

NEW ZEALAND
ELECTRICAL CODE OF PRACTICE
FOR
HOMEOWNER/OCCUPIER'S
ELECTRICAL WIRING WORK
IN DOMESTIC INSTALLATIONS

Issued by:
Deputy Secretary
Energy Safety Service
Wellington, New Zealand

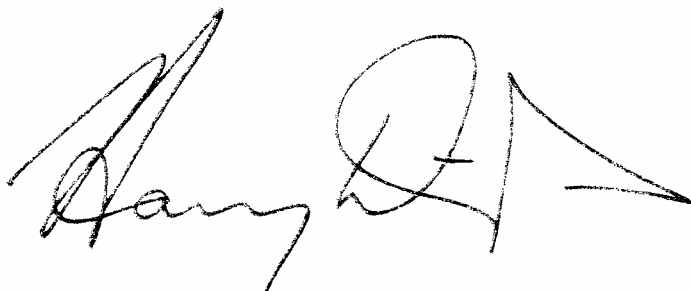
THE ELECTRICITY ACT 1992

Approval of the New Zealand Electrical Code of Practice for Homeowner/Occupier's Electrical Wiring Work in Domestic Installations 2004 (NZECP 51:2004) and the Revocation of the New Zealand Electrical Code of Practice for Electrical Wiring Work in Domestic Premises (NZECP 51:1993)

Pursuant to section 38 of the Electricity Act 1992, I hereby approve the New Zealand Electrical Code of Practice for Homeowner/Occupier's Electrical Wiring Work in Domestic Installations 2004 (*NZECP 51:2004*) and the Revocation of the New Zealand Electrical Code of Practice for Electrical Wiring Work in Domestic Premises (*NZECP 51:1993*).

The New Zealand Electrical Code of Practice for Homeowner/Occupier's Electrical Wiring Work in Domestic Installations 2004 (*NZECP 51:2004*) and the Revocation of the New Zealand Electrical Code of Practice for Electrical Wiring Work in Domestic Premises (*NZECP 51:1993*) was issued by the Deputy Secretary, Energy Safety Service, acting under delegated authority (*pursuant to section 41 of the State Sector Act 1988*) from the Chief Executive, Ministry of Economic Development on the 17th day of June 2004.

Dated this 27th day of July 2004.

A handwritten signature in black ink, appearing to read 'Gary R. [unclear]', written in a cursive style.

Associate Minister of Energy

COMMITTEE REPRESENTATION

This Code of Practice was prepared by the Energy Safety Service, Ministry of Consumer Affairs, in consultation with the following:

Electrical Contractors Association of New Zealand
Electricity Engineers' Association of New Zealand Inc
Institution of Professional Engineers New Zealand
Standards New Zealand
New Zealand Electrical Institute
Building Industry Authority of New Zealand
Electrical Workers Registration Board
Electrical Safety Organisation
National Council of Women of New Zealand
New Zealand Council of Elders
Consumers Institute

REVIEW

This Code of Practice will be revised as occasions arise. Suggestions for improvements of this Code are welcome. They should be sent to ECP 51, Energy Safety Service, Ministry of Consumer Affairs, PO Box 1473, WELLINGTON.

ACKNOWLEDGEMENT

The damp location diagrams for baths, showers and other fixed water containers are taken from the Joint Australian/New Zealand Wiring Rules Standard AS/NZS 3000:2000, with permission from Standards New Zealand.

FOREWORD

Are you competent to be able to carry out the work to which this code applies? You are only permitted to carry out work on 230 volt (V) domestic electrical installations. To increase your skills in electrical work, there are training courses available at your local polytechnic or through your Community educational services or Marae.

When you are running in new cables from the main switchboard of an existing installation you are **NOT** permitted to gain entry into the back of any switchboard enclosure. The cables must be left in the ceiling space in close proximity to the main switchboard. The placing and connection of any cable into the switchboard must be carried out by a licensed electrical worker.

For new electrical installations you may place the cables into the main switchboard enclosure (*providing there is no electricity supply connected to that switchboard*). The connection of the cables into the switchboard must be carried out by a licensed electrical worker and must be inspected by a licensed electrical inspector.

The testing and certification of electrical work carried out by the owner of an electrical installation in accordance with this code must be undertaken by a licensed electrical inspector. The inspector will inspect and test the work in accordance with NZS 3019 and must include a random selection of socket-outlets and light switches and light fittings, all socket-outlets rated above 10 A, all permanently connected appliances and all fittings, electrical appliances and light fittings associated with damp locations. Upon completion, the inspector will certify and sign the work.

The following extracts from the Electricity Act 1992 and Electricity Regulations 1997 are applicable to domestic electrical installations that are owned and occupied by the owner.

To obtain copies of the relevant legislation, see website: www.legislation.govt.nz

Electricity Act section 169 only Clause 20 shown

169. Regulations – (1) The Governor-General may from time to time, by Order in Council, make regulations for all or any of the following purposes:

(20) Prescribing the limits or scope of prescribed electrical work which any of the persons referred to in section 108 (2) of this Act, or any person to whom section 109 or section 110 or section 111 or section 112 of this Act applies, may do or assist to do:

Electricity Act section 110

110. Exemption for domestic electrical work – (1) Notwithstanding anything in section 108 of this Act, the owner of any premises that are occupied or intended to be occupied by that person as a residence for that person, or for that person and members of his or her family, may do any electrical wiring work, or assist in doing any electrical wiring work, in relation to those premises, if–

- (a) That work is within the limits prescribed in regulations made under section 169 of this Act for the purposes of this section; and
- (b) The work is carried out in accordance with the requirements of any regulations made under section 169 of this Act; and
- (c) The work is carried out in a competent manner; and
- (d) While that work is being carried out, no part of the work is connected to a power supply; and
- (e) Where required by regulations made under section 169 of this Act,
 - (i) Before connection to a power supply, the work is tested and certified by a registered electrical inspector in accordance with regulations made under that section; and
 - (ii) The work is connected to a power supply by such an inspector.

(2) For the purposes of subsection (1) of this section, the term “owner”, in relation to any premises, means the person who (*whether alone or as a joint tenant or tenant in common*) would for the time being be entitled to receive the rack rent of the premises on his or her own account if the premises were let to a tenant at a rack rent.

Electricity Regulation 17 (2)(n)

17. Prescribed electrical work

(2) The following work is deemed not to be prescribed electrical work:

- (n) Work done on low voltage fittings, where–
 - (i) The work consists of–
 - (A) The replacement of a fuse link with a fuse link or plug-in miniature circuit-breaker of appropriate rating; and
 - (ii) There is in force in respect of the work a standard set by the Secretary for the purpose; and
 - (iii) The work is done in a competent manner, without payment or reward, and in accordance with that standard.

For the purposes of Regulation 17 (2)(n), Appendix A of this code is deemed to meet the Secretary’s requirements.

Electricity Regulation 47

47. Home-owners' electrical wiring work

(1) For the purposes of section 110 of the Act, any person to whom that section applies may do or assist in doing the following work on low voltage electrical installations:

- (a) Remove and replace any of the following kinds of fittings where the work does not involve work on any switchboard:
 - (i) Switches:
 - (ii) Socket-outlets:
 - (iii) Permanent connection units:
 - (iv) Light fittings:
 - (v) Batten holders:
 - (vi) Cord grip lampholders:
 - (vii) Ceiling roses:
 - (viii) Flexible cords connected to any permanent connection unit, ceiling rose, or cord grip lampholder:
 - (ix) Water heater switches:
 - (x) Thermostats:
 - (xi) Elements:
- (b) Remove and replace fuse links:
- (c) Connect and disconnect fixed wired appliances:
- (d) Relocate existing switches, socket-outlets, and lighting outlets that are supplied with electricity by tough-plastic-sheathed cables:
- (e) Install, extend, and alter subcircuits (*including submains*), provided that—
 - (i) The person must not enter (*whether personally, by holding any material or equipment, or otherwise*) any enclosure where live active wires are likely to be present; and
 - (ii) The work is tested by a registered electrical inspector, in accordance with NZS 3019, and the work is certified by that inspector in accordance with regulation 39, before being connected to a supply of electricity by such an inspector.

(2) A person who carries out work pursuant to section 110 of the Act must carry out the work in accordance with the requirements of ECP 51.

2-wire Cables

If your existing electrical installation contains 2-wire cables (*that are used for lighting circuits*) and you wish to add additional lights to the circuit (*which would require 3-wire cable if the light fitting is required to be earthed*) you need to contact a licensed electrical worker for guidance on how this should be wired.

If you are planning to add additions or alterations in your existing electrical installation and the lighting circuit consists of only a 2-wire cable, it is recommended that you run a 3-wire cable to the main switchboard location rather than branching off an existing 2-wire lighting cable.

Some electrical installations may have lighting circuits wired where the cables running from the switchboard are connected at the light fitting and then looped between light fittings (*known in the trade as 3-plate wiring*), this means that live wires are always present at the light fitting rather than at the switches. A way of checking for this is to unscrew a number of light switches and if there are only 2-wires (*coloured red*) at the switches, this would indicate that the live wires are at the light fitting. If unsure, contact a licensed electrical worker.

Remember, if you are adding new circuits to an existing installation, these should be run from the main switchboard location. The circuits must be left in the ceiling space in close proximity to the switchboard.

Maori terms

From a Maori perspective, the term “earth” or Papatuanuku translates as Earth Mother – the source of all energy. When aligning this concept to the flow of electricity, a useful parallel can be made to the 3-pin plug.

Electricity	Maori
Active (phase)	Spiritual element, active, tapu
Neutral	Physical element, neutral, noa
Earth	Mauri or life force derived from Papatuanuku or Earth Mother

For the purposes of regulation 17(2)(n), for payment or reward also means koha.

CONTENTS

FOREWORD	iv
Outline	1
Section 1:Introduction, Definitions, General, Tools, RCD Requiements and Testing and Certification Requirements	2
1.1 Introduction	2
1.2 Definitions	4
1.3 General	8
1.4 Tools	9
1.5 Residual Current Device requirements	9
1.6 Testing and Certification requirements	10
Section 2:The Main Switchboard and Meter Box	12
2.1 General	12
Section 3:Selecting and Installing Cables	14
3.1 General	14
3.2 Placing cables	17
3.3 Running TPS cable circuits	17
3.4 Protecting your cables	18
3.5 Supports for cables	19
3.6 Connecting cables	19
3.7 Underground cables	20
Section 4:Earthing and Equipotential Bonding	25
4.1 The main earthing system	25
4.2 Equipotential bonding	26
Section 5:Connecting Fittings, Electrical Appliances and Light Fittings	28
5.1 General	28
5.2 Preparing cables	28
5.3 Extra requirements for light switches and light fittings	30
5.4 Extra requirements for electric storage water heaters	32
5.5 Extra requirements for electric cooking appliances	33
Section 6:Specific Requirements for Damp Locations	35
6.1 General	35
6.2 Definitions	36
6.3 Classification of zones	36
6.4 Socket outlets	38
6.5 Switches	39

6.6	Light fittings, battenholders and cord grip lampholders	39
6.7	Electrical appliances (<i>heaters, heated towel rails, fans etc</i>)	40
Section 7: Specific Requirements for Recessed Light Fittings and Their Auxiliary Equipment		48
7.1	General	48
7.2	Definitions	48
7.3	Installation requirements	49
7.4	Recessed light fittings and auxiliary equipment - classes	52
7.5	Auxiliary equipment	54
7.6	Moist areas	55
Appendix A RCDs, Fuses, and Circuit-Breakers		60
A1	Residual current devices (<i>RCDs</i>)	60
A2	Fuses and circuit-breakers	61
A3	Replacing or repairing a ruptured or blown fuse	67
A4	Procedure for testing cartridge fuses	68
A5	Replacing re-wireable fuses with plug-in circuit-breakers	70
Appendix B Electrical Safety Checks		73
B1	Stay safe	73
B2	Socket-outlets	73
B3	Heating appliances	74
B4	Light fittings	74
B5	RCDs	74
B6	Electrical appliances	75
Tables		
Table 1:	Installation circuits	13
Table 2:	Cable insulation types	14
Table 3:	Circuit wire sizes	15
Table 4:	Requirements for physical protection of underground cables	20
Table 5:	Zone dimensions for baths and showers	36
Table 6:	Classification of zones for other fixed water containers not exceeding 45 litres	38
Table 6A:	Classification of zones for other fixed water containers exceeding 45 litres	38
Table 7:	Summary of types of fittings, electrical appliances and light fittings for the different zones, including the IP ratings	41
Table 8:	Moisture transfer classes	52

Table 9:	Thermal insulation clearance classes	53
Table 10:	Recessed light fittings: clearances from thermal insulation	54
Table 11:	Recessed light fittings cross-referenced with ceiling types	56
Table 12:	Circuits and current ratings of fuses or circuit-breakers	62
Table 13:	Fuse/circuit-breaker sizes	70

Figures

Figure 1:	Colour coding of flexible cords and TPS cable wires	16
Figure 2:	Location of holes for cables in 100 x 50 mm timber framing	19
Figure 3:	1-way lighting circuit	22
Figure 4:	2-way lighting circuit	23
Figure 5:	Socket-outlet circuit (<i>including permanent connection unit</i>)	24
Figure 6:	Earth electrode and connections	26
Figure 7:	Wire with insulation removed	29
Figure 8:	Wire doubled over	29
Figure 9:	Ceiling rose, batten holder, lampholder and permanent connection unit	31
Figure 10:	Connecting up electric storage water heaters that do not have supply connection blocks	33
Figure 11:	Electric cooking appliance supply cable and flush box	34
Figure 12:	Zone dimensions baths	43
Figure 13:	Zone dimensions for showers with a base	44
Figure 14:	Zone dimensions for showers without base	45
Figure 15:	Zone dimensions baths and showers (<i>elevation</i>)	46
Figure 16:	Zone dimensions for other fixed water containers not exceeding 45 litres	47
Figure 17:	Zone dimensions for other fixed water containers exceeding 45 litres	47
Figure 18:	Minimum clearances for recessed light fittings	58
Figure 19:	Moist, habitable, and utility areas	59
Figure 20:	Prohibited cutting or notching of joists, beams, rafters and ceiling battens	59
Figure 21:	Types of fuses	65
Figure 22:	Other types of re-wireable fuses	66
Figure 23:	Testing cartridge fuses	69
Figure 24:	Replacement of fuses with plug-in circuit-breakers	72

OUTLINE

If you own your domestic installation, and do not have an appropriate electrical qualification, and you are planning to carry out electrical wiring work there, you are required by law to do the work “in a workmanlike manner”, in accordance with this Code, without payment, reward or koha. Only a licensed electrical worker can carry out work on another person’s home or do work for payment, reward or koha.

If you carry out work in accordance with this Code, you are considered to have met the requirements of the Electricity Act and Regulations set out in the Foreword.

To increase your skills in electrical work, courses are available from your local polytechnic or Community educational services or Marae.

When you are carrying out electrical wiring work on your own 230 volt (V) domestic electrical installation that is owned and occupied by you, you need to read Sections 1 – 6. The details for installing recessed light fittings are set out in Section 7.

Any electrical wiring work carried out by you can only be connected to the electricity supply by a licensed electrical inspector, see Foreword regulation 47(1)(e)(ii).

You are **NOT** permitted to gain entry into the back of any live wiring or switchboard enclosure or meter-box. The wiring installation **MUST** be carried out by a licensed electrical worker.

If you are to remove any existing fitting (*socket-outlet, switch etc*) **ALWAYS** test the circuit and disconnect the electricity supply, by removing the fuse or turning off the circuit-breaker on the main switchboard.

This Code does **NOT** apply to:

- (a) the wiring of meter-boxes or switchboards;
- (b) electrical installations of swimming pools, paddling pools or spa pools, saunas, fountains or water features;
- (c) the use of wiring in conduits (*either metal or plastic*), neutral screen or armoured type wiring;
- (d) the installation of telecommunications, security or fire alarm systems.

Section 1: INTRODUCTION, DEFINITIONS, GENERAL, TOOLS, RCD REQUIREMENTS, AND TESTING AND CERTIFICATION REQUIREMENTS

1.1 INTRODUCTION

- 1.1.1 If you are the owner of a domestic electrical installation that is for your own private use, then this Code is for you. The work to which this Code applies will be connected to a 230 V system of supply.
- 1.1.2 This Code covers the installation of Tough Plastic Sheath (TPS) wiring only and the use of flexible TPS cabling and fittings connected to those wires.
- 1.1.3 If you carry out any new electrical wiring work in your domestic installation, you must have the work inspected and tested by a licensed electrical inspector.
- 1.1.4 If you are planning to carry out electrical work on a new domestic electrical installation, it is recommended (*before any work is started*) that you contact a licensed electrical worker or an inspector who will be inspecting your work when completed. Ask for information about the position of the main switchboard, meter-box and any special wiring requirements. It is important to know the position of the main switchboard and meter-board, in particular, so that you know the position to which you will run the cables and what type of cable to use. Electricity retailers usually require that revenue meter(s) must be able to be read from outside the home.
- 1.1.5 Before carrying out new electrical wiring work in an existing domestic installation, it is recommended that you contact a licensed electrical worker for any special wiring requirements. RCDs are required for any new wiring (*see subsection 1.5*). If the RCD is to be connected to the main switchboard, this work **MUST** be carried out by a licensed electrical worker. If the RCD forms part of a socket-outlet, it can be installed by you. This RCD must be connected to the first socket-outlet on the new wiring circuit from the switchboard.
- 1.1.6 For electrical installations of new homes or for extensions to existing homes, construction site plans that have been

approved by your local authority will be on site. Use these plans for laying out where you want your lighting switches, light fittings, socket-outlets, oven, cooktop etc. This will assist you when it comes to running the circuit wiring from the main switchboard, and with the number of circuits you should run (see *Table 2 for the guide to the installation circuits, and Table 4 for the correct circuit wire sizes*).


- 1.1.7 You are **NOT** permitted to gain entry into the back of any live wiring or switchboard enclosure or meter-box. The wiring installation of any switchboard or meter-box must be carried out by a licensed electrical worker. Following inspection and testing, a licensed electrical inspector will live the new wiring.
- 1.1.8 For new electrical installations you may place the cables into the main switchboard enclosure (*providing there is no electricity supply connected to that switchboard*). The connection of the cables into the switchboard must be carried out by a licensed electrical worker and must be inspected and tested by a licensed electrical inspector before livening.
- 1.1.9 If you are to remove any existing fitting (*socket-outlet, switch etc*), **ALWAYS** test the circuit and disconnect the electricity supply, by removing the fuse or turning off the circuit-breaker on the main switchboard.
- 1.1.10 Use the manufacturer's instructions for the wiring of fittings if they are available.
- 1.1.11 This Code includes advice on how to repair a rewirable fuse link or replace a cartridge fuse, and how to replace a fuse carrier with a plug-in circuit-breaker. It also covers the correct procedures for resetting a circuit-breaker or a residual current device (*RCD*) and gives a recommended time interval for regularly testing RCDs, see Appendix A.
- 1.1.12 This Code also provides general electrical safety tips in and around your home, see Appendix B.

1.2 DEFINITIONS

AC	Alternating current, e.g. your electrical installation uses AC.
Active (<i>Phase</i>) Red (<i>Installation wiring only</i>)	Any wire used to conduct electricity that is maintained at a different voltage from the neutral or earth wires.
Batten holder	A fitting that holds a light bulb. It is usually constructed entirely of insulating material, except for the parts that carry current, see Figure 9 (<i>Page 31</i>). There are two types, bayonet-cap and edison screw.
Cable	One or more insulated wires, enclosed in a sheath.
Ceiling rose	A fitting (<i>usually used to attach to the ceiling</i>) designed for the connection between the electrical installation wiring and a flexible cord (which is in turn connected to a lampholder), see Figure 9 (<i>Page 31</i>).
Circuit	Wires arranged for the purpose of carrying an electric current.
Circuit-breaker	A device designed to automatically disconnect the power supply in the event of an overload or fault. This can also be manually operated as a switch to disconnect a circuit. Circuit-breakers are different to residual current devices in that they will not protect you from receiving an electric shock.
Damp location	A place where moisture is present (<i>either permanently or intermittently</i>) to the extent that it might decrease the effectiveness or safety of an electrical installation.
DC	Direct current, e.g. a torch or portable radio uses direct current from a battery.

Degree of protection/ Ingress Protection (<i>IP</i>) rating	The extent of protection provided by an enclosure against contact with hazardous parts or against the entrance of solid foreign objects, water or dust. Enclosures need to be marked with an IP rating, e.g. IP67; the last two digits will vary depending on the type of enclosure.
Domestic installation	An electrical installation in a private dwelling or the portion of an electrical installation that is associated solely with an individual flat or living unit.
Earth electrode	A metal rod or rods, or other conducting objects, that provides an effective connection to the earth.
Earthed	Effectively connected to the earth.
Earthing wire	A wire that connects any portion of the earthing system– (a) To another portion of the earthing system; or (b) To a portion of the installation; or (c) To electrical equipment that is required to be earthed.
Easily accessible	Capable of being reached quickly and easily without obstructions, and without having to use a movable ladder. Not more than 2 m above the ground, floor or platform.
Electrical appliance	An appliance that needs electricity to work.
Electrical installation	(a) All fittings that form: (i) Part of a system for conveying electricity; and (ii) Part of such a system at any point from the point of supply to the point where electricity is used; and (b) Includes any fittings that are used, or designed or intended for use, by any person, in or in connection with the generation of electricity for that person's use and not for supply to any other person; but (c) Does not include any electrical appliance.
Equipotential bonding	The electrical connection of exposed metal parts so that they are at substantially the same voltage.

Equipotential bonding wire	A wire connecting any exposed metal to adjacent exposed metal.
Fitting	Everything used, or designed or intended for use, in or in connection with the generation, conversion, transformation, conveyance, or use of electricity, e.g. switch, socket-outlet, batten holder etc.
Flexible cord	A cable that is designed to be flexed frequently and connects an electrical appliance to the electrical installation by a plug or permanent connection unit. See Figure 1 (<i>Page 16</i>) for types of flexible cords and colour coding of flexible cords.
Fuse (<i>rewireable</i>)	A device that disconnects a circuit from a power supply by means of a wire designed to melt when a high electrical current flows.
Isolating transformer	A device that reduces the risk to a user of receiving an electric shock to earth, which may otherwise occur when the user simultaneously touches earth and live parts.
Lampholder (<i>all insulated</i>)	A fitting that holds a light bulb. It is constructed almost entirely of insulating material, and includes parts that carry an electrical current, see Figure 9 (<i>Page 31</i>).
Light fitting (<i>Luminaire</i>)	An electrical appliance for supporting or containing a light bulb(s) together with any lampholder, shade, or reflector. Includes pendants or standard lamps.
Main earthing wire Green or Green/yellow	A wire that connects the earth electrode to the earth bar of the main switchboard.
Main equipotential bonding wire Green or Green/yellow	A wire that connects any equipotentially bonded metal to an earth electrode or earth bar on the main switchboard.
Main switchboard	The switchboard that provides the consumer with the greatest degree of control of the supply of electricity to the electrical installation. This does not necessarily include a panel for metering.

Multiple-earthed neutral (<i>MEN</i>) system	The system of public 230 V power supply used in New Zealand.
Multi-meter	An electrical test instrument designed to measure various quantities of an electrical circuit. The test instrument should be one that measures voltage (<i>V</i>), amperage (<i>A</i>) AC and DC, and resistance (<i>ohms</i> (Ω)).
Permanent connection unit (<i>PCU</i>)	A fitting designed for a permanent connection between electrical installation wires and a power supply cord, see Figure 9 (<i>Page 31</i>). This fitting is used for fixed wired appliances, such as storage heaters and heated towel rails.
Residual current device (<i>RCD</i>) used for personal protection	<p>A device that will protect you from receiving a fatal electric shock, if a fault to earth occurs in an electrical installation.</p> <p>The RCD must be Type A with a rated residual current of 30 milli-ampere (<i>mA</i>) and be either labelled as such or have the symbol  on the device.</p> <p>There are three common “functional” types of RCDs used for personal protection, being:</p> <p>(a) The type mounted on your switchboard for protection of lighting and socket-outlet wiring. Switchboard mounted types may also be referred to as an RCCB or RCBO: these types are a combined circuit-breaker and RCD. The circuit-breaker is identified by a toggle switch, while the RCD is usually identified by a test push button.</p> <p>(b) The type that forms part of a socket-outlet (<i>SRCD</i>) and has two push buttons mounted on the faceplate for the functional operation of the RCD (<i>these are located in a damp area such as a bathroom or garage</i>).</p>

Residual current device (RCD) used for personal protection (cont'd)	<p>(c) The portable type (<i>PRCD</i>), which also has two bush buttons mounted on the faceplate (<i>these are used with portable electrical appliances outdoors, e.g. hedge clippers, concrete mixers, lawn mowers, etc</i>).</p> <p>RCDs will not protect you if the active and neutral wires are touched at the same time. This action is not safe and could cause a fatal electric shock.</p> <p>RCDs are not to be confused with circuit-breakers, which are similar in appearance; circuit-breakers will not protect you from receiving an electric shock.</p>
Socket-outlet	A fitting that forms part of the electrical installation and is designed to accept the pins of a plug.
Tough Plastic Sheathed (<i>TPS</i>)	A cable with an outer sheath of flexible plastic over 1, 2, 3 or 4 insulated wires; see Figure 1 (<i>Page 16</i>) for types and colour coding of <i>TPS</i> cables.
Wires	Inner wires of any cable.

1.3 GENERAL

- 1.3.1 Only use new cables and fittings.
- 1.3.2 If you are designing a new electrical installation, make sure to include at least two lighting circuits, and that each room has an adequate number of socket-outlets. It is easier to install these fittings before the walls of your home have been lined.
- 1.3.3 When wiring new circuits, you must select the right size cables for the particular circuit you are running in; see Table 3 (*Page 15*) for correct circuit wire sizes.
- 1.3.4 To prevent water and dust accumulating in the socket-outlet, do not mount socket-outlets in the floor or on any bench top or horizontal surface.
- 1.3.5 Make sure all fittings (*flush boxes, brackets, mounting blocks, switches, socket-outlets, permanent connection units, lampholders, ceiling roses*) and light fittings are securely fixed in position.

- 1.3.6 When securing any fixed wired heater or light fitting, make sure they are located well away from flammable materials (*e.g. curtains, drapes, opening doors and beds etc*).
- 1.3.7 Locate wall mounted light fittings at least 1.2 m above the floor.
- 1.3.8 If you are installing fittings, electrical appliances or light fittings in damp or potentially damp locations (*e.g. bathrooms, laundries, kitchens, garages, external walls*), they must be adequately protected from moisture with the correct degree of protection (*IP rating*).
- 1.3.9 The level of protection from moisture is measured by the degree of protection for fittings, electrical appliances or light fittings in damp locations. The IP rating ranges from IPX1 to IPX8.
- 1.3.10 See section 6 for the additional requirements for installation of fittings, electrical appliances or light fittings in damp locations.

1.4 TOOLS

You will need the following tools for wiring your electrical installation:

- (a) A cutter for stripping wire (*e.g. wire strippers or pocket knife*).
- (b) A small pair of side-cutting pliers (*side-cutters*).
- (c) A pair of pliers (*normal*).
- (d) A small pair of pointed nose or needle nose pliers (*long nose pliers*).
- (e) A hammer.
- (f) Electric drill and extension lead and/or a battery drill. High speed drill bits.
- (g) Various types and sizes of screwdrivers, depending on the type of accessory.

1.5 RESIDUAL CURRENT DEVICE REQUIREMENTS

- 1.5.1 All new lighting and socket-outlet circuits installed in a new electrical installation must be protected by one or more RCDs. The RCDs must be mounted on the main switchboard

supplying the circuit. *(This does not apply to permanently connected appliances, hot water cylinders, or electric ranges, ovens or hobs).*

- 1.5.2 All new lighting and socket-outlet circuits run from the main switchboard in existing electrical installations will require an RCD. The RCD could either be fitted to that switchboard for the lighting and socket-outlet circuit or could be of a type that is incorporated in the first socket-outlet of the circuit. The fitting of an RCD to the switchboard must be carried out by a licensed electrical worker.

1.6 TESTING AND CERTIFICATION REQUIREMENTS

- 1.6.1 When changing fittings in an existing electrical installation, you must test the circuit to ensure that the power has been disconnected. Use a multi-meter that measures AC voltage and DC resistance. You should have this meter with you before you begin repairs.
- 1.6.2 Always check the correct operation of the multi-meter before commencing any tests. The voltage reading is checked by setting the meter to the required voltage range (250 V AC) and measuring the voltage at a socket-outlet. Turn the socket-outlet switch to the “OFF” position, push one probe into the neutral slot (*top right looking at the front of the socket-outlet*) or into the earth (*bottom*) slot, and push the other probe into the active (*top left*) slot. Turn the socket-outlet switch to the “ON” position. The reading at the meter will be approximately 230 V.
- 1.6.3 Any new electrical wiring work must be checked and tested by a licensed electrical inspector to ensure the safety of your electrical installation. This provides confirmation that the new electrical wiring work carried out meets the requirements of this Code and the Electricity Regulations. The licensed electrical inspector will issue written confirmation that the requirements of this Code and the Electricity Regulations have been complied with.

- 1.6.4 The inspector will inspect and test the work in accordance with NZS 3019 and will include a random selection of socket-outlets and light switches and light fittings, all socket-outlets rated above 10 A, all permanently connected appliances and all fittings, electrical appliances and light fittings associated with damp locations. Upon completion, the inspector will certify and liven the work.
- 1.6.5 The details of the new electrical wiring work inspected and connected to the supply will be included on a Certificate of Compliance (CoC). You will be issued with a copy of this Certificate.
- 1.6.6 This work could be subject to audit.

Section 2: THE MAIN SWITCHBOARD AND METER BOX

2.1 GENERAL

- 2.1.1 When installing a **NEW** main switchboard and meter box, consult with your licensed electrical worker to establish an easily accessible location. This position will allow you to run cables from the main switchboard to the installation.
- 2.1.2 Switchboards are not allowed to be located:
- (a) In a fire-isolated stairway, passageway or ramp. They may be installed in other egress paths subject to requirements of the Building Code;
 - (b) In a damp location;
 - (c) Inside a room containing a sauna;
 - (d) Above a fixed or stationary cooking appliance; or
 - (e) Inside a cupboard containing a firehose reel; and
 - (f) Not less than 1.2 m from the floor and not more than 2.0 m from the floor or ground.
- 2.1.3 In a **NEW** electrical installation, providing the power supply has not been connected to the main switchboard, you can place the cables into that switchboard enclosure.
- 2.1.4 In an **EXISTING** electrical installation, you must **NOT** under any circumstances place or connect cables into the switchboard; this work must only be carried out by a licensed electrical worker.
- 2.1.5 A typical electrical installation could have the following circuits, see Table 1 (*Page 13*), (*Table 1 is only a guide; some installations will have more circuits while others may have less*).

TABLE 1: INSTALLATION CIRCUITS

Type of circuit	Wire size	Number of circuits
Lighting	1.0 mm ²	2 or more
Socket-outlets 10 A	2.5 mm ²	Any number Areas such as kitchens and laundries 3 x double socket-outlets per circuit. Other areas up to 12 double socket-outlets
Socket-outlets 15 or 20 A	2.5 mm ²	1
Water heater 3 kW	1.5 mm ²	1
Water heater 3-6 kW	2.5 mm ²	1
Free standing electric range	6.0 mm ²	1
Separate oven and/or cook top	4.0 mm ²	1
Permanently connected appliances including dishwashers, heaters, etc	2.5 mm ²	1 above 10 A. Up to 10 A can be wired as part of a socket-outlet circuit
Submains to garage or out-building	2.5 mm ²	1 for each
Mains cable	16 mm ²	1

Section 3: **SELECTING AND INSTALLING CABLES**

3.1 **GENERAL**

- 3.1.1 For the correct colour coding of cables and flexible cords, see Figure 1 (*Page 16*).
- 3.1.2 Only use cables designed for 230 V. Make sure that the earth wires are insulated and coloured green or green/yellow.
- 3.1.3 The insulation rating of cables are marked 450/750 V or 600/1000 V on the plastic sheath in your standard low voltage electrical installation. **NEVER** use cables designed for extra-low voltage (*telecommunications cables*) applications in your 230 V installation.
- 3.1.4 In addition, cables must meet the requirements in Table 2.

TABLE 2: CABLE INSULATION TYPES

For the mains cable	Tough plastic sheathed (<i>TPS</i>) cable
For installation wiring	Tough plastic sheathed (<i>TPS</i>) cables
For main earth or main equipotential wire	Poly Vinyl Chloride (<i>PVC</i>) insulated conduit wire

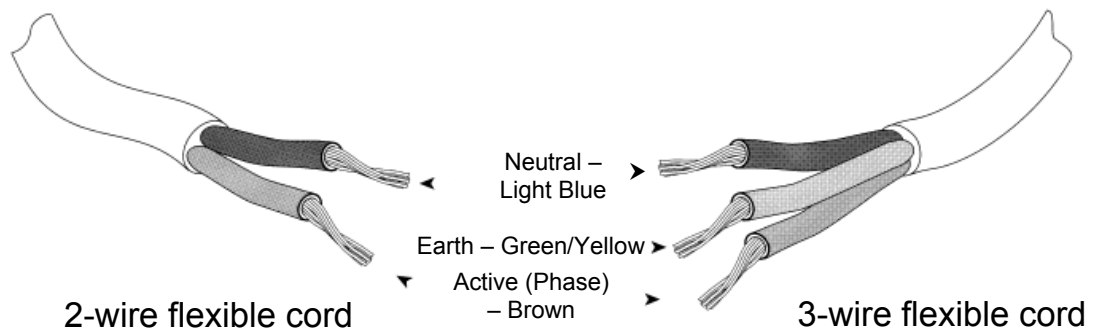
- 3.1.5 For the purposes of this Code cables above 1 mm² must have stranded conductors.
- 3.1.6 All cables when installed, must be adequately protected against mechanical damage. This can be carried out by either having additional protection, such as being enclosed in PVC conduit or metal pipes, or placing the cables in a suitable location that requires no additional protection.
- 3.1.7 The cables (*see Table 2*) that you use for wiring circuits in your electrical installation must have the appropriate wire size in accordance with Table 3 (*Page 15*).

TABLE 3: CIRCUIT WIRE SIZES

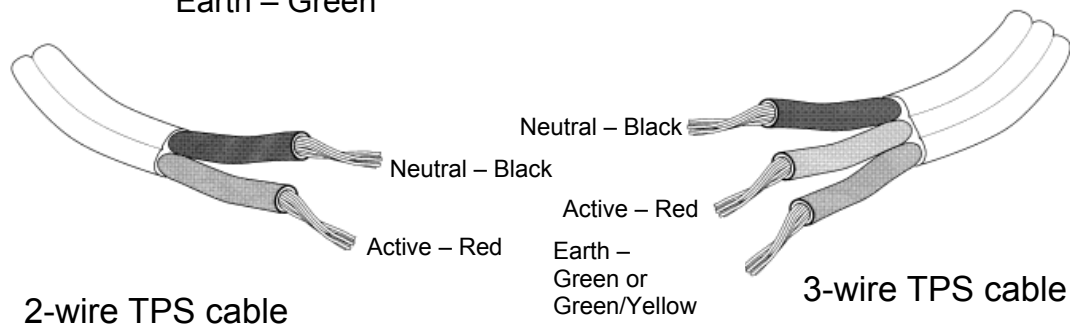
Circuits	Minimum Wire Size	Wire Colour
1-way lighting	2 + E* cable wires 1.0 mm ²	Red-Black-Green or Green/Yellow
2-way lighting control (<i>straps between the 2 switches</i>)	3 wire cable 1.0 mm ²	Red-White-Blue
Storage water heaters up to 3 kW	2 + E cable 1.5 mm ² (stranded conductors)	Red-Black-Green or Green/Yellow
Storage water heaters between 3 kW and 6 kW	2 + E cable 2.5 mm ² (stranded conductors)	Red-Black-Green or Green/Yellow
Socket-outlets and permanent connection units	2 + E cable 2.5 mm ² (stranded conductors)	Red-Black-Green or Green/Yellow
Submains to garages or out buildings	2 + E cable 2.5 mm ² (stranded conductors)	Red-Black-Green or Green/Yellow
Cooking hobs Separate ovens	2 + E cable 4 mm ² 2 + E cable 4 mm ² (stranded conductors)	Red-Black-Green or Green/Yellow
Electric range	2 + E cable 6 mm ² (stranded conductors)	Red-Black-Green or Green/Yellow
Mains	2 wire cable 16 mm ² (stranded conductors)	Red-Black
Main equipotential bonding wire	Conduit wire 4 mm ² (stranded conductors)	Green or Green/Yellow
Main earth wire	Conduit wire 6 mm ² (stranded conductors)	Green or Green/Yellow

*2 + E is also known as twin and earth

FIGURE 1: COLOUR CODING OF FLEXIBLE CORDS AND TPS CABLE WIRES



NOTE: Older flexible cords will be colour coded:
 Active – Red
 Neutral – Black
 Earth – Green



NOTE: Older TPS cable will have the earth conductor in the centre position and may have green insulation or alternatively no insulation.

3.2 PLACING CABLES

- 3.2.1 Cables must either be placed in areas where they will not be damaged or they must be given additional protection. If cables are being placed in the ceiling, run them close to the eaves; they can then run along the ceiling joists to the various circuit positions. The only protection for the cables will be along the joists, to which the cable must be clipped.
- 3.2.2 **Ensure** cables in your electrical installation are placed at least 50 mm from any door bell circuit, or other circuit operating at a voltage that is different from the 230 V electrical installation.
- 3.2.3 **Ensure** cables in your electrical installation are placed at least 50 mm from any telecommunications circuit to prevent noise interference with the telecommunication circuit.

3.3 RUNNING TPS CABLE CIRCUITS

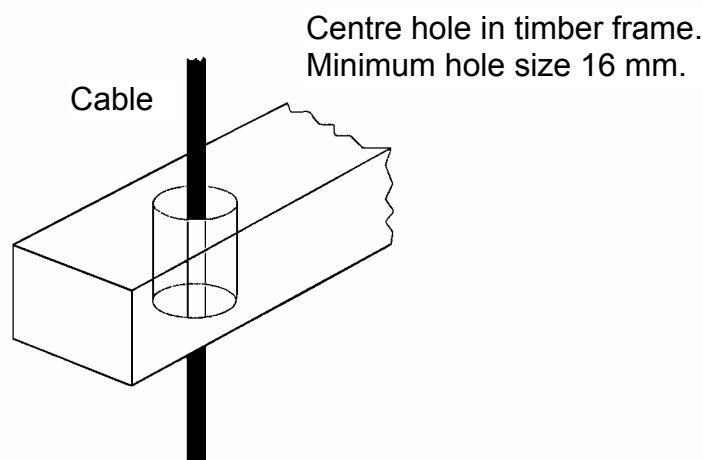
- 3.3.1 When running TPS cable circuits from your switchboard to say a light switch, socket-outlet, or other circuits, work out the route the cables are going to take, making use of the floor plans as discussed in Section 1. The cable should be drawn off the drum (*at the switchboard location*) and passed over and under obstructions and through holes along the route until the end of the cable finishes up at its destination. Avoid twisting the cable when drawn from the drum, by passing a strong stick or piping through the hole of the drum and supporting this so that the drum rotates as the cable is being drawn off.
- 3.3.2 1-way lighting circuits (*i.e. lights that have only one operating switch for each light*), see Figure 3 (*Page 22*), are run from the main switchboard to the first light switch position and then in and out of each additional light switch on the circuit. A cable is then run from each switch to the light fitting position. If there is more than one light on the circuit, loop a cable between the light fittings. If a 2-way switch (*i.e. where 1 light is being controlled by 2 light switches*) is being installed, see Figure 4 (*Page 23*) for a wiring diagram.

- 3.3.3 Socket-outlet circuits, see Figure 5 (*Page 24*) are run from the main switchboard to the first socket-outlet position (*on that circuit*) and then in and out of each additional socket-outlet on the circuit. For wiring permanent connection units, see Figure 5 (*Page 24*). Permanent connection units can either form part of a socket-outlet circuit or have their own separate circuit run from the main switchboard.
- 3.3.4 All other circuits, electric range, water heater, and submains are run from the main switchboard to their location.

3.4 **PROTECTING YOUR CABLES**

- 3.4.1 You must provide adequate protection for the cables if there is any chance that they might become damaged.
- 3.4.2 If you are installing cables that are located less than 2.0 m from the floor or ground, they must be protected by placing them inside a wall cavity, or by fitting a barrier (e.g. *PVC trunking, PVC conduit, etc*) over the cable.
- 3.4.3 When you are pulling PVC cables across one another during the cable installation, take care so that the cable sheaths do not rub together and cause the sheath to burn due to friction.
- 3.4.4 Any holes drilled for cables in timber framing must be located in the centre of the timber, see Figure 2 (*Page 19*), and must have a diameter between 16 mm and 35 mm. All cables must be at least 50 mm from the finished surface of the wall, etc, that covers the cabling; for cables with less than 50 mm cover, mechanical protection will be required.

FIGURE 2: LOCATION OF HOLES FOR CABLES IN 100 X 50 MM TIMBER FRAMING



3.5 SUPPORTS FOR CABLES

3.5.1 If you are placing a cable in an accessible ceiling-space or under floor-space (*e.g. where you gain access through a trap-door*), and the cable is within 2.0 m of the access, you must provide fixing for the cable at least every 300 mm. Remember that cables should be placed so that they will not be mechanically damaged by persons working in the roof or under the floor space. Do not run cables on purlins near the roofing.

3.5.2 Cables that run through areas where the ceiling and roof are separated by not less than 100 mm of timber (*skillion roof, see Table 11 Page 56*) must be provided with mechanical protection. The protection can be achieved by placing short pieces of metal pipe through the hole drilled in the timber, and then passing the cable through the pipe.

3.5.3 In all other cases, you must fix the cable at least every 1 m.

3.5.4 To fix cables in place, use cable clips, saddles or clamps.

3.6 CONNECTING CABLES

3.6.1 Cables that enter the main switchboard in new installations and flush boxes, see Figure 11 (*Page 34*), must be of

adequate length to enable the easy connection of wires to the switchboard terminals or associated terminals of fittings.

- 3.6.2 A fitting, electrical appliance or light fitting that has an earth terminal must only be supplied from a cable that contains an earth wire (*green/yellow or green*). The earth wire must be connected to the earth terminal of the fitting, electrical appliance or light fitting.

3.7 UNDERGROUND CABLES

- 3.7.1 Dig a trench 600 mm deep.
- 3.7.2 Bed directly buried underground cables on 50 mm of sand, and cover them with at least another 50 mm of sand.
- 3.7.3 Provide a physical barrier that protects the cable, using ground treated timber (*H4*), concrete slabs or plastic slabs (*polymeric coverstrips*) laid on top of the sand, see Table 4.
- 3.7.4 Alternatively the cable can be protected by using heavy duty plastic conduit or galvanised pipe. No bedding of sand is then required.

TABLE 4: REQUIREMENTS FOR PHYSICAL PROTECTION OF UNDERGROUND CABLES

If you are using:	It/They must be:
Timber	(a) 100 mm minimum width (b) 25 mm thick (c) ground treated to class H4.
Concrete slabs	at least 50 mm thick.
Plastic slabs (<i>polymeric coverstrips</i>)	at least 3 mm thick.
PVC conduit or PVC pipe	The pipe diameter should be such so that the cable is able to easily slip down the pipe.
Galvanised pipe	The pipe diameter should be such so that the cable is able to easily slip down the pipe.

- 3.7.5 Back fill the trench to cover the cable by 200 mm of fill; then lay a plastic marker strip over the full length of cable in the trench. Fill the trench.
- 3.7.6 Put up marker signs where any cable enters or leaves a building. This will identify that there is a cable located underground near the building.
- 3.7.7 If the cables rise above ground to enter a building or other structure, you must provide mechanical protection for the cable from the trench depth to a height of 2.0 m above ground.

FIGURE 3: 1-WAY LIGHTING CIRCUIT

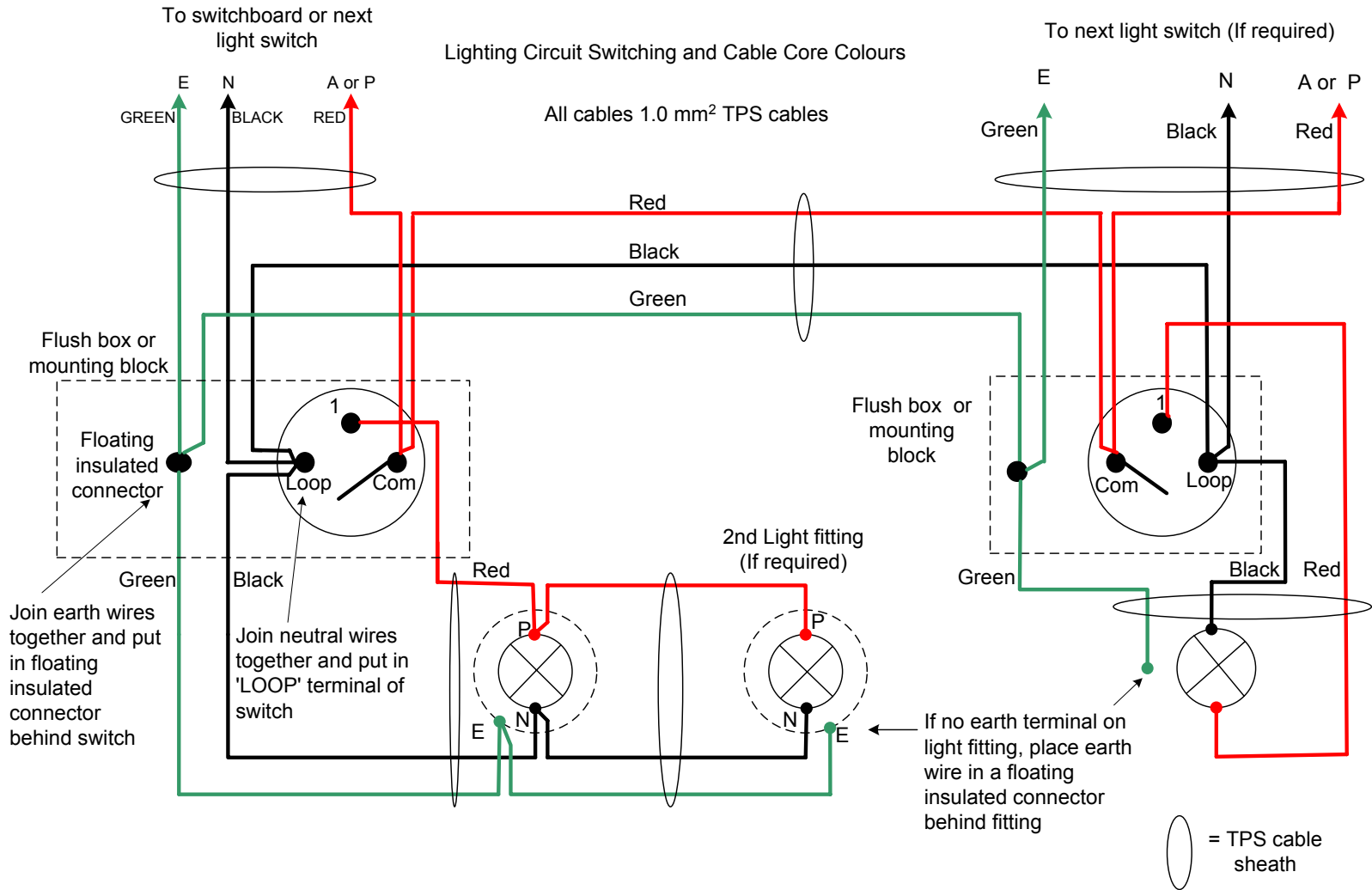


FIGURE 4: 2-WAY LIGHTING CIRCUIT

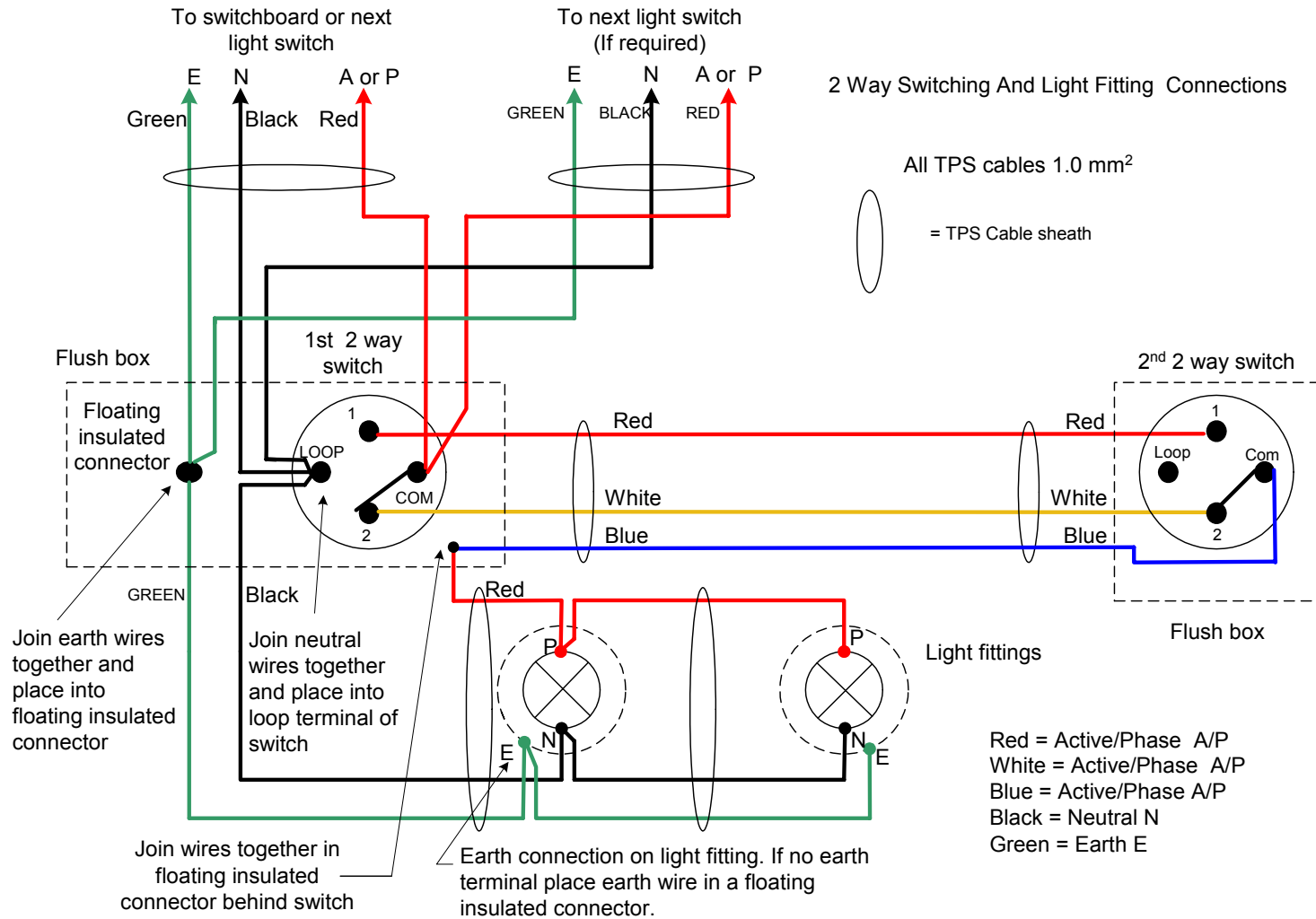



FIGURE 5: SOCKET-OUTLET CIRCUIT (INCLUDING PERMANENT CONNECTION UNIT)


NOTES:

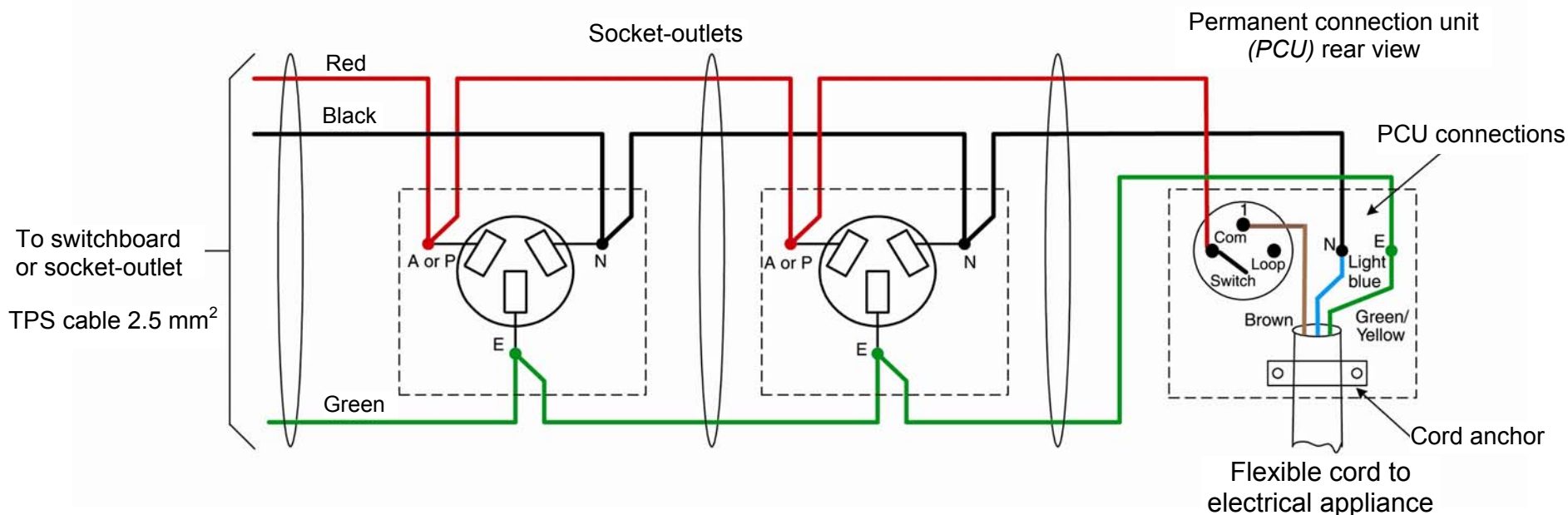
- 1 All socket-outlets are required to have a switch as part of the unit, the switch is not shown on the drawing.
- 2 Only the external wiring connections to the socket-outlet are shown.
- 3 There is only one set of wiring terminals for either single or double socket-outlets.
- 4 The terminals are usually colour coded. Red = Active or Phase, Black = Neutral, and Green = Earth.
- 5 If there are more than 2 socket-outlets on the same circuit, wiring between the the socket-outlets is the same as shown below.
- 6 For connection of RCD socket-outlets, refer to manufacturer's instructions.
- 7 Permanent connection units can either have their own circuit from the the switchboard or form part of the socket-outlet circuit. The unit must have a cord anchorage to hold the flexible cord in place.

SOCKET-OUTLET AND PERMANENT CONNECTION UNIT CONNECTIONS

 = TPS cable sheath

TPS cables must be 2 + E (*twin and earth*)

 = Flush box



NOTE: PCU switch shown in “OFF” position

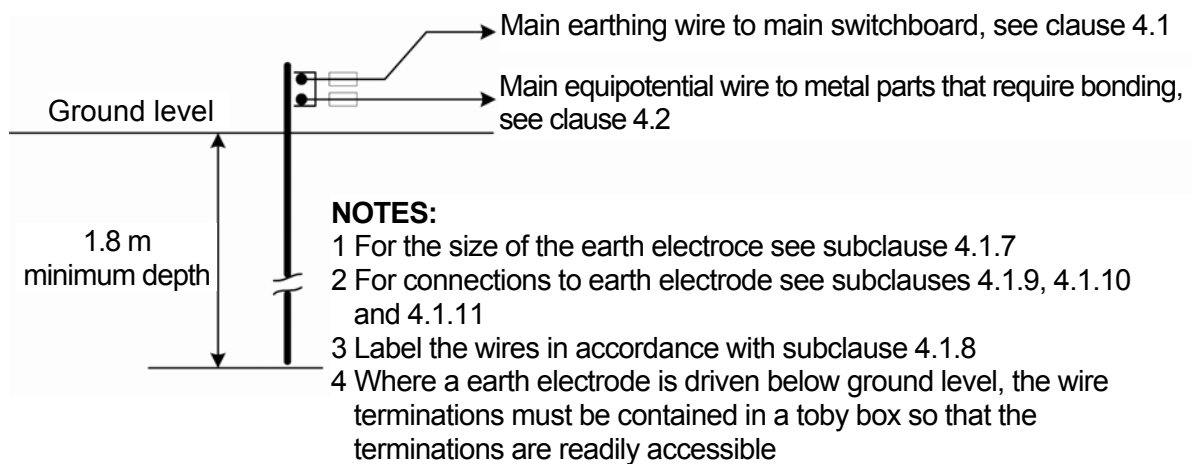
Section 4: EARTHING AND EQUIPOTENTIAL BONDING

4.1 THE MAIN EARTHING SYSTEM

- 4.1.1 Your main earthing wire and main equipotential bonding wire must be made of high conductivity copper.
- 4.1.2 The insulation on the main earthing wire and main equipotential bonding wire must be green/yellow or green.
- 4.1.3 The main earthing wire must be at least 6 mm² in size.
- 4.1.4 Run your main earthing wire from the main switchboard location to the earth electrode position.
- 4.1.5 The main earthing system of an electrical installation must consist of:
- (a) An earth electrode;
 - (b) A main earthing wire;
 - (c) An earth bar (*located on the main switchboard*) for the connection of the main earthing wire, protective earthing wires and/or bonding wires within the installation;
 - (d) A removable link, which effectively disconnects the neutral bar from the earth bar.
- NOTE:** The requirements of (c) and (d) above must be carried out by the licensed electrical worker as part of the switchboard installation.
- 4.1.6 Locate the main earthing wire and earth electrode where the electrode and connections will not be at risk of damage.
- 4.1.7 The earth electrode must be suitable for purpose (*generally obtainable from an electrical wholesaler*). This electrode will be at least 12 mm diameter. The electrode when installed will be driven to a vertical depth of not less than 1.8 m.
- 4.1.8 You must label the main earthing wire at the earth electrode. Use a permanent fitting (*like a screwed-down plastic label or copper label, or one that can be threaded onto the cable*) at the connection point that is clearly marked with the words: **"EARTHING LEAD - DO NOT DISCONNECT"** or **"EARTHING CONDUCTOR - DO NOT DISCONNECT"**.
- 4.1.9 Connect the main earthing wire to the earth electrode (see *Figure 6, Page 26*) with:

- (a) A crimp lug bolted to the electrode with a 10 mm diameter stainless steel bolt, washers (1 flat and 1 spring), nut and locknut; or
- (b) A correctly sized earth clamp.

FIGURE 6: EARTH ELECTRODE AND CONNECTIONS



- 4.1.10 The main earthing wire termination must be readily accessible at the earth electrode.
- 4.1.11 The main earthing wire connection must:
- (a) Be mechanically and electrically sound;
 - (b) Be protected against damage, corrosion, and vibration;
 - (c) Not place any strain on the various parts of the connection;
 - (d) Not damage the wire or fittings; and
 - (e) Be secured at the earth electrode in accordance with subclause 4.1.9.

4.2 EQUIPOTENTIAL BONDING

What needs equipotential bonding

- 4.2.1 Equipotential bonding is required for metal parts that do not form a part of the electrical installation but which people can touch, and which may become live as the result of an electrical fault (see clause 4.2.6 for examples of where equipotential may be required).

- 4.2.2 The main equipotential bonding wire must be at least 4 mm² in size.
- 4.2.3 Run the main equipotential bonding wire to the earth electrode position.
- 4.2.4 Connect the equipotential bonding wire to the earth electrode with a correctly sized crimp lug or earth clamp.
- 4.2.5 All equipotential bonding wires must:
- (a) Be mechanically and electrically sound;
 - (b) Be protected against damage, corrosion and vibration;
 - (c) Not place any strain on the various parts of the connection;
 - (d) Not damage the cable wire or fittings; and
 - (e) Be secured at the earth electrode in accordance with subclause 4.2.4.
- 4.2.6 Metal parts that could potentially come in contact with the electrical system may require equipotential bonding. These include:
- (a) Metal water pipes (*hot and cold*);
 - (b) Metal waste pipes;
 - (c) Metal gas reticulation pipes;
 - (d) Metal sinks and bench tops;
 - (e) Metal shower trays;
 - (f) Metal urinals; and
 - (g) Exposed structural steel work.
- 4.2.7 However, equipotential bonding is not required where it can be shown that there is complete segregation between any piece of accessible metal and the electrical system.
- 4.2.8 You don't need to bond the following, as long as they are isolated by plastic pipes and do not come into contact with earth or earthed metal:
- (a) Metal taps;
 - (b) Metal baths, shower trays, metal sinks or metal urinals; or
 - (c) Gang nail plates where no electrical cable is in contact with the plate.

Section 5: CONNECTING FITTINGS, ELECTRICAL APPLIANCES AND LIGHT FITTINGS

5.1 GENERAL

For connecting cables to fittings, see Figures 3 to 5 (*Pages 22 to 24 for wiring diagrams*) and Figure 9 (*Page 32 for fitting types*).

5.2 PREPARING CABLES

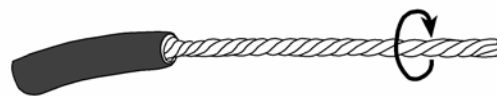
5.2.1 This is how you should prepare a TPS cable:

- (a) Carefully remove the outer sheath so as not to cut the insulation on the wires or expose bare wires. The pocket knife or side-cutters can be used for this task, taking particular care not to cut or damage (*nick*) the inner insulation of the wires. If you accidentally do so, then cut off the damaged length and start the procedure again.
- (b) Remove a sufficient amount of outer sheath, to enable the wires to reach the connections.
- (c) Carefully strip coloured insulation from the wires, see Figure 7 (*Page 29*). The safest way of stripping back the insulation is to use wire strippers, since these can be set to accommodate the size of wires. The use of a pocket knife or side cutters, unless carefully used, is likely to damage the wires under the insulation. Approximately 20 mm is about right in most cases. If you cut or damage any strands of wire, start again.
- (d) Twist the strands of the wires tightly together using pliers, in the direction that they have been lightly twisted during manufacture (*usually clockwise*). The twisted wires are then ready for the formation of a double end. The end of the wire is then doubled over using pliers to form a rounded end, see Figure 8 (*Page 29*).
- (e) If you have more than one cable being connected to a fitting, twist the same coloured wires tightly together using pliers.

FIGURE 7: WIRE WITH INSULATION REMOVED

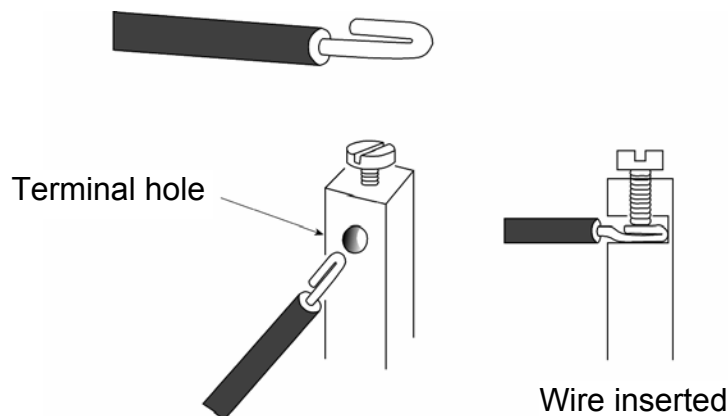


Wires emerge loosely twisted



Twist wires tightly clockwise

FIGURE 8: WIRE DOUBLED OVER



- 5.2.2 Once you have connected the wires to a fitting, light fitting or electrical appliance and before you secure the fitting or light fitting, you must make sure that:
- There are no un-terminated wires. Fit floating insulated connectors where earth wires are not used at light switches or light fittings; if more than one, twist together;
 - When completed, there should be no exposed wire beyond the terminal. Give the wire a firm tug to see that the connection is soundly made;
 - The wires will not be damaged when the accessory or light fitting is secured.

5.3 EXTRA REQUIREMENTS FOR LIGHT SWITCHES AND LIGHT FITTINGS

5.3.1 Wires must be identified as being active (*phase*), neutral or earth wires, either by the colour of the insulation, or by coloured sleeves over the exposed parts of the insulated wire. The sleeving of the earth (*green/yellow or green*) wire is **NOT** permitted under any circumstances.

NOTE: existing installations may have sleeved green wires to allow their use as active or neutral wires, but this former practice is **NOT** permitted in new installation work.

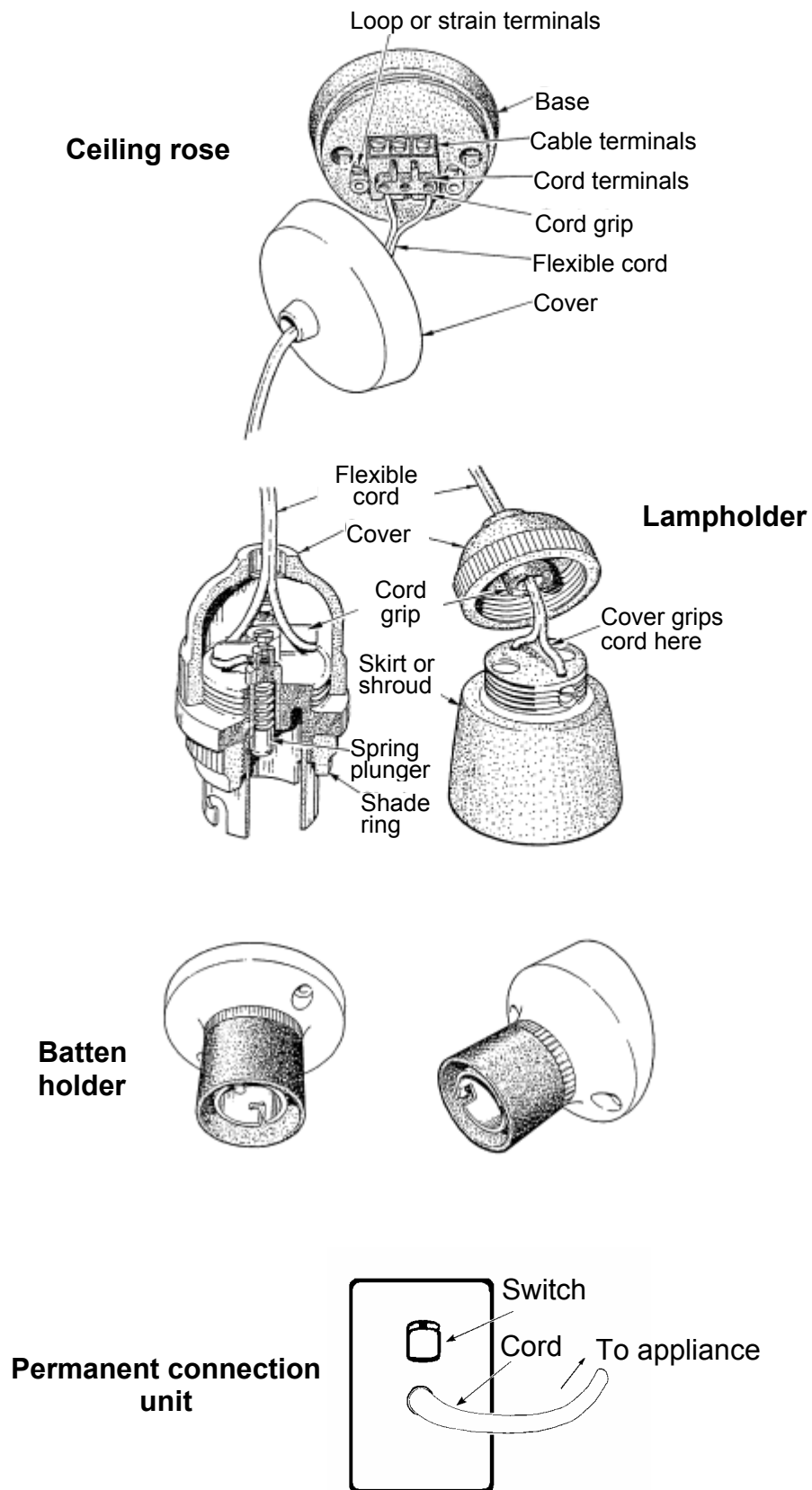
5.3.2 If you intend the coloured sleeve to re-identify the wire for another purpose, make sure that it covers the entire length of the insulated wire that has been exposed from the sheathing, and at both ends of the cable. The use of coloured tape is **NOT** permitted.

5.3.3 If you are hanging a lighting pendant from a ceiling rose with a flexible cord, the cord must be the sheathed round type with a minimum wire size of 0.75 mm².

5.3.4 Light fittings that have an earth terminal must be earthed. Light fittings of the double insulated type must not be earthed.

5.3.5 Pillars, posts, grips, or tortuous paths in ceiling roses and lampholders must be used for anchoring wires.

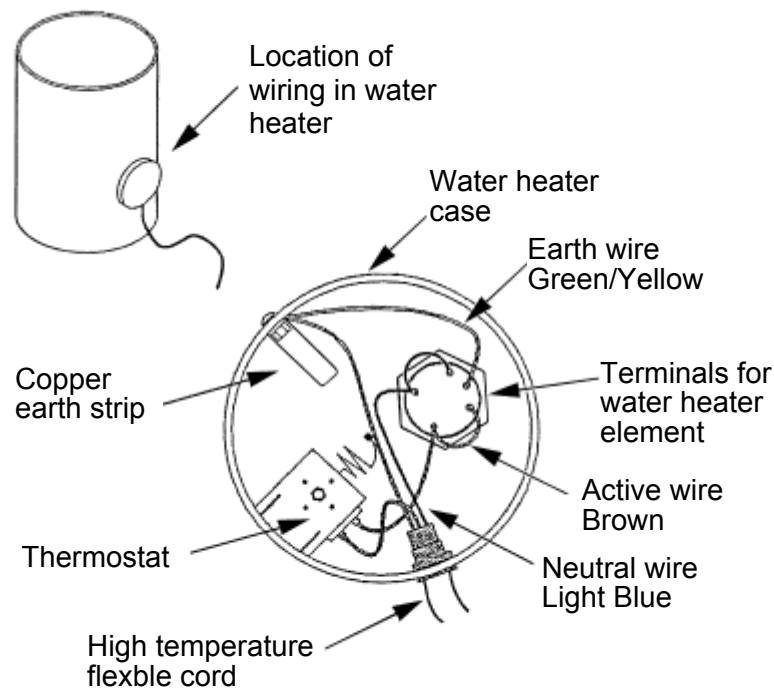
FIGURE 9: CEILING ROSE, BATTEN HOLDER, LAMPHOLDER AND PERMANENT CONNECTION UNIT



5.4 EXTRA REQUIREMENTS FOR ELECTRIC STORAGE WATER HEATERS

- 5.4.1 An electric storage water heater must have an isolating switch located next to it. The isolating switch must have a minimum current rating of 15 amps.
- 5.4.2 The cable installation, and the flexible cord that supplies an electric storage water heater, must be the three-core type that includes an earth wire.
- 5.4.3 The wire insulation of the cable or flexible cord in the element enclosure must have a minimum temperature rating of 85 degrees Celsius. The temperature rating is marked on the cable sheath.
- 5.4.4 If you use a flexible cord to supply an electric storage water heater, you must anchor it at the isolation switch and at the water heater with properly designed and installed cord anchorages to prevent stress on the connections. A knot in a flexible cord is **NOT** an acceptable cord anchorage.
- 5.4.5 If your electric storage water heater does not have a supply connection block, connect it up according to Figure 10 (*Page 33*).

FIGURE 10: CONNECTING UP ELECTRIC STORAGE WATER HEATERS THAT DO NOT HAVE SUPPLY CONNECTION BLOCKS

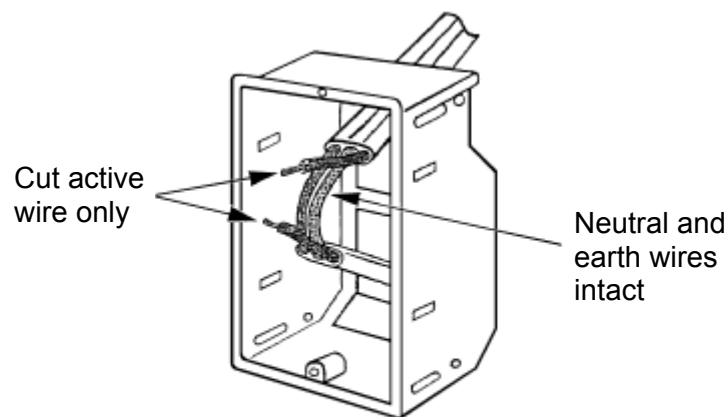


5.5 EXTRA REQUIREMENTS FOR ELECTRIC COOKING APPLIANCES

- 5.5.1 Fixed wired and free standing cooking appliances must have a switch mounted in an easily reachable position within 2 m of the cooking appliance. You must ensure that it is not necessary to reach over the cooking surface to operate the switch. A solution to this is to mount the switch on the wall alongside the cooking appliance.
- 5.5.2 Connect free standing cooking appliances to the supply by using an appropriately rated power supply cord and plug. The normal rating for the plug and socket connecting a cooking appliance to the wiring is 32 amps.

- 5.5.3 When you are connecting the switch for a cooking appliances, only the active (*phase*) red wire of the supply cable, see Figure 11, needs to be connected into the switch.
- 5.5.4 Remove approximately 100 mm of the TPS cable outer sheath without damaging the inner wires, cut the red wire in the middle and strip 10 mm of insulation from the cut end, twist tightly and terminate in the switch terminals. Leave the neutral and earth wires intact, see Figure 11.

FIGURE 11: ELECTRIC COOKING APPLIANCE SUPPLY CABLE AND FLUSH BOX



Section 6: **SPECIFIC REQUIREMENTS FOR DAMP LOCATIONS**

6.1 **GENERAL**

- 6.1.1 This section applies when you are installing fittings, electrical appliances or light fittings in locations where water or moisture is permanently or sometimes present. The water or moisture may take the form of liquid, or vapour (*including steam*).
- 6.1.2 This section applies to damp locations:
- (a) In bathrooms, showers, laundries, washrooms, kitchens; and
 - (b) Similar rooms that contain baths, showers or fixed basins.
- 6.1.3 The requirements in this section are to ensure that:
- (a) Moisture will be stopped from getting into any fitting, electrical appliance or light fitting. This is done by placing cables and fittings, electrical appliances or light fittings in good locations, and by using the correct IP rating of the fitting, electrical appliance or light fitting for the area in which they are being installed.
 - (b) People in rooms or areas where their hands, feet or bodies might be wet will be protected from getting electric shocks.
- 6.1.4 Fittings, fixed wired appliances or light fittings installed in damp situations must be:
- (a) Designed and constructed for the location; and
 - (b) Made of corrosion-resistant material; and
 - (c) Installed to the manufacturer's instructions.
- 6.1.5 If you install control panels, fittings, fixed wired appliances or light fittings in a classified Zone, they must have at least the following degree of protection against moisture:
- (a) Zone 0: IPX7.
 - (b) Zone 1: IPX4 baths/showers.
 - (c) Zone 2: IPX4.
 - (d) Zone 3: no specific degree of protection is required.

(e) For light fittings above Zones 1 and 2 and below 3 m: IPX4.

6.1.6 **Do not** install switchboards in Zones 0, 1, 2 or 3.

6.1.7 **Do not** install control panels in Zone 0.

6.2 DEFINITIONS

Fixed plumbing connection	The point on the fixed piping of the plumbing system to which a fixed shower rose or a flexible hose connection for a portable shower rose is made.
Zones	The volumes based on the dimensions of both horizontal and vertical planes. Zones are based on distances from the water source, and the frequency of water reaching that zone. The closer a zone is to the water source, the greater degree of protection is required.

6.3 CLASSIFICATION OF ZONES

6.3.1 Classification of Zones for baths and showers.

The zoning requirements for baths and showers are based on the dimensions of the following four Zones (*see Table 5*) taking account of walls, ceilings floors and fixed partitions (*such as screens, doors, curtains and fixed partitions*) that provide effective protection against spraying water. See Figures 12 to 15 (*Pages 43 to 46*).

TABLE 5: ZONE DIMENSIONS FOR BATHS AND SHOWERS

Zone 0	The area of the interior of the bath or shower base.
Zone 1	(a) For a bath, the area limited by: (i) The internal rim of the bath above zone 0; and (ii) The ceiling, or, the horizontal plane 2.25 m above the floor, whichever is the lower. (b) For a bath and a shower, the area limited by:

Zone 1 (<i>cont'd</i>)	<ul style="list-style-type: none"> (i) The internal rim of the bath or shower base above zone 0; and (ii) The parallel vertical plane 1.2 m radius from the fixed plumbing connection; and (iii) A barrier of minimum height of 1.8 m, or a barrier the same height of the fixed plumbing connection, whichever is the highest, may be used to reduce the 1.2 m dimension of (ii) above; and (iv) The higher of the horizontal plane 2.25 m above the floor (or the ceiling if it is lower), or the height of the fixed plumbing connection. <p>(c) For a shower, the area limited by:</p> <ul style="list-style-type: none"> (i) The internal rim of the shower base above zone 0; and (ii) The parallel vertical plane 1.2 m from the fixed shower plumbing connection; and (iii) A barrier of minimum height of 1.8 m, or a barrier the same height of the fixed plumbing connection, whichever is the highest, may be used to reduce the 1.2 m dimension of (ii) above; and (iv) The higher of the horizontal plane 2.25 m above the floor (or the ceiling if it is lower), or the height of the fixed plumbing connection.
Zone 2	<p>The area limited by:</p> <ul style="list-style-type: none"> (a) The vertical plane external to Zone 1 and the parallel vertical plane 0.6 m external to Zone 1; and (b) The floor to the ceiling, or the horizontal plane 2.25 m above the floor, whichever is the lower.
Zone 3	<p>The area limited by:</p> <ul style="list-style-type: none"> (a) The vertical plane external to Zone 2 and the parallel vertical plane 2.4 m external to Zone 2; and (b) The floor to the ceiling, or the horizontal plane 2.25 m above the floor, whichever is the lower.

NOTE: The zones do not extend beyond the boundaries of the room.

6.3.2 The requirements for fixed water containers (see Tables 6 and 6A) other than baths and showers are based on the dimensions of the following two classifications of Zones, see Figures 16 and 17 (Page 47). There are no Zones 1 and 3 associated with these water containers.

TABLE 6: CLASSIFICATION OF ZONES FOR OTHER FIXED WATER CONTAINERS NOT EXCEEDING 45 LITRES

Zone 0	The area of the interior of the water container.
Zone 2	For an individual water container with a capacity not exceeding 45 litres, the area limited by the: (a) Vertical plane 0.15 m from the internal rim of the water container; and (b) Floor and the horizontal plane 0.4 m above the water container.

NOTE: The zones do not extend beyond the boundaries of the room.

TABLE 6A: CLASSIFICATION OF ZONES FOR OTHER FIXED WATER CONTAINERS EXCEEDING 45 LITRES

Zone 0	The area of the interior of the water container.
Zone 2	For an individual water container with a capacity exceeding 45 litres, the area limited by the: (a) Vertical plane 0.5 m from the internal rim of the water container; and (b) Floor and the horizontal plane 1.0 m above the water container.

NOTE: The zones do not extend beyond the boundaries of the room.

6.4 SOCKET-OUTLETS

6.4.1 **Do not** install socket-outlets within 0.3 m of a floor of a bathroom, laundry or other similar location where the floor might get wet. In addition, remember the degree of protection required; the following must apply to the installation of socket-outlets in the classified Zones.

6.4.2 **Do not** install socket-outlets in Zones 0 or 1.

- 6.4.3 In Zone 2, socket-outlets must:
- (a) Have automatic switching and be incorporated in a shaver supply unit; or
 - (b) Be enclosed in a cupboard provided that the enclosure is maintained during the normal operation of the connected appliance **AND** the socket-outlet is protected by an RCD having a residual operating current not greater than 30 milli-amperes.
- 6.4.4 In Zone 3, socket-outlets must:
- (a) Be protected by an RCD, having a residual operating current not greater than 30 milli-amperes; or
 - (b) Be supplied by an individual isolating transformer; or
 - (c) Be supplied at safety extra-low voltage.
- 6.4.5 **Do not** install socket-outlets in Zones 0 or 2 of other fixed water containers, see Figures 16 and 17 (*Page 47*).

6.5 SWITCHES

- 6.5.1 **Do not** install switches within 0.3 m of a floor of a bathroom, laundry or other similar location where the floor might get wet. In addition, the following must apply to the installation of switches in the classified Zones.
- 6.5.2 **Do not** install switches in Zone 0.
- 6.5.3 Any switch you install in Zone 1 and 2 must have at least the required degree of protection for the Zone, see Table 7 (*Page 41*).

6.6 LIGHT FITTINGS, BATTENHOLDERS AND CORD GRIP LAMPHOLDERS

- 6.6.1 The following must apply to the installation of light fittings, battenholders, and cord grip lampholders in the classified Zones:
- (a) Zone 0: IPX7 and specifically designed to be used in a bath, shower or water container and supplied with a safety extra-low voltage system not exceeding 12 V AC or 30 V “Ripple free DC” with the supply source located outside of Zone 0.

- (b) Zones 1 and 2: IPX4.
 - (c) Zone 3: no IP rating required.
- 6.6.2 Above Zones 1 and 2: IPX4, light fittings to a height of 3 m.
- 6.6.3 Above Zones 1 and 2: battenholders or cord grip lampholders to a minimum height of 3 m.
- 6.6.4 In Zone 2 only, regardless of the IP rating required, the light fitting may be:
- (a) Class II (*double insulated*), which requires the removal of a cover to access the lamp(s); or
 - (b) Supplied with a safety extra-low voltage system not exceeding 12 V AC or 30 V ripple free DC, with the supply source located outside Zone 2.

NOTES:

- 1 A battenholder or cord grip lampholder is not Class II.
- 2 If you mount a light fitting on the ceiling in the following areas:
 - (a) Above Zone 1 or 2 and greater than 3 m from the floor level; or
 - (b) In or above Zone 3;
 you do not need to comply with the IP ratings or the Class II as detailed above.

6.7 **ELECTRICAL APPLIANCES (*HEATERS, HEATED TOWEL RAILS, FANS ETC*)**

- 6.7.1 The following must apply to the installation of electrical appliances in the classified Zones:
- (a) Zone 0: electrical appliances with the required degree of protection, IPX7; and, specifically designed for Zone 0 and installed to the manufacturer's instructions; and, operated from a safety extra-low voltage system not exceeding 12 V AC. or 30 V ripple free DC, with the supply source located outside Zone 0;
 - (b) Zones 1 and 2: IPX4;
 - (c) Zone 3: no IP rating required.

NOTES:

- 1. Instantaneous water heaters installed in Zone 1 would be mounted on the fixed plumbing connection.

2. Extractor fans installed in Zones 1, 2 or 3 could be mounted in the walls or in or on the ceiling of the different Zones.
3. Electrical appliance heaters that you install in Zones 1, 2 and 3 must be mounted not less than 0.3 m above the floor, or have the element totally enclosed in metal (*e.g. a heated towel rail*).
4. The control switch for these appliances, if mounted externally, must have the required degree of protection for the Zone.

TABLE 7: SUMMARY OF TYPES OF FITTINGS, ELECTRICAL APPLIANCES AND LIGHT FITTINGS FOR THE DIFFERENT ZONES, INCLUDING THE IP RATINGS

Fittings, electrical appliances and light fittings	Zone 0	Zone 1	Zone 2	Zone 3
Socket-outlets See Clause 6.4	Not permitted	Not permitted	Not permitted except for shaver unit or RCD protected in a normally closed cupboard	Less than 0.3 m not permitted Above 0.3 m no IP rating but must be:- <ul style="list-style-type: none"> • RCD protected • Isolated supply • ELV supply
Switches See Clause 6.5	Not allowed	As for Zone 2	Less than 0.3 m not permitted Above 0.3 m IPX4	Less than 0.3 m not permitted Above 0.3 m no IP rating

Light fittings See Clause 6.6	IPX7 and Safety ELV supply	IPX4 Sealed light fitting	IPX 4, As for Zone 1 Class II, Exterior ball fitting ELV	No IP rating
Electrical appliances See Clause 6.7	IPX 7 and specifically designed and safety ELV	IPX4 Instantaneous water heaters, fans	IPX4 Heated towel rails, fans.	No IP rating

FIGURE 12: ZONE DIMENSIONS BATHS

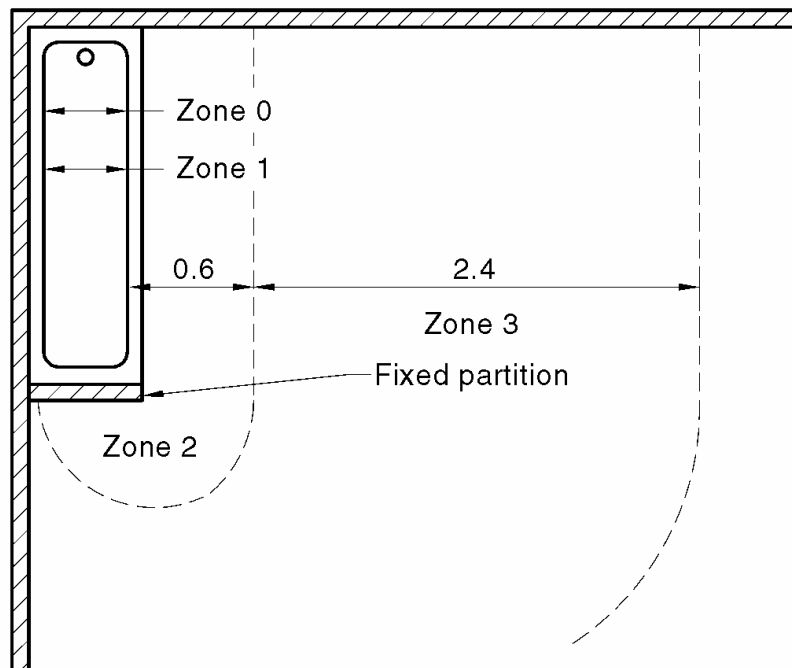
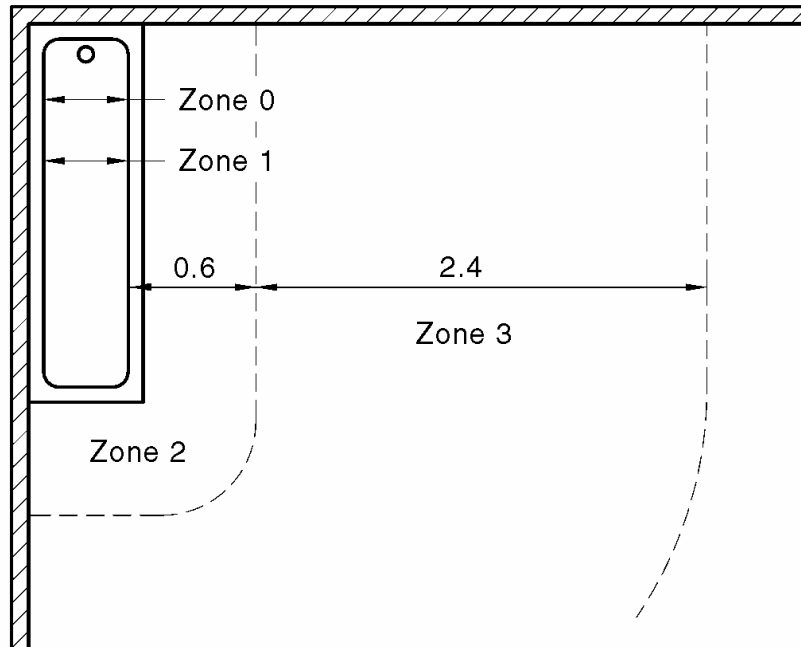


FIGURE 13: ZONE DIMENSIONS FOR SHOWERS WITH A BASE

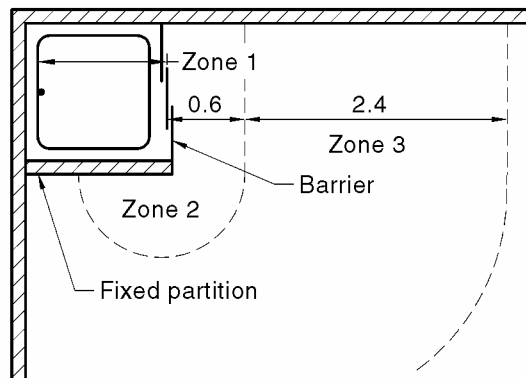
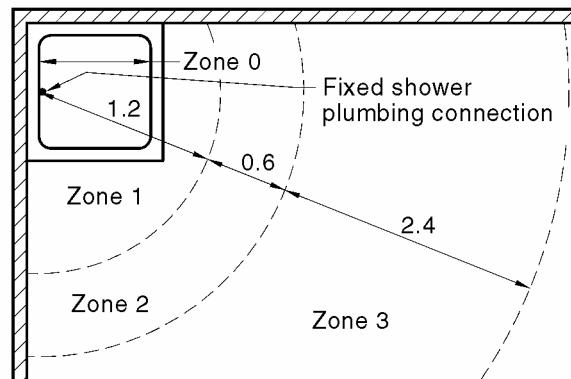
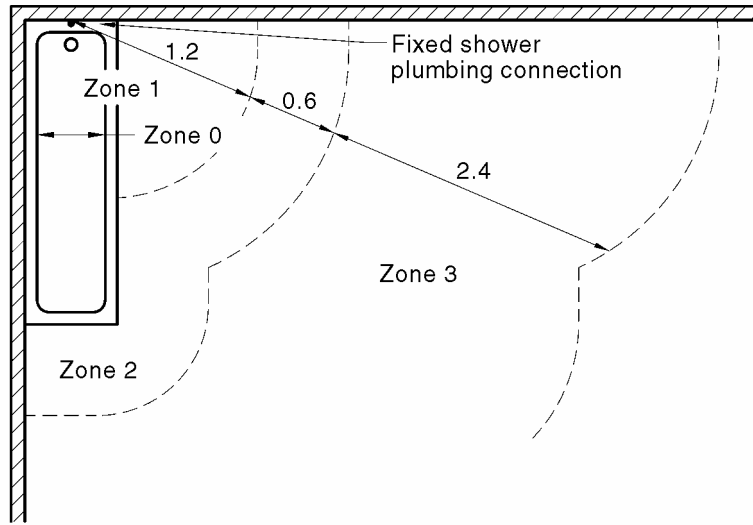


FIGURE 14: ZONE DIMENSIONS FOR SHOWERS WITHOUT A BASE

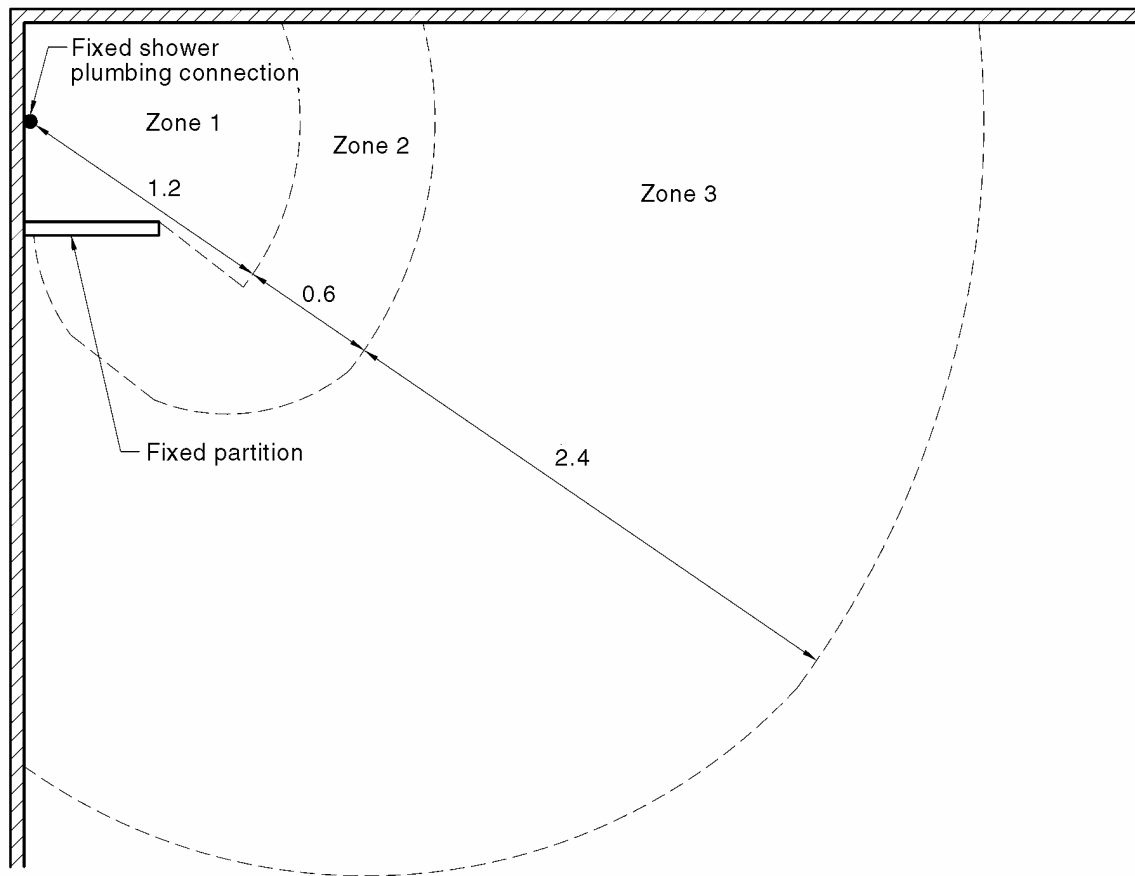


FIGURE 15: ZONE DIMENSIONS BATHS AND SHOWERS (ELEVATION)

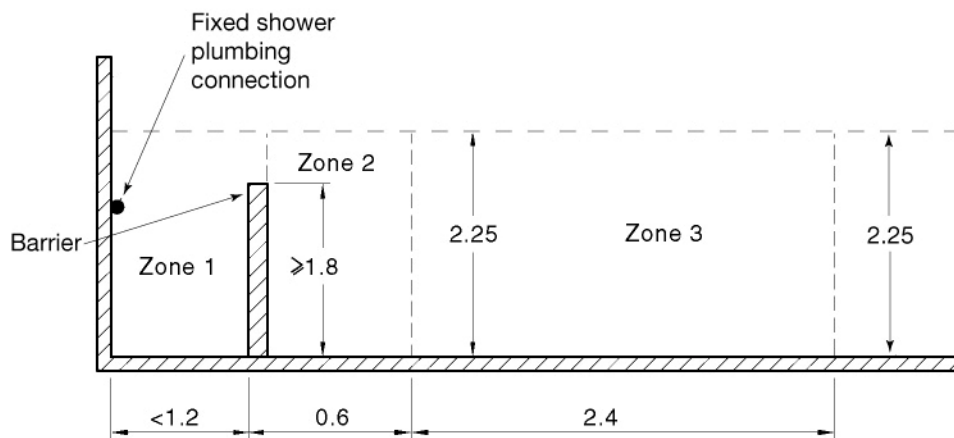
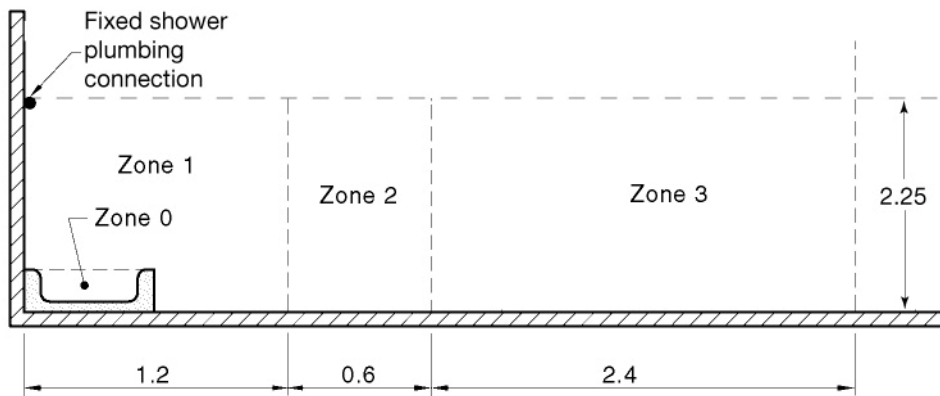
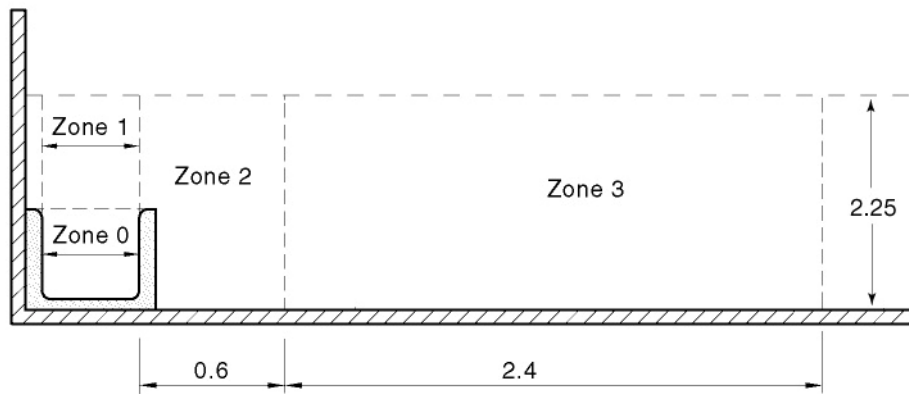


FIGURE 16: ZONE DIMENSIONS FOR OTHER FIXED WATER CONTAINERS NOT EXCEEDING 45 LITRES

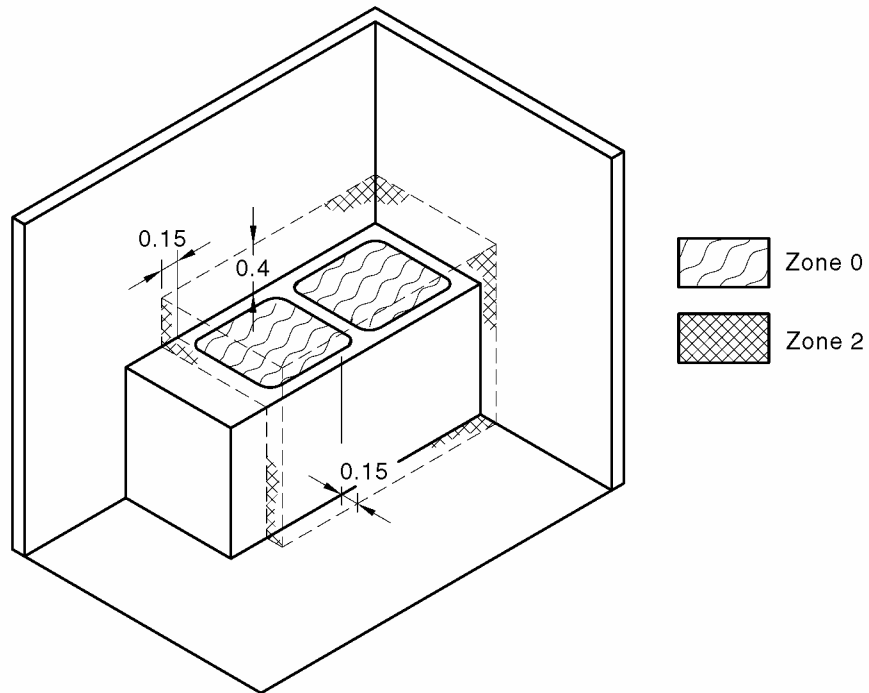
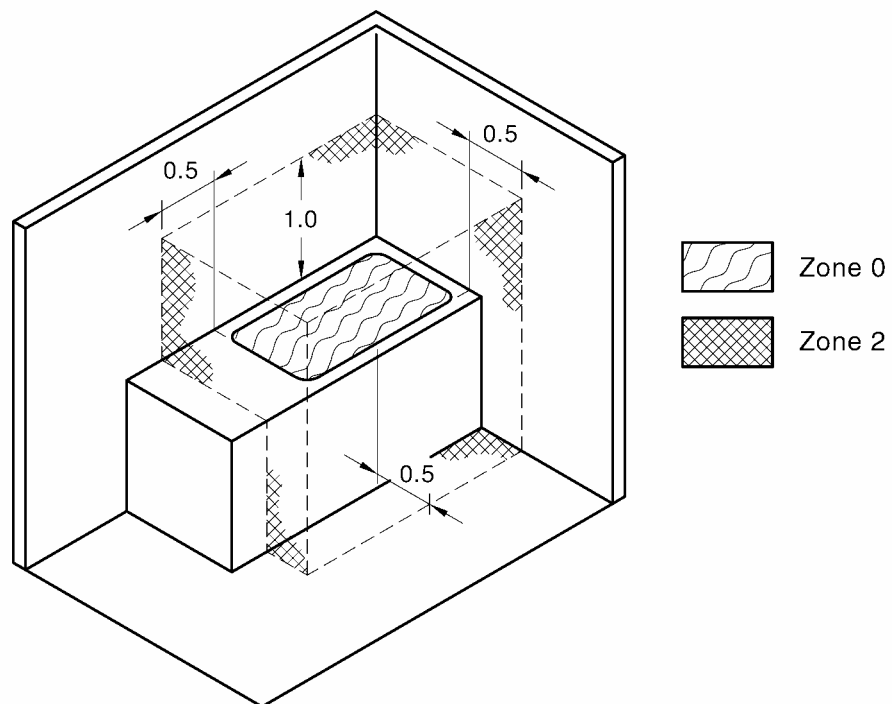


FIGURE 17: ZONE DIMENSIONS FOR OTHER FIXED WATER CONTAINERS EXCEEDING 45 LITRES



OTHER SPECIFIC REQUIREMENTS

Section 7: **SPECIFIC REQUIREMENTS FOR RECESSED LIGHT FITTINGS AND THEIR AUXILIARY EQUIPMENT**

7.1 **GENERAL**

- 7.1.1 This section has been copied directly from ECP 54 to highlight the dangers of recessed light fittings and their auxiliary equipment if not installed correctly. When purchasing recessed light fittings, ensure that they comply with the requirements of ECP54. The label on the light fitting or its packaging should state the rating of the light in accordance with ECP 54, i.e. CS, CA, etc.
- 7.1.2 This section sets out the installation requirements for recessed light fittings and their auxiliary equipment in your home.
- 7.1.3 This section does not apply to recessed light fittings that are:
(a) Recessed into swimming pools;
(b) Ground-planted in gardens, pavements and ducts.
- 7.1.4 You must install circuit wiring for recessed light fittings in accordance with the relevant requirements of this Code.

7.2 **DEFINITIONS**

Auxiliary equipment	Devices such as ballasts, transformers, high intensity discharge (<i>HID</i>) control gear, covers, “heatcans” and other control equipment.
Building element	Any structural and non-structural component or assembly incorporated into or associated with a building. These include fixtures, services, drains, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports, see Figure 19 (<i>Page 59</i>).

Concealed space	Any part of the space within a building that cannot be seen from an occupied space, see Figure 18 (Page 58).
Fire separation	Any building element that separates firecells, or firecells and safe paths, and provides a specific fire resistance rating.
Habitable space	Any space used for activities normally associated with domestic living; not including any bathroom, laundry, toilet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature that is not used frequently or for extended periods, see Figure 19 (Page 59).
Heat dispersal cover (<i>heatcan</i>)	A device for enclosing a recessed light fitting to alter the way that the heat produced by the light fitting is dispersed.
Moist area	A room or space where excessive moisture vapour or where steam is generated or is frequently present (<i>e.g. bathrooms, laundries, clothes-drying rooms etc</i>). The definition includes, but is not limited to, damp areas. In open plan areas, the moist area extends to adjoining spaces for a distance of 2 m from the centre of any appliance, fixture or fitting that will generate water vapour, see Figure 19 (Page 59).
Recessed light fitting	A light fitting intended by the manufacturer to be fully or partly recessed into a mounting surface.
Utility space	Any toilet, pantry, walk-in wardrobe, corridor, hallway, lobby, or other space of a specialised nature that is not used frequently or for extended periods, see Figure 19 (Page 59).

7.3 INSTALLATION REQUIREMENTS

7.3.1 Recessed light fittings and their auxiliary equipment may pose a risk of fire or damage to your home if they are not installed and maintained correctly. When combustible building elements (*e.g. timber*) are exposed to high temperatures for a long time, they can be caused to spontaneously combust. You must install and maintain recessed light fittings and their

auxiliary equipment in such a way that they are electrically safe, and to prevent:

- (a) The risk of fire;
- (b) Damage to your home; or
- (c) Excessive heat transferred being to the building elements.

Recessed light fitting installations must not:

- (a) Degrade the structural integrity of your home;
- (b) Degrade structural ceiling elements by cutting or notching joists, beams, rafters or battens, see Figure 20 (*Page 59*);
- (c) Affect the durability of building materials or cause deterioration or combustion of building materials;
- (d) Encourage moisture to move from moist areas into concealed spaces;
- (e) Degrade the thermal insulation or acoustic rating of the space below the minimum required limit;
- (f) Degrade the fire resistance rating of any space; or
- (g) Degrade the insulation of adjacent cabling.

Clearances

- 7.3.2 You must install recessed light fittings and their auxiliary equipment so that they have adequate clearances from structural members and building elements such as thermal insulation, see Figure 18 (*Page 58*), in accordance with the manufacturer's installation instructions.
- 7.3.3 If there are no manufacturer's installation instructions, use a minimum clearance of 200 mm from the lampholder of the light fitting to the building elements.
- 7.3.4 Clearances from specific building elements and general installation requirements must be in accordance with the manufacturer's installation instructions and this Code, see Figure 18 (*Page 58*).

Supports

- 7.3.5 You must structurally support any recessed light fittings and auxiliary equipment so that they do not put strain on or damage any building elements.

Moisture

- 7.3.6 In moist areas, you must install recessed light fittings so that the moisture can not get into concealed spaces. The construction of the recessed light fitting must also suit this purpose.

Thermal Insulation

- 7.3.7 You must install recessed light fittings and their associated equipment so that the thermal efficiency of your home (*as required by the Building Industry Authority Approved Document H1, Energy Efficiency*) is not decreased below the minimum required limit.
- 7.3.8 If you install recessed light fittings in loose, sprayed insulation or in flammable insulation, you must mount a purpose built box or structure around the recessed light fitting that prevents contact between the fitting and the insulation, while maintaining any required ventilation.

Fire Resistance Rating

- 7.3.9 If you install recessed light fittings where building elements are fire resistance rated, the installation must not lessen the integrity of that fire resistance rating. You must install recessed light fittings in accordance with the manufacturer's installation instructions and this section.

Acoustic Rating

- 7.3.10 If you install recessed light fittings where building elements are acoustic resistance rated, the installation must not lessen the integrity of that acoustic rating. You must install recessed light fittings in accordance with the manufacturer's installation instructions and this section.

7.4 RECESSED LIGHT FITTINGS AND AUXILIARY EQUIPMENT - CLASSES

TABLE 8: MOISTURE TRANSFER CLASSES

Recessed light fittings are categorised into five “moisture transfer” classes:

1	Open	(O)	An open recessed light fitting is a light fitting in which the area that is open between the “Occupied Space” and the “Concealed Space” is greater than 15% of the area of the hole cut in the ceiling into which the light fitting is fitted.
2	Restricted	(R)	A restricted recessed light fitting is a light fitting in which the area that is open between the “Occupied space” and the “Concealed Space” is greater than 5% but not more than 15% of the area of the hole cut in the ceiling into which the light fitting is fitted.
3	Closed	(C)	A closed recessed light fitting is a light fitting in which the area that is open between the “Occupied Space” and the “Concealed Space” is not more than 5% of the area of the hole cut in the ceiling into which the light fitting is fitted.
4	Fire resistance rated	(FR)	A fire resistance rated recessed light fitting is a light fitting that is sealed between the “Occupied Space” and the “Concealed Space” and does not compromise the fire resistance rating of the space.
5	Acoustic rated	(AR)	An acoustic rated recessed light fitting is a luminaire that is sealed between the “Occupied Space” and the “Concealed Space” and does not compromise the acoustic rating of the space.

TABLE 9: THERMAL INSULATION CLEARANCE CLASSES

Recessed light fittings are also categorised into three thermal insulation clearance classes:

1	Abutted	(A)	The aperture made in the insulation material is of the same size as the hole made in the ceiling surface into which the light fitting is recessed.
2	Standard 0.1 m	(R)	The aperture made in the insulation material is approximately 100 mm larger on each side of the fitting than the size of the hole made in the ceiling surface into which the light fitting is recessed.
3	Specified	(*)	The aperture made in the insulation material is that which is specified in the manufacturer's installation instructions.

Applying the classes

- 7.4.1 The first letter refers to the Moisture Transfer Class, see Table 8, and the second letter refers to the Thermal Insulation Clearance, see Table 9. Table 10 (*Page 54*) gives sub-categories that can then be applied to the various areas. For example, "OA" is an open, abutted light fitting.
- 7.4.2 Use Table 11 (*Page 56*) to apply the different types of light fitting to the various areas and ceiling construction types.

TABLE 10: RECESSED LIGHT FITTINGS: CLEARANCES FROM THERMAL INSULATION

Thermal Insulation Clearance	Moisture Transfer Class				
	Open	Restricted	Closed	Fire resistance rated	Acoustic rated
Abutted	OA	RA	CA	Look at the manufacturer's installation instructions	
Standard 100 mm	OS	RS	CS		
Specified	O*	O*	O*		

*: Denotes that the second classification is specified in the manufacturer's installation instructions.

7.5 AUXILIARY EQUIPMENT

7.5.1 The auxiliary equipment must:

- (a) Be electrically safe;
- (b) Be adequately supported, ventilated and not covered by thermal insulation;
- (c) Prevent the risk of overheating and fire;
- (d) Be positioned so as not to be degraded or damaged by heat given off the light fittings or their lamps;
- (e) Not be damaged by the effects of moisture or vapour; and
- (f) Be enclosed so that no-one can get at live low voltage parts without using a tool.

7.5.2 You must ensure that:

- (a) Transformers are not installed directly above lampholders;
- (b) Transformers are not installed within a fire barrier unless they are fire rated; and
- (c) Cables supplying power to the light fitting or auxiliary equipment are kept away from heat sources (*e.g. the rear of lamps, or too close to auxiliary equipment*).

7.5.3 Auxiliary equipment such as heat dispersal covers (*heatcans*) must be classified according to Table 10 and must be

installed in accordance with the manufacturer's installation instructions.

7.6 **MOIST AREAS**

If you install recessed light fittings in moist areas, they must be the type that prevents the transfer of moist air, steam or water vapour into concealed spaces. They must be:

- (a) Physically enclosed or sealed and rated suitable for use in moist areas; or
- (b) The closed type; or
- (c) The restricted type, where the space is provided with adequate mechanical ventilation, in accordance with the New Zealand Building Code G4.

TABLE 11: RECESSED LIGHT FITTINGS CROSS-REFERENCED WITH CEILING TYPES

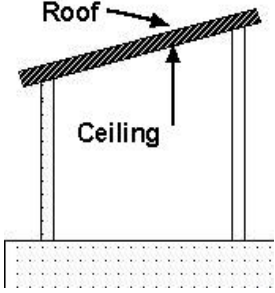
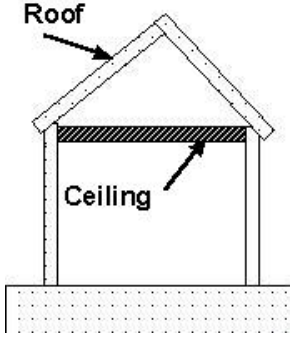
			Ceiling Types											
			Skillion Roof						Ceiling Below Accessible Roof Space					
														
Light Fitting Type			Thermally Insulated			No Insulation			Thermally Insulated			No Insulation		
Symbol	Moisture Transfer	Insulation Clearance	Utility	Habitable	Moist	Utility	Habitable	Moist	Utility	Habitable	Moist	Utility	Habitable	Moist
OA	Open	Abutted	✓			✓			✓			✓		
OS	Open	100mm				✓						✓		
O*	Open	To spec				✓						✓		
RA	Restricted	Abutted	✓	✓		✓	✓		✓	✓		✓	✓	
RS	Restricted	100mm				✓	✓					✓	✓	
R*	Restricted	To spec				✓	✓					✓	✓	
CA	Closed	Abutted	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CS	Closed	100mm				✓	✓	✓				✓	✓	✓
C*	Closed	To spec				✓	✓	✓				✓	✓	✓

TABLE 11: RECESSED LIGHT FITTINGS CROSS-REFERENCED WITH CEILING TYPES (CONT'D)

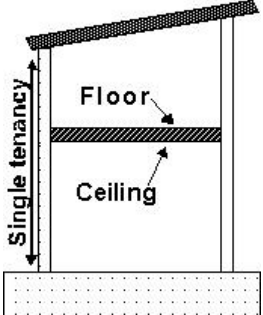
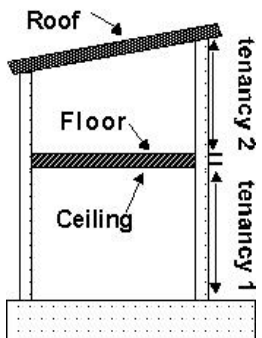
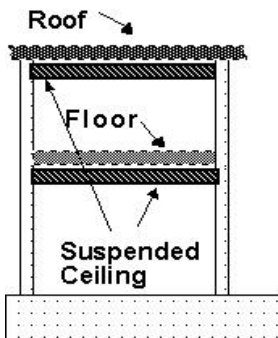
Ceiling Types																		
Ceiling Within Floor– No Fire or Acoustic Separation						Ceiling Within Floor– Fire or Acoustic Separation Required						Suspended Ceiling						
Single Tenancy						Dual Tenancy												
																		
Thermally Insulated		No Insulation				Thermally Insulated		No Insulation				Thermally Insulated		No Insulation				
Utility	Habitable	Moist	Utility	Habitable	Moist	Utility	Habitable	Moist	Utility	Habitable	Moist	Utility	Habitable	Moist	Utility	Habitable	Moist	
			✓	✓	✓	Do Not Penetrate Fire or Acoustic Separation Unless A Special Fire Rated or Acoustic Rated Light Fitting is Used				✓	✓	✓	✓	✓	✓	✓	✓	
			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

FIGURE 18: MINIMUM CLEARANCES FOR RECESSED LIGHT FITTINGS

Building element above the fitting

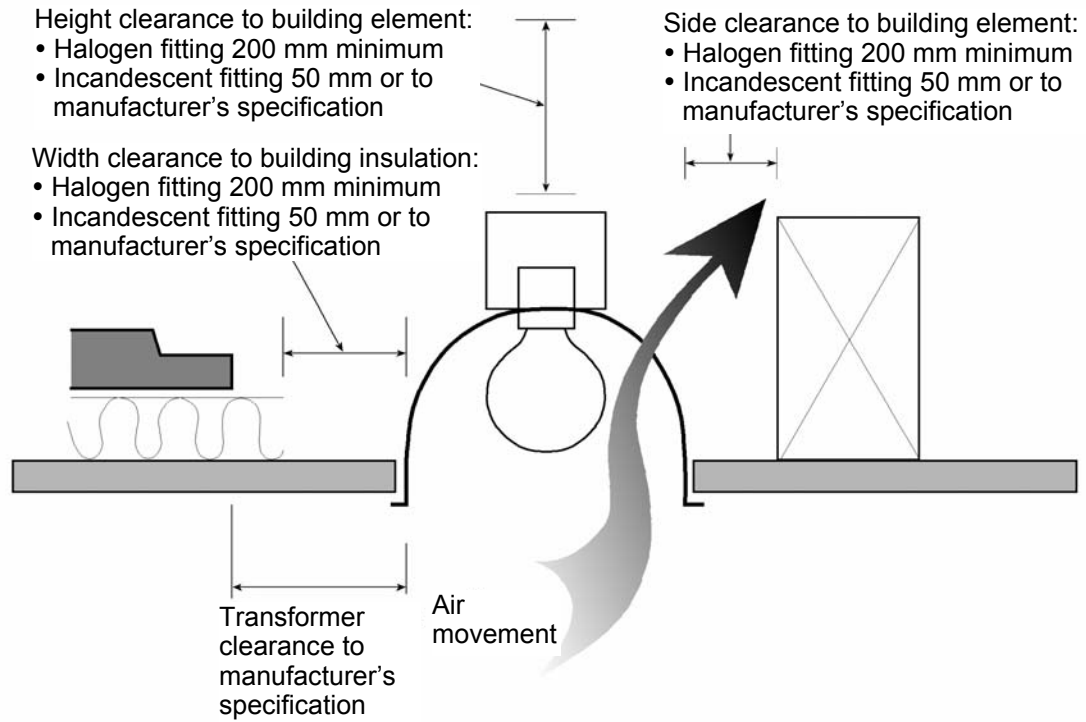


FIGURE 19: MOIST, HABITABLE, AND UTILITY AREAS

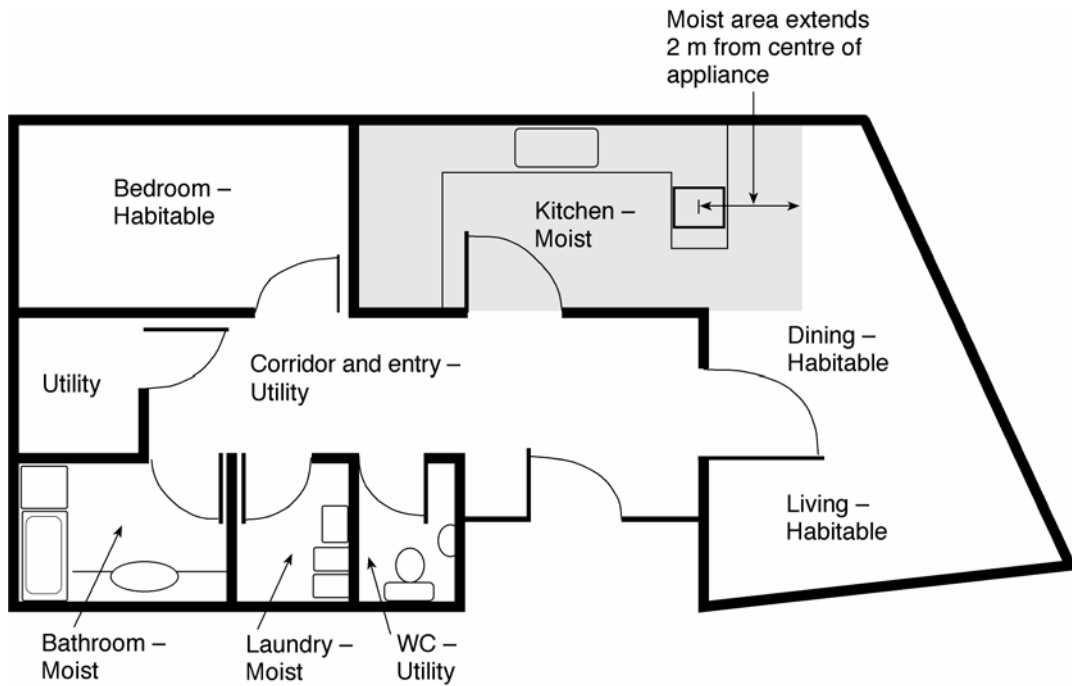
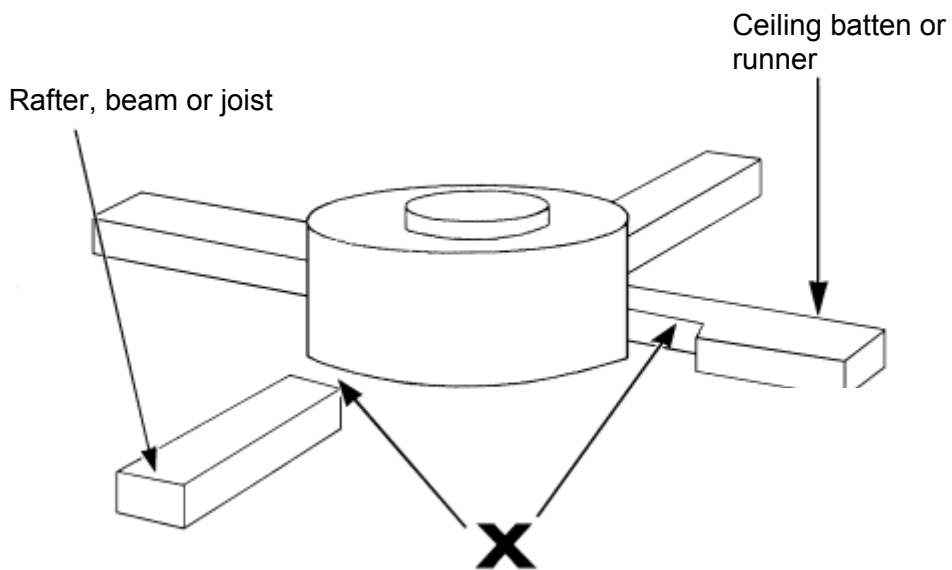


FIGURE 20: PROHIBITED CUTTING OR NOTCHING OF JOISTS, BEAMS, RAFTERS AND CEILING BATTENS



APPENDIX A: RCDs, FUSES AND CIRCUIT-BREAKERS

A1 RESIDUAL CURRENT DEVICES (*RCDs*)

- A1.1 An RCD that is used for personal protection will protect you from receiving a fatal electric shock, if a fault to earth occurs in an electrical installation. If a fault occurs, the RCD will turn off the power supply to the circuit(s) it controls.
- A1.2 RCDs used for personal protection come in three types:
- (a) The type mounted on your switchboard. These are different from circuit-breakers, which are similar in appearance (*circuit-breakers will not protect you from receiving a severe or fatal electric shock*). The RCD will have an operating switch and a “test” button, while the circuit-breaker has only an operating switch.
 - (b) The type that forms part of a socket-outlet (*usually located in a damp area such as a bathroom or laundry*) will have a “test” and “reset” button.
 - (c) The portable type for use with portable electrical appliances outdoors, e.g. hedge clippers, etc. These also have a “test” and “reset” button.
- A1.3 It is very important, even where RCDs are being used, to ensure that you do **NOT** touch any bare wires or connections when you are carrying out repairs on the installation wiring or on any electrical appliance that is plugged in, unless the power supply has been disconnected.
- A1.4 From 1 January 2003, the Electricity Regulations require all new domestic electrical installations to have a number of RCDs mounted on the main switchboard of that installation. These will provide protection of all lighting and socket-outlet circuits of that installation.
- A1.5 All new circuits run from the main switchboard of an existing installation are also required to be RCD protected. This RCD may be mounted on the switchboard for lighting and socket-outlet circuits or at the first socket-outlet on the circuit.
- A1.6 Prior to 1 January 2003, domestic electrical installations may have had an RCD fitted in the bathroom or laundry, usually as a socket-outlet type.

- A1.7 A good time to check that your switchboard RCDs are working is at the beginning and end of daylight saving. This can be done by pressing the “test” button on the RCD. Remember this test disconnects the power and will require you to reset any electronic timers, etc.
- A1.8 All switchboard mounted RCDs include an operating switch. If the RCD is on, this will be indicated by the switch position at “ON” or “I”; if the RCD is off, this will be indicated by the switch position being at “OFF” or “O”; if in the mid-way position, the RCD has automatically turned off and has disconnected the power.
- A1.9 All socket-outlet type RCDs include an indicator lamp or indicator flag. These types of RCDs should be tested monthly. This can be done by operating an electrical appliance from the socket-outlet and pushing the test button on the RCD; this should cause the appliance to turn off.
- A1.10 Portable type RCDs include an indicator lamp or indicator flag. These types of RCD should be tested each time you use them. This can be done by operating the electrical appliance connected to the RCD pushing the test button will turn the appliance off.
- A1.11 Always reset the RCD after testing. For the switchboard mounted types, reset the RCD by switching the operating switch from “OFF” or “O” to the “ON” or “I” position until a clicking sound is heard. For the socket-outlet and the portable types, press the ‘reset’ button.
- A1.12 Never use an RCD if the “test” button fails to turn off (*test button does not extend*). Seek advice from a licensed electrical worker as the RCD may need replacing.

A2 FUSES AND CIRCUIT-BREAKERS

- A2.1 Fuses or circuit-breakers prevent overloading of the electrical wiring of the installation. These are found on the main switchboard and on other switchboards of the installation. Fuses may also be found in electric ranges and can be found inside electronic appliances.

- A2.2 Fuses and circuit-breakers on switchboards are normally labelled (*below each fuse or circuit-breaker*) with the type of circuit they control, see Table 12.
- A2.3 The number of fuses and/or circuit-breakers on the main switchboard will depend on the number of circuits in the electrical installation. However, in general, there will be:
- (a) At least 2 lighting circuits;
 - (b) Any number of socket-outlet circuits; and
 - (c) Separate circuits for the electric range, water heater and supplies to garages or outbuildings.
- A2.4 If the switchboard is not marked to indicate the circuit, then check the marking on the fuse carrier. It will be marked with the current rating of the fuse in amperes (A), see Table 12.

TABLE 12: CIRCUITS AND CURRENT RATINGS OF FUSES OR CIRCUIT-BREAKERS

Circuit	Example of Label	Current Rating (Amperes)
Lighting	“LIGHT”	5 A or 10 A
Socket-outlets	“HTG” or “S-O” or “GPO” or “Power”	10 A, 15 A or 20 A
Night store heater	“Storage heater”	15 A or higher
Water heating	“W/H”	10 A or 15 A
Electric range	“RANGE”	30 A or 32 A
Separate oven Hob	“Oven” “Hob”	15 A 20 A
Garages or outbuildings	“SUB”	15 A to 32 A

- A2.5 In the event of an overload, the fuse will melt or the circuit-breaker will turn off the electrical supply to that circuit. This prevents damage to the circuit wiring of the installation.
- A2.6 If the fuse blows again after you have repaired it or the circuit-breaker continues to turn off, the fault will need to be identified. This could be due to:

- (a) Overloaded circuit, i.e. too many electrical appliances operating at the same time from a socket-outlet(s);
- (b) Faulty or damaged switch or socket-outlet;
- (c) Faulty electrical appliance;
- (d) Faulty light fitting, or blown light bulb;
- (e) Damaged or faulty wiring in the installation.

A2.7 Depending on the fault that you have identified, take further action as follows:

- (a) To prevent overloading a circuit, disconnect some of the electrical appliances; or
- (b) If there are faulty or damaged switches or socket-outlets, replace with new. Carry out this work in accordance with ECP 51 or contact a licensed electrical worker; or
- (c) Disconnect all electrical appliances that have stopped operating, repair the fuse or switch the circuit-breaker to the on position, and reconnect the electrical appliances one at a time. The electrical appliance that causes the fuse to blow or circuit-breaker to turn off is faulty and will require repair.
- (d) If a light bulb has blown, replace bulb. If the light fitting is faulty, contact a licensed electrical worker.
- (e) If there is damaged or faulty wiring, contact a licensed electrical worker.

A2.8 There are two general types of fuses used in electrical installations, the cartridge fuse (*also known as HRC – high rupturing capacity*) and the re-wireable fuse, see Figure 21 (*Page 65*) for fuse types. See also Figure 22 (*Page 66*) for other types of re-wireable fuses.

A2.9 The cartridge fuse is an insulating tube fitted with metal caps at each end and contains a fuse wire surrounded by insulating powder. This is held inside a specially designed carrier that plugs into a base.

- (a) **Never** attempt repairs to a cartridge fuse.
- (b) **Always** replace the cartridge fuse with a new one of the same type, current rating and physical size.
- (c) **Never** attempt to bridge a break in the cartridge fuse or holder in any way.

A2.10 Re-wireable fuses are the type most often found in older domestic installations. They are made of a porcelain or bakelite base and have a fuse carrier containing the

replaceable fuse wire. For replacement, ensure that a single strand of the same current rating fuse wire is used.

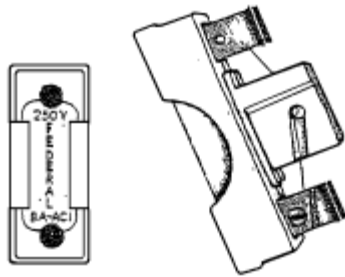
- A2.11 If any fuse base or carrier is damaged, cracked or broken, or is showing signs of heating or burning, the base and carrier will need to be replaced by a licensed electrical worker.

Circuit-Breakers

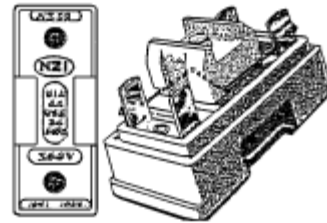
- A2.12 Circuit-breakers do the same thing as fuses. The types of circuit-breakers most commonly found on switchboards are the on/off push button and the on/off switch types.
- A2.13 To reset on/off push button types, simply push the button that has popped out, back in.
- A2.14 Some switch on/off types, when tripped (*automatically turned off*) by a fault, will move to the mid-point between “ON” and “OFF”. They need to be reset by switching them to “OFF” before turning back to “ON”. It is important to identify where the “ON” and “OFF” positions are. Some may have the “ON” position pointing up while others could be pointing down. The circuit-breaker will be marked “ON” or “OFF” or be marked “I” for “ON” and “O” for “OFF”.

FIGURE 21: TYPES OF FUSES

RE-WIRABLE FUSES



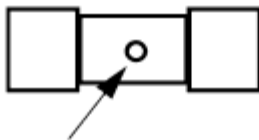
Federal fuse



NZI fuse

CARTRIDGE FUSES

Pull-cap fuse

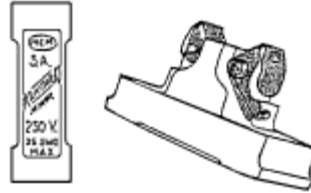


If black, it usually indicates the fuse has blown

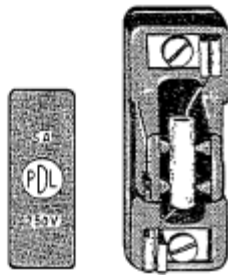
Knife-blade fuse
Rarely found in domestic installations. If used, it would be for the main fuse.



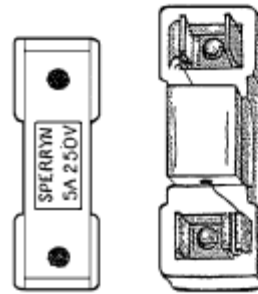
FIGURE 22: OTHER TYPES OF RE-WIREABLE FUSES



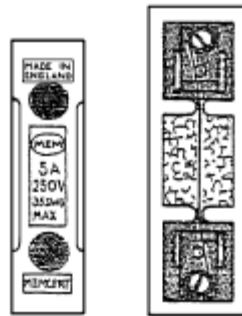
Kantark fuse



PDL fuse



Sperryn fuse



MEM fuse

A3 REPLACING OR REPAIRING A RUPTURED OR BLOWN FUSE

To find out which fuse has ruptured or blown:

- A3.1 Unplug any suspected electrical appliance that may be overloading the circuit or is faulty, check for any faulty switches or socket-outlets or turn light switches to the “OFF” position in case the light bulb has blown. For permanently connected electrical appliances, turn the permanent connect unit (*PCU*) switch to the “OFF” position.
- A3.2 For added safety, turn the “MAIN SWITCH” on the switchboard to the ‘OFF’ position. This will prevent you coming into contact with live parts when removing fuse carriers.
- A3.3 Remove the fuse carriers by grasping them between thumb and finger. Then:
- (a) For a re-wireable fuse, examine each fuse carrier until you find the blown fuse.
 - (b) For a cartridge fuse, check to see if the indicator has turned black, see Figure 23 (*Page 69*) or check by using a multi-meter set on the Ω scale. See subclause A4 for testing a cartridge fuse.
- A3.4 You will need the following items for repairing a blown, re-wireable fuse:
- (a) Correct amperage fuse wire, usually sold on labelled cards of different current ratings, i.e. 5, 10, 15, 20 and 30 A;
 - (b) A pair of scissors or small side cutters;
 - (c) A multi-meter (*optional*).
- A3.5 You will need these items for replacing a ruptured cartridge fuse:
- (a) New cartridges of the same type and rating;
 - (b) A multi-meter.

Replacing the blown fuse wire

- A3.6 Remove any fuse wire from the blown fuse or any melted bits of wire.

- A3.7 Make sure that the fuse wire pathway where you are going to place the new fuse wire is clean.
- A3.8 Select the correct current rating of fuse wire. **Never** use more than one strand of fuse wire or a larger size fuse wire than is indicated on the carrier, or you could create a fire hazard.
- A3.9 Thread the fuse wire through the pathway in the fuse carrier and connect the ends at the terminals.
- A3.10 Trim the fuse wire so that no ends of the wire project out of the fuse carrier.
- A3.11 Place the fuse carrier back into its associated base.
- A3.12 Before turning on the main switch, **make sure your face is turned away from the fuse**. If the fuse blows again a hazard could be created.

Replacing the ruptured cartridge fuse:

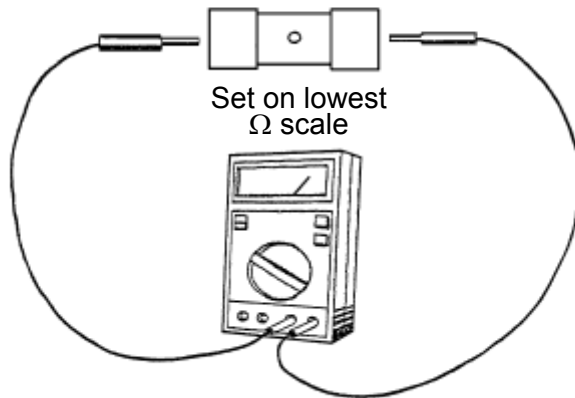
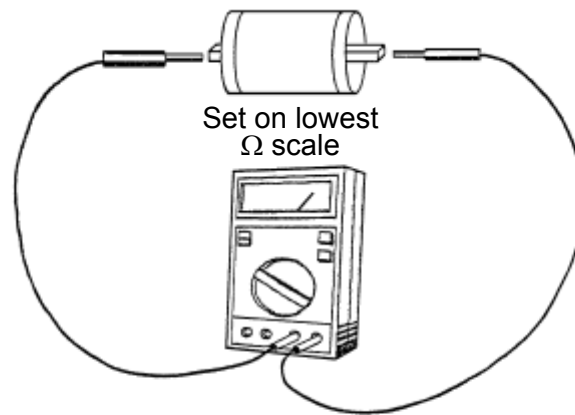
- A3.13 Select the correct size cartridge. Ensure the replacement cartridge is of the same type, current rating and physical size. **Always** use cartridge fuses in this type of fuse carrier.
- A3.14 Place the cartridge into the fuse carrier.
- A3.15 Place the fuse carrier back into its associated base.
- A3.16 Turn on the main switch. If the fuse ruptures again it is unlikely that any hazard would be created, unlike the re-wireable fuse.

A4 PROCEDURE FOR TESTING CARTRIDGE FUSES

- A4.1 Remove cartridge fuse.
- A4.2 Carry out a test on the cartridge fuse by using a multi-meter on the lowest Ω scale, see Figure 23 (*Page 69*).
- A4.3 Connect one probe to one end of the fuse and the other probe to the other end. Make sure they make good contact with the metal.
- A4.4 If the fuse has ruptured, there will be no reading.

FIGURE 23: TESTING CARTRIDGE FUSES

NOTE: Meter readings show fuse is satisfactory



A5 REPLACING RE-WIREABLE FUSES WITH PLUG-IN CIRCUIT-BREAKERS

- A5.1 Plug in circuit-breakers offer a simple way to assist in preventing a switchboard overload. You can replace re-wireable fuses with plug-in circuit-breakers, as long as the fuse base:
- (a) Is not damaged, cracked or broken; and
 - (b) Is not showing signs of heating or burning; and
 - (c) Can hold the plug-in circuit-breaker without exposing live contacts.
- A5.2 If the base needs to be replaced, contact or arrange with a licensed electrical worker to do this work.
- A5.3 **Always** check the fuse size and match it up with the correct size circuit-breaker.
- A5.4 **Do not** remove all the fuse carriers at once. Replace them individually so you can make sure you are putting in the right sized circuit-breaker. See Table 13, for the correct fuse/circuit-breaker match.

TABLE 13: FUSE/CIRCUIT-BREAKER SIZES

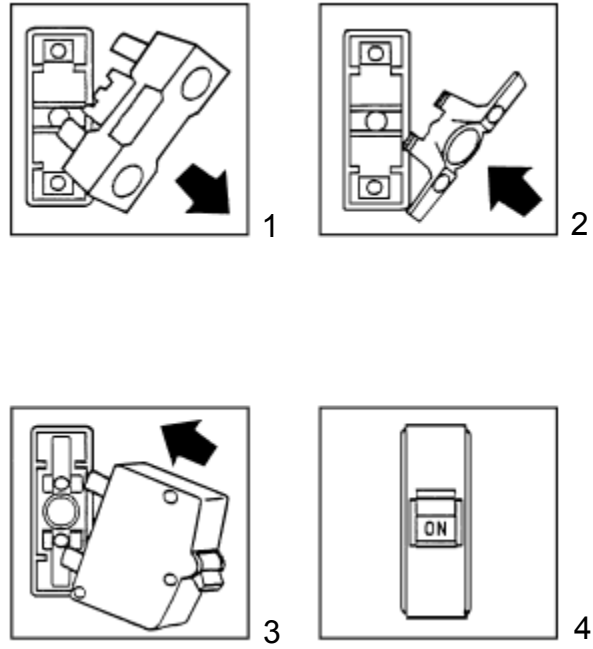
Fuse (A)	Circuit-breaker (A)
5	6
10	10
15	16
20	20
30	25, 32

- A5.5 The electric range fuse (*30 amp re-wireable fuse*) has a large base and can't be replaced with a plug-in circuit-breaker. However, if you want to have the re-wireable fuse replaced with a circuit-breaker, get a licensed electrical worker to fit a circuit-breaker on your switchboard.

To replace the fuse carrier with a plug-in circuit-breaker

- A5.6 Turn the main switch to the “**OFF**” position on the switchboard on which the re-wireable fuse is to be replaced by the circuit-breaker. Verify this by turning a light switch “ON” in your home (*the light should not work*).
- A5.7 Remove the fuse carriers one at a time, see Figure 24(1) (*Page 72*).
- A5.8 Check that the fuse base is suitable for fitting the plug-in circuit-breaker by inserting the circuit-breaker into the fuse base. The circuit-breaker should be firmly retained and there should be no exposed (*bare*) metal contacts visible when the circuit-breaker is fitted. If there are no exposed metal contacts, remove the plug-in circuit-breaker and proceed to the next step (*A5.10*).
- A5.9 Where the plug-in circuit-breaker is **NOT** firmly retained or if there are exposed metal contacts, the fuse base must be changed. Get a licensed electrical worker to fit a permanently wired circuit-breaker or fit a correct fuse base for the plug-in circuit-breaker.
- A5.10 Place the plastic insert (*which is provided with the plug-in circuit-breaker*) over the contacts of the fuse base, see Figure 24(2) (*Page 72*).
- A5.11 Make sure the circuit-breaker is in the “OFF” position.
- A5.12 Insert the circuit-breaker, making sure it is the correct amperage, see Figure 24(3) (*Page 72*).
- A5.13 Repeat steps from A5.7 – A5.12 for all fuses being replaced.
- A5.14 Restore the main switch at the completion of work and make arrangements with a licensed electrical worker to replace unsuitable fuse bases.
- A5.15 Turn each circuit-breaker to the “ON” position. This will be in the up position, see Figure 24(4) (*Page 72*).
- A5.16 Check that all lights and socket-outlets are working.

FIGURE 24: REPLACEMENT OF FUSES WITH PLUG-IN CIRCUIT-BREAKERS



APPENDIX B: ELECTRICAL SAFETY CHECKS

Check the back pages of your Yellow Pages for information on first aid.

B1 STAY SAFE

- B1.1 Always remember that electric voltages and currents can be dangerous. Unplug, disconnect or isolate any electrical appliance, cord set or extension lead before attempting any inspection, replacement or repair of any appliance, cord or extension lead.
- B1.2 Replace any broken or damaged fittings.
- B1.3 Never replace a blown fuse wire with a larger size fuse wire.
- B1.4 Always turn the power supply off if painting or wallpapering around switches or socket-outlets or other fittings.
- B1.5 Contact your electricity retailer (obtain contact details from your power account) to disconnect the power supply if working or painting near overhead electric lines.
- B1.6 Never erect radio and TV aerials near overhead electric lines.
- B1.7 Never erect boat masts near overhead electric lines. Also watch out for overhead electric lines when moving boats onshore or close to shore. Always look up and check.
- B1.8 Beware of overhead electric lines when installing wire fences.
- B1.9 Never fly kites near overhead electric lines.

B2 SOCKET-OUTLETS

- B2.1 Never overload socket-outlets. Socket-outlets are designed to take one or two electrical appliances, (*the total current rating of a double socket-outlet is 10 A*).
- B2.2 Never allow children to play with socket-outlets. Make your socket-outlets safe by inserting safety caps. Some modern socket-outlets usually have in-built safety shutters that only open when the pins of a plug are pushed into the shutter.

- B2.3 If there are not enough socket-outlets in the installation and you use a socket-outlet multi-box, make sure that it has a circuit-breaker mounted in it. **WARNING:** The total amount of load or electrical appliances that can be connected to a multi-box must be limited to the recommendations on the multi-box. Multi-boxes are not suitable for refrigerators, freezers, toasters, kettles, heaters, washing machines or dryers. Overloading with these electrical appliances will result in the multi-box contacts failing and this could cause a fire. Also ensure that the multi-box is not left on the floor; mount it on the wall.

B3 HEATING APPLIANCES

- B3.1 Never have your water heater thermostat set too high. About 65-70°C is acceptable.
- B3.2 Never place heating appliances near curtains or bedding or clothing.
- B3.3 Never place clothes on top of heaters for drying purposes. Always use a drying rack at least 1 metre away from the heater.
- B3.4 Never place a heating appliance in a closed room. Always leave a door or window partly open.

B4 LIGHT FITTINGS

- B4.1 Where a maximum wattage lightbulb is indicated, do not exceed this wattage; else use a smaller wattage lightbulb.
- B4.2 Ensure that drapes and furnishing are kept clear of light fittings.

B5 RCDs

- B5.1 Always plug a portable residual current device directly into the socket-outlet and test the RCD tripping, reset the RCD and then plug in the flexible cord into the RCD. Doing this protects you from a fault in the cord as well as the electrical appliance.

- B5.2 Test socket-outlet RCDs on a regular basis. Monthly testing is recommended. Press the test button on the RCD. The operational status will be indicated by the RCD operating toggle position, an indicator lamp or indicator flag.
- B5.3 Always reset the RCD after testing. Reset the RCD by switching the operating toggle from “OFF” or “O” to the “ON” or “I” position until a clicking sound is heard.
- B5.4 Never use an RCD if the test button fails to trip (*test button does not extend*). Seek advice from a licensed electrical worker as the RCD may need replacing.
- B5.5 If an RCD repeatedly trips, disconnect all the electrical appliances connected to the RCD, reset the RCD and reconnect the appliances **one at a time** until the appliance trips the RCD. This indicates that the last appliance connected is faulty and should be repaired before re-use. If the circuit includes a computer, the computer may cause a trip due to the inherent leakage of current associated with these appliances. Seek advice from a licensed electrical worker if required.
- B5.6 Occasionally, an electrical appliance may test “clear” when connected to an RCD on its own but may cause the RCD to trip when connected with a second appliance that has also tested clear. The cause of this may be that the leakage current of both, when added together, exceeds the RCD’s trip setting. In this case seek advice from a licensed electrical worker.

B6 ELECTRICAL APPLIANCES

- B6.1 Replace any frayed or damaged cords on electrical appliances; do not tape them up.
- B6.2 Never take electrical appliances into a bathroom when they are supplied with electricity from another room.
- B6.3 Never use electrical appliances outdoors unless they are protected by an isolating transformer or by a residual current device.
- B6.4 Always switch off an electrical appliance before unplugging it.

- B6.5 Always unplug or disconnect electrical appliances before undertaking any repairs.
- B6.6 Never use a repaired electrical appliance or second hand appliance unless it has been tested.
- B6.7 Never leave electrical appliances unattended around swimming pools.