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**NEW ZEALAND ELECTRICAL
CODE OF PRACTICE
FOR CONTROL PROTECTION AND
SWITCHBOARDS**

Issued by the Office of
The Chief Electrical Engineer,
Energy and Resources Division, Ministry of Commerce

THE ELECTRICITY ACT 1992

Approval of the New Zealand Electrical Code of Practice for
Control Protection and Switchboards 1995 (NZECP 14:1995)

Pursuant to section 38 of the Electricity Act 1992, I, hereby approve the New Zealand Electrical Code of Practice for Control Protection and Switchboards 1995 (NZECP 14:1995).

The New Zealand Electrical Code of Practice for Control Protection and Switchboards 1995 (NZECP 14:1995) was issued by the Acting Secretary of Commerce on the 6th day of July 1995.

Dated this 29th day of April 1996.

Douglas Lorimer Kidd
Minister of Energy

COMMITTEE REPRESENTATION

This Code of Practice was prepared by the Ministry of Commerce, Chief Electrical Engineer's Office with reference to the following organisations:

Electrical Consultants
Electrical Supply Engineers' Association of NZ
New Zealand Electrical Institute
Electrical Contractors' Association of NZ Inc
Electrical Engineers
Polytech Tutor
Electrical Workers Registration Board
Trans Power

REVIEW

This Code of Practice will be revised as occasions arise. Suggestions for improvements of this Code are welcome. They should be sent to the Chief Electrical Engineer's Office, Ministry of Commerce, PO Box 1473, WELLINGTON

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INTRODUCTION

The safety of an electrical installation is heavily dependant on the rating of fittings used to disconnect supply in the event of faults and the capacity to isolate or control the supply of electricity to sections of that installation.

Generally the fittings used to provide isolation and protection is located in switchboards, which also include the components of an installation that align its compatibility with the supply system.

This code of practice is intended to set acceptable practices for the construction of switchboards and the control and protection of electrical circuits within electrical installations operating at standard low voltage (230/400 volt) supplied from MEN systems of supply.

CONTROL, PROTECTION AND SWITCHBOARDS

SECTION 1

SCOPE AND APPLICATION, INTERPRETATION, GLOSSARY, AND NUMBERING

1.1 SCOPE AND APPLICATION

1.1.1 This Code sets out requirements for switchboards and for the control and protection of:

- (a) Electrical circuits and associated fittings of:
 - (i) Standard low voltage MEN electrical installations; and
 - (ii) Those parts of an electrical installation that operate an MEN system at standard low voltage; and
- (b) Fixed wired appliances that are connected to electrical installations of the kinds referred to in subparagraphs (i) and (ii) of paragraph (a) of this clause.

1.1.1.1 The requirements set out in the Code are intended to ensure that the electrical installations specified in clause 1.1.1 operate satisfactorily with regard to:

- (a) Protection requirements for persons and property;
- (b) The arrangement and control of circuits;
- (c) The protection of circuits from over-current and/or short-circuit currents; and
- (d) The types and location of switchboards and control panels.

1.1.2 This Code sets obligations for the control and protection of electrical circuits and their associated fittings, and fixed wired appliances in standard low voltage electrical installations. Please note that electrical circuits and their associated fittings, and fixed wired appliances, in the following areas or the following kinds also have other Codes that apply to them:

- (a) Caravans and caravan parks (*see NZECP 1*);
- (b) Damp situations (*see NZECP 2*);
- (c) Supply by generating systems not exceeding low voltage (*see NZECP 4*);
- (d) Cold cathode discharge lighting (*see NZECP 5*);
- (e) Medical locations and associated areas (*see NZECP 12*);
- (f) Hazardous areas (*see NZECP 24*);
- (g) Boat marinas and pleasure vessels (*see NZECP 29*); and
- (h) Mineral insulated cables and equipment (*see NZECP 33*).

1.2 INTERPRETATION

For the purposes of this Code, the definitions below shall apply.

- 1.2.1 Circuit-breaker - means a switch capable for opening a circuit automatically, as a result of predetermined conditions, such as those of over-current or under-voltage, or by some form of external control that is designed to interrupt excessive current up to its fault breaking rating.
- 1.2.2 Control panel - means an assembly of fittings for the control or protection of:
(a) A motor, machine, or fixed wired appliance; or
(b) More than one motor, machine, or fixed wired appliance operating as a group (*other than a group forming an integral part of a single machine or single fixed wired appliance*).
- 1.2.3 Distribution switchboard - means a switchboard that has no link between neutral and earth. (*taken from regulation 2(1) Electricity Regulations 1993*)
- 1.2.4 Domestic installation - means an electrical installation in a private dwelling, or that portion of an electrical installation associated solely with an individual flat or unit.
- 1.2.5 Electrical appliance - means any appliance that uses, or is designed or intended to use, electricity, whether or not it also uses, or is designed or intended to use, any other form of energy. (*taken from section 2(1) Electricity Act 1992*)
- 1.2.6 Fault-current limiter - means a circuit-opening fitting designed to limit the instantaneous fault current.
- 1.2.7 Final subcircuit - means a circuit originating at a switchboard and to which electrical appliances are or will be connected.
- 1.2.8 Fittings - means everything used, designed or intended for use, in or in connection with the generation, conversion, transformation, conveyance, or use of electricity. (*taken from section 2(1) Electricity Act 1992*)
- 1.2.9 Fixed wired appliance - means an electrical appliance, or a transformer, that is connected to the wiring of an electrical installation other than by means of a plug and socket. (*taken from regulation 2(1) Electricity Regulations 1993*)
- 1.2.10 Fuse - means a fitting for opening a circuit by utilising a fusible element designed to interrupt the supply of an excessive electrical current.

- 1.2.11 Main switchboard, in respect of an electrical installation - means that switchboard which is used by the consumer to provide the greatest degree of control of the supply of electricity to that installation. *(taken from regulation 2(1) Electricity Regulations 1993)*
- 1.2.12 Multiple electrical installation - means an installation incorporating:
- (a) A number of domestic installations; or
 - (b) A number of non-domestic installations; or
 - (c) A combination of domestic and non-domestic installations.
- 1.2.13 Non-domestic installation - means any electrical installation other than a domestic installation.
- 1.2.14 Over-current - means a current exceeding the rated value of fittings *(i.e., for conductors, the rated value is the current-carrying capacity)*.
- 1.2.15 Protective fitting - means a fitting that interrupts the flow of electricity to a circuit or part of a circuit under adverse conditions of over-current, short-circuit, or leakage to earth: and *(without limitation)* includes circuit-breakers, fuses, RCDs, and fault current limiters.
- 1.2.16 Point *(in fixed wiring)* - means a termination of cables, for example at a socket-outlet, a lampholder, a ceiling rose, or directly at the terminals of an electrical appliance or a luminaire.
- 1.2.17 Readily accessible - means capable of being reached quickly and without climbing over or under or removing obstructions.
- 1.2.18 Residual current devices or *(RCDs)* - means fittings -
- (a) That incorporate a magnetic core through which all active and neutral conductors of a circuit pass; and
 - (b) That are capable of sensing a current imbalance *(residual current)* as a result of leakage from that circuit; and
 - (c) That are designed to disconnect the supply of electricity when the current imbalance *(residual current)* exceeds a predetermined level.
- (taken from regulation 2(1) Electricity Regulations 1993)*
- 1.2.19 Short-circuit current - means an over-current resulting from a fault of negligible impedance between any two or more live conductors or between live conductors and earth that have different levels of voltage under normal operating conditions.
- 1.2.20 Socket-outlet - means a fitting that:
- (a) Has contacts intended for making a detachable connection with the contacts of a plug; and
 - (b) Is, or is to be, fixed or suspended.

- 1.2.21 Submain - means those fittings forming part of an electrical installation that are used for the supply of electricity from the main switchboard to any other switchboard, whether or not through intermediate switchboards. *(taken from regulation 2(1) Electricity Regulations 1993)*
- 1.2.22 Switchboard - means an assembly of switchgear with or without instruments, but does not include a control panel or meter panel. *(taken from regulation 2(1) Electricity Regulations 1993)*
- 1.2.23 Switchgear - means any fittings for controlling the distribution of electricity, or for controlling or protecting electrical circuits and electrical appliances.

1.3 GLOSSARY OF ABBREVIATIONS USED IN THIS CODE

A	Amperes
HRC	High rupturing current
m	Metres
mA	Milliamperes
MEN	Multiple-Earthed Neutral
mm	Millimetres
mm ²	Square millimetres
NZECP	New Zealand Electrical Code of Practice
RCD	Residual current device

1.4 NUMBERING SYSTEM OF THIS CODE

- 1.4.1 Sections are numbered from 1 to 6.
- 1.4.2 Subsections are numbered by one full stop between two numbers *(eg: 1.4)*.
- 1.4.3 Clauses are numbered by two full stops between three numbers *(eg: 5.1.1)*.
- 1.4.4 Subclauses are numbered by three full stops between four numbers *(eg: 3.3.1.2)*.
- 1.4.5 Paragraphs contain numbering punctuated by one or more full stops together with a parenthesised letter.
- 1.4.6 Subparagraphs are represented by lower case roman numerals enclosed in parenthesis following paragraphs.
- 1.4.7 Unless otherwise specified, references in this Code to sections, subsections, clauses, subclauses, paragraphs or subparagraphs are references to those of this Code.

SECTION 2

PROTECTION FOR SAFETY

2.1 GENERAL

Electrical installations shall be controlled and protected to ensure that:

- (a) Persons are protected against danger from direct and indirect contact with live parts of the installation; and
- (b) There is no risk of ignition of flammable materials from high temperatures or electric arc from the switching of over-currents or of short-circuits; and
- (c) Persons are protected against injury, and property is protected against damage, from excessive high temperatures or electromechanical stresses resulting from over-currents likely to arise in the installation; and
- (d) Persons are protected against injury, and property is protected against damage, from harmful effects of faults which could occur by contact between live parts of circuits that are supplied with electricity at different voltages.

SECTION 3

SWITCHBOARDS

3.1 GENERAL

Every electrical installation shall have a switchboard and shall have fitted:

- (a) A main switch or switches for control of the installation; and
- (b) Protective fittings for circuits of the installation.

3.2 LOCATION OF SWITCHBOARDS

3.2.1 Switchboards shall be installed and maintained in accessible positions, and be suitably constructed for the environment in which they are located.

3.2.2 The location of the main switchboard shall be identified as follows:

- (a) Subject to paragraph (b) of this clause, where the main switchboard is located within a room or enclosure, any door required for personal access to the switchboard shall be prominently and permanently marked to identify that the main switchboard is located in that room or enclosure.
- (b) The requirements of paragraph (a) of this clause need not be applied to the main switchboard of a domestic installation.

3.2.3 Switchboards shall not be located, placed, or erected:

- (a) In stairwells or under stairways unless totally enclosed in metal or another fireproof material; or
- (b) In a damp situation; or
- (c) Within a room containing a sauna; or
- (d) Above a fixed or stationary cooking appliance; or
- (e) Within a cupboard containing a fire hose reel.

3.3 ACCESSIBILITY OF SWITCHBOARDS

3.3.1 Adequate space shall be provided around a switchboard on all sides where persons are likely to pass. *(The intent of this obligation is to enable all fittings to be safely and effectively operated and adjusted, and to enable ready escape from the vicinity of the switchboard under emergency conditions.)*

3.3.1.1 The space referred to in clause 3.3.1 may be achieved by providing:

- (a) A horizontal clearance of not less than one metre from any part of the switchboard or fitting; and
- (b) A vertical clearance to a height from the ground floor or platform or other walked on surface of 2 m, or to a distance of not less than the height of the switchboard, whichever is the greater.

3.3.2 Switchboards shall be located to allow easy access to fittings.

- 3.3.2.1 Any switches, operating handles, or controls associated with switchboards are to be located not more than 600 mm from the edge or side of the cupboard or bench across which a person must reach to operate, or work on, the switchboard.
- 3.3.3 Where a switchboard is designed to allow persons to enter the switchboard enclosure, provision shall be made for ready and safe access and exit from such a space.
- 3.3.4 Any opening or doorway to a switchboard area shall be not less than 600 mm wide and shall extend from the floor of the switchboard area for a height of not less than 2 m.
- 3.3.5 Any door which is intended to allow persons to leave the vicinity of the switchboard shall open outwards, away from the switchboard, without the use of a key or tool.

3.4 ARRANGEMENT OF FITTINGS ON SWITCHBOARDS

- 3.4.1 Fittings mounted on a switchboard shall be arranged so that live parts are not exposed to direct personal contact. Where access to switchboards is not restricted, a tool or key shall be required to remove escutcheon plates and switchboard covers.
- 3.4.1.1 Live parts may be exposed provided that the switchboard is installed in a separate area where the means of access to such areas is provided by a lock or a mechanism requiring the use of a tool.
- 3.4.1.2 A switchboard in a domestic installation shall not contain exposed live parts.
- 3.4.1.3 Fittings mounted on switchboards shall be securely attached.
- 3.4.2 Subject to clause 3.4.1 and to subclause 3.4.1.1, fuses mounted on switchboards shall not have exposed live parts.
- 3.4.3 Subject to subclause 3.4.3.1, protective fittings shall not be fixed on the back of, or behind, a switchboard panel or frame.
- 3.4.3.1 Clause 3.4.3 does not apply in the case of a fuse, where:
- (a) The fuse is used;
 - (i) Solely as a fault current limiter; or
 - (ii) To protect instruments or control fittings on the switchboard; and
 - (b) In the case of circuit-breakers, the circuit-breakers are able to be operated from the front of the switchboard.
- 3.4.4 Switchboards shall have fitted:
- (a) A neutral busbar for the connection of the neutral conductors; and
 - (b) an earth continuity busbar for the connection of the earthing conductors.

- 3.4.4.1 Main switchboards shall have a removable link of adequate size between the neutral busbar and earth continuity busbar.
- 3.4.5 The electrical current carrying capacity of a neutral busbar shall be adequately sized for the connected load.
- 3.4.6 Every neutral and every earth continuity busbar shall be of a type where:
- (a) The incoming main neutral or earthing lead cannot be inadvertently disconnected from the appropriate busbar; and
 - (b) A separate terminal is provided for the incoming main neutral conductor, the main earthing conductor, and each outgoing circuit; and
 - (c) A mechanism is provided for securely clamping the conductor between metal surfaces so as to prevent the spreading of the cable strands.
- 3.4.6.1 Neutral busbars, earth continuity busbars, and links shall be located and mounted so that -
- (a) Access is not obstructed by the structure or wiring of the switchboard; and
 - (b) All outgoing conductors can be readily and safely connected or disconnected from the busbars without moving other cables and without isolating the electricity supply to the switchboard.

3.5 MARKING

- 3.5.1 Switchboards and their fittings shall be legibly and indelibly marked in a manner that identifies the various sections of the electrical installation they control.
- 3.5.2 Switches, circuit-breakers, fuses, earth-leakage protective fittings, and similar fittings on a switchboard shall be marked to identify the circuits they control.
- 3.5.3 Busbars shall be marked to identify if they are active, neutral, or earth.
- 3.5.4 Terminals of busbars, circuit-breakers, fuses, and other fittings mounted on a switchboard shall be marked or arranged to identify the corresponding active and neutral connection to each circuit.

3.6 TYPES OF SWITCHBOARDS

- 3.6.1 The first switchboard from the electricity supply end in an electrical installation operating at standard low voltage shall be MEN.
- 3.6.2 MEN switchboards of an electrical installation shall:
- (a) Be supplied with electricity from a MEN electricity supply system, or another MEN switchboard; and
 - (b) Have a connection to the earth electrode made to the earth continuity busbar; and

- (c) Have a removable link between the earth continuity busbar and the neutral busbar; and
- (d) Not be supplied with electricity from either a linked busbar switchboard or a distribution switchboard.

3.6.3 Linked busbar switchboards of an electrical installation shall:

- (a) Not be supplied from a distribution switchboard; and
- (b) Have an earth continuity conductor that links the earth continuity busbar of the linked busbar switchboard with the earth continuity busbar of the switchboard from which that linked busbar switchboard derives a supply of electricity; and
- (c) Have a removable link between the earth continuity busbar and the neutral busbar; and
- (d) Not supply a MEN or distribution switchboard.

3.6.4 Distribution switchboards of an electrical installation shall:

- (a) Not be supplied from a linked busbar switchboard; and
- (b) Have an earth continuity conductor that links the earth continuity busbar of the distribution switchboard with the earth continuity busbar of the switchboard from which that distribution switchboard derives a supply of electricity; and
- (c) Not be supplied with electricity from more than one switchboard (*but this does not prevent the total segregation of a single physical switchboard assembly into 2 separate sections*); and
- (d) Not supply a MEN or linked busbar switchboard; and
- (e) Not have a link between any neutral and earth conductors.

3.7 CONTROL PANELS

3.7.1 Control panels shall be installed so that any parts requiring access are not obstructed by the structure of any building, of any machine, or of any non-removable fixture.

3.7.1.1 Control panels shall be installed in locations which are dry and well ventilated unless they are suitably protected against the ingress of moisture.

3.7.2 Where a control panel is designed in such a manner that persons would need to enter the space behind the control panel to work on, connect, or maintain the fittings, provision shall be made for ready and safe access to, and exit from, such a space.

SECTION 4

SELECTION OF PROTECTIVE FITTINGS

4.1 GENERAL

- 4.1.1 Protective fittings forming part of a electrical installation shall:
- (a) Be selected to operate under conditions of over-current, short-circuit, earth fault current, under-voltage and over-voltage, earth leakage current, phase reversal, and no-voltage; and
 - (b) Have characteristics appropriate to their function; and
 - (c) Operate at values of current, voltage, and time which are suitably related to the characteristics of the circuits and fittings they protect; and
 - (d) When protecting a circuit or fitting, be selected to automatically disconnect the active conductors .
- 4.1.2 Protective fittings shall be provided to break any over-current flowing in the circuit conductors before such a current, if it were flowing causes a temperature rise detrimental to insulation, joints, terminations, or surroundings of the conductors.
- 4.1.3 Short-circuit current protective fittings may have a current rating of up to two times that of the lowest rated conductor in the circuit, where -
- (a) The minimum size of conductors in the circuit is not less than 1 mm², and the maximum demand in the circuit is not greater than that of the lowest rated conductor; and
 - (b) The use of the short-circuit protective fitting that is selected will not result in the short-circuit rating of the circuit being exceeded.
- 4.1.4 The current rating of any protective fittings that supply electricity to other fittings (*not being conductors*) that have a rating of 32 A or less shall not exceed twice the rating of the lowest rated other fitting.

4.2 TYPES OF PROTECTIVE FITTINGS

- 4.2.1 The fittings for short-circuit current and over-current protection shall be any of the following types having the correct operating characteristics:
- (a) HRC fuse links.
 - (b) Circuit-breakers.
 - (c) Any other fitting having similar characteristics to HRC fuse links, or to circuit-breakers, provided that the fitting is not of the automatically reclosing type.
- 4.2.2 Fittings for protection against over-current and short-circuit current shall be capable of interrupting any over-current (*up to and including the prospective short-circuit current*) at the point where the protective fittings are installed.

- 4.2.3 Fittings used solely for protection against over-current shall be capable of interrupting any over-current but can have an interrupting capacity lower than the prospective short-circuit current.
- 4.2.4 Fittings used solely for protection against short-circuit current shall be capable of interrupting any short-circuit current up to and including the prospective short-circuit current.
- 4.2.5 RCDs shall be selected according to the purposes for which the devices are required.
- 4.2.5.1 For personal protection, an RCD with a rated residual operating current of not greater than 30 mA shall be used.
- 4.2.5.2 The operation of residual current devices installed for personal protection from the use of electrical appliances shall be verified as meeting all of the following requirements:
- (a) At the rated residual current for an a.c. fault, the devices operate to disconnect the supply within 300 milliseconds.
 - (b) At 5 times the rated residual current for an a.c. fault, the devices operate to disconnect the fault within 40 milliseconds.
 - (c) At 1.4 times the rated residual current for a pulsating d.c. fault, the devices operate to disconnect the fault within 300 milliseconds.
 - (d) At 7 times the rated residual current for a pulsating d.c. fault, the devices operate to disconnect the fault within 40 milliseconds.

4.3 FAULT-CURRENT LIMITATION

Where fault-current limitation fittings are to be used, they shall be selected to limit the instantaneous fault current to a value within the capacity of the fitting or fixed wired appliance being protected. In making that selection the following factors shall be taken into account:

- (a) The short-circuit current available from the supply system.
- (b) The rating and characteristics of the connected fitting or fixed wired appliance.
- (c) The rating and characteristics of the protective fitting associated with the connected fitting or fixed wired appliance.

SECTION 5

PROTECTION OF CIRCUITS

5.1 MAINS, SUBMAINS AND FINAL SUBCIRCUITS

- 5.1.1 Except as provided for in clause 5.1.4 every main, submain, and final subcircuit shall be individually protected against over-current, and short-circuit current by a circuit protective fitting located at the beginning of the circuit.
- 5.1.2 On the occurrence of a short-circuit or earth fault of negligible impedance, the short-circuit protective fitting shall operate to disconnect the faulty circuit or circuits in a period not exceeding 40 milliseconds.
- 5.1.3 Over-current protective fittings shall be of a type that operate, in the event of an over-current of 150% the rating of the circuit conductors, within four hours.
- 5.1.4 Where protective fittings for mains and submains are rated for short-circuit faults only, a separate over-current protective fitting shall be provided for in the electrical installation.
- 5.1.5 Except where a subcircuit is of a design where over-current cannot occur, an over-current protective fitting shall be provided at the beginning of, or at all points on, the subcircuit.
- 5.1.6 Protective fittings shall not be inserted into an earthed neutral conductor or into a circuit unless the active conductors are switched simultaneously.

5.2 ELECTRIC MOTORS

Electric motors (other than those forming part of electrical appliances) shall,-

- (a) Have an effective means of starting and stopping that is located to enable easy operation; and
- (b) Be fitted with a means of preventing automatic restarting after a stoppage due to a drop in voltage or the complete failure of electricity supply, where restarting may result in injury to persons or damage to property; and
- (c) Be installed with protection, either as part of the motor or incorporated in the circuit supplying the motor, to prevent danger to persons and property from faults due to electrical or thermal overload, or due to short circuits; and
- (d) Where the protection required by paragraph (c) of this subsection is of the electronic overload kind, the motor terminal enclosure is labelled "**WARNING -- ELECTRONIC OVERLOAD**"; and
- (e) Where of the polyphase type and where failure of one phase or reversal of phase rotation of electricity supply may result in injury to persons or damage to property, be fitted with phase failure protection or phase reversal protection, as the case may be.

SECTION 6

CONTROL REQUIREMENTS

6.1 GENERAL

- 6.1.1 Isolating switches shall be provided in an electrical installation so as to allow the disconnection of the electrical installation, or of circuits or fittings or fixed wired appliances of the installation, as required for maintenance, testing, fault detection, repair, or emergency purposes.
- 6.1.1.1 Every main switch and any switch or circuit-breaker used for isolation shall have a current rating not less than the maximum demand of that portion of the electrical installation it supplies or controls.
- 6.1.1.2 Every fixed wired appliance shall be controlled by a manually operated fitting mounted within easy reach for normal operation, and that fitting shall be additional to any automatic control fitting, and shall be arranged to isolate the appliance effectively from the electricity supply.
- 6.1.1.3 Where the manually operated fitting referred to in subclause 6.1.1.2 is remote from the fixed wired appliance, an additional means of isolation shall be provided adjacent to the appliance or, alternatively, provision shall be made for the remote means of isolation to be effectively locked in the off position.
- 6.1.2 All emergency isolating switches shall be installed in readily accessible positions.
- 6.1.3 Supplies of electricity to a fire compartment within an electrical installation shall be able to be isolated from a single operating position.
- 6.1.4 Every single pole switch or circuit-breaker of an electrical installation shall operate the active conductor of the circuit in which it is connected.
- 6.1.5 Where an electrical installation comprises multiphase circuits, every switch or circuit-breaker shall simultaneously operate all the active conductors of the circuit.
- 6.1.5.1 The requirements of clause 6.1.5 need not apply to the following:
- (a) An automatically controlled switch controlling a motor, if another switch is connected in series with it and that other switch operates simultaneously the active conductors;
 - (b) Remote control switches in control circuits; or
 - (c) Switches or circuit-breakers in submains or final subcircuits.
- 6.1.6 Any linked or multi-pole switch or circuit-breaker inserted in a neutral or earth conductor shall be so arranged that the contacts to which the neutral and earth conductors are connected cannot be opened before, or closed after, the contacts to which the live conductors are connected.

- 6.1.7 A switch or circuit-breaker shall not operate in the neutral conductor of -
- (a) An earthed sheathed return (*ESR*) system;
 - (b) A submain where the neutral is used for the earthing of electrical installations in outbuildings; or
 - (c) A control circuit with an earthed neutral.
- 6.1.8 Under the following conditions a switch may operate a neutral conductor in any electrical installation containing systems or submains, as the case may be, of the kinds referred to in paragraphs (a) and (b) of clause 6.1.7:
- (a) Where the switch is a multipole switch and includes a contact intended for connection to the neutral.
 - (b) Where the switch is linked with corresponding switches so that the neutral contact cannot remain open when the active contacts are closed.
 - (c) Where the switch is employed in a fire-pump control circuit.
- 6.1.9 Socket-outlets with a rating of 32 A or more shall have an adjacent switch or shall be fitted with an integral isolator.
- 6.1.10 A low voltage electric range that is not a fixed wired appliance shall be connected to a power supply through a socket-outlet of appropriate rating and have a readily accessible isolation switch.

6.2 SPECIFIC REQUIREMENTS

- 6.2.1 The supply of electricity to every electrical installation shall be controlled on the main switchboard by a main isolating switch or switches that control the whole of the electrical installation.
- 6.2.2 Main switches shall be readily accessible and the means of operating such switches shall be not more than 2 m above the ground, floor or platform.
- 6.2.3 Main switches shall be legibly and permanently marked "**MAIN SWITCH**" with the operating position clearly designated.
- 6.2.4 Where main switches are capable of being operated by remote control the following requirements shall apply:
- (a) The remote control system shall consist of a control panel incorporating fittings for the selective opening and closing of all main switches controlled.
 - (b) The remote control system shall be located and identified in accordance with clauses 6.2.2 and 6.2.3.
 - (c) Control and signalling circuits between the main switchboard and the control panel shall either:
 - (i) Operate at extra-low voltage; or
 - (ii) Be arranged and installed to provide protection against contact with live parts in the case of a fire or other emergency.
 - (d) Control circuits shall be designed, arranged, and installed to prevent inadvertent reclosing of the main switches due to a fault or malfunction in the circuit wiring.

- (e) The remote control circuits shall comply with clause 6.3.2.
- (f) The main switch shall be provided with a suitable device to enable it to be locked in the open position.
- (g) Any number of main switches may be controlled from a remote position.

6.2.5 Electric motors (*other than those forming part of electrical appliances*) shall:

- (a) Have an effective means of starting and stopping that is located in a position that enables easy operation; and
- (b) Be fitted with a means of controlling automatic restarting after a stoppage due to a drop in voltage, or after the complete failure of electricity supply.

6.2.6 Electric motors shall have a means of isolation to disconnect all voltage from the motor, and that means of isolation shall -

- (a) Be located adjacent to the motor; or
- (b) If not located adjacent to the motor, be capable of being locked in the off position.

6.3 FIRE AND SMOKE CONTROL EQUIPMENT, EMERGENCY EVACUATION EQUIPMENT AND LIFTS

6.3.1 Fault-current limiters that are used to protect fire and smoke control equipment, evacuation equipment, or lifts shall not be used to provide protection to any other part of the electrical installation.

6.3.2 Cables associated with fire and smoke control equipment, evacuation equipment, and lifts shall be capable of maintaining an adequate supply of electricity to the equipment when exposed to fire.

6.3.3 Over-current protective fittings provided on circuits supplying fire-pump motors shall -

- (a) Have an inverse time characteristic; and
- (b) Be rated, or in the case of circuit-breakers set, to -
 - (i) Carry continuously 150% of the full-load motor current; and
 - (ii) Open the circuit in not less than 50 seconds at 600% of the full-load motor current.

6.3.4 Control circuits associated with the operation of fire-pump motors shall -

- (a) Be directly connected between the conductors of the pump circuit;
- (b) Be arranged so that the active conductor of the control circuit is directly connected to the coil of the fitting within the starter that operates the motor; and
- (c) Not be provided with over-current protective fittings other than those provided for the pump-motor circuit.

6.3.5 Each part of an electrical installation supplying electricity to fire equipment shall be controlled by separate main switch from those used to control the remainder of the electrical installation.

- 6.3.6 Switches operating in the circuit supplying electricity to fire and smoke control equipment, evacuation equipment, or lifts shall be clearly marked to indicate the fire and smoke control equipment, evacuation equipment, or lifts that they control.
- 6.3.7 Where fire-pump motors are automatically controlled, a manually operated isolating switch shall be connected on the supply side of the pump motor controller.
- 6.3.7.1 The isolating switch referred to in clause 6.3.7 shall -
- (a) Physically separate the fire pump circuit from all active supply conductors;
 - (b) Have a current rating of not less than;
 - (i) The full-load current of the motor where the isolating switch is installed directly in the motor supply circuit; or
 - (ii) The control circuit when the isolating switch is installed in the motor starter circuit.
 - (c) Be installed adjacent to or on the pump motor controller; and
 - (d) Be provided with a device for locking the switch in the closed position.
- 6.3.8 Over-temperature protective fittings shall not be provided on fire-pump motors where the operation of such fittings might reduce the operating time of the equipment under emergency conditions.