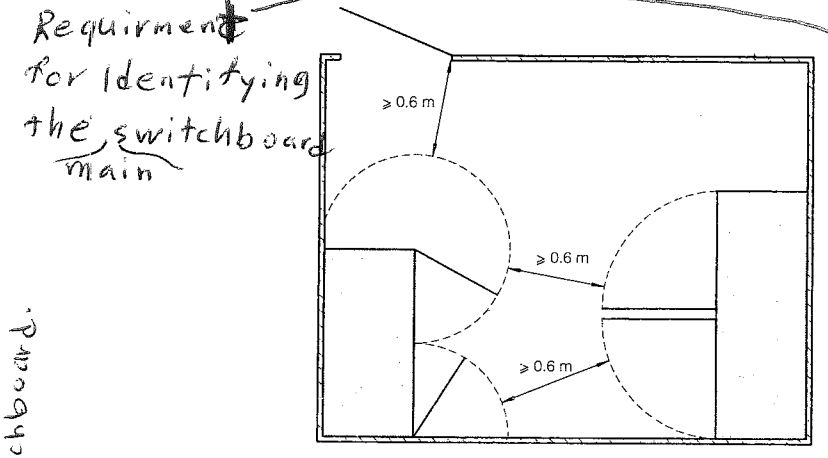


FIGURE 2.19 ACCESS TO SWITCHBOARDS—FACING SWITCHBOARDS

2.9.2.3 *Location of main switchboard*

(a) *General* The main switchboard shall be readily accessible. The main switchboard, or a panel for the remote control of main switches in accordance with Clause 2.3.3, shall be located within easy access of an entrance to the building.

(b) *Multiple electrical installations* In multiple electrical installations the main switchboard shall not be located within any tenancy or single electrical installation of a multiple premise, either domestic or non-domestic.

2.9.2.4 *Identification of main switchboard*

The main switchboard shall be legibly and permanently marked 'MAIN SWITCHBOARD'.

Where a main switchboard is located within a room or enclosure, any door required for immediate personal access shall be prominently and permanently marked to identify the room or enclosure in which the main switchboard is located.

The location of the main switchboard shall be legibly and permanently indicated by a conspicuous notice at each entry to the building that may be used by emergency services personnel.

Notices indicating the location of the main switchboard shall be of permanent construction and shall incorporate the term 'MAIN SWITCHBOARD' in contrasting colours.

Exceptions:

1 *Identification of the main switchboard and its room or enclosure need not apply in a single domestic electrical installation.*

2 *The location of the main switchboard need not be marked at an entry to a building where the location is clearly indicated at a Fire Indicator Panel.*

AMDT No. 1 JUL 2009.

Page 107 Clause 2.9.2.3(a)

Delete the words 'Clause 2.3.3.4' and *replace* with 'Clause 2.3.3.5'.