**Part 1: Scope, Application and Fundamental Principles**

**SECTION 1 SCOPE, APPLICATION AND FUNDAMENTAL PRINCIPLES**

**1.1 SCOPE**

This Standard sets out requirements for the design, construction, and verification of electrical installations, including the selection and installation of electrical equipment forming part of such electrical installations.  
These requirements are intended to protect persons, livestock, and property from electric shock, fire, and physical injury hazards that may arise from an electrical installation that is used with reasonable care and with due regard to the intended purpose of the electrical installation.

* In addition, guidance is provided so that the electrical installation will function correctly for the purpose intended and takes into account mitigating the foreseeable adverse effects of disruption to supply.

**1.2 APPLICATION**

This Standard may be applied through legislative requirements, made in each state and territory of Australia and in New Zealand, concerned with the safety of electrical installations. The Standard may also be applied in conjunction with any additional requirements, exemptions, or restrictions in such legislation.  
The principal application of this Standard is to electrical installations in all types of premises and land used by electricity consumers. However, the Standard may also be referenced or applied through legislative or other requirements relating to the effect of electrical installations in matters such as the following:

* (a) Safety of workplaces.
  + NOTE: For example, any relevant work health and safety legislation and associated codes.
* (b) Safe design and construction of buildings.
  + NOTE: For example, national building codes [such as the National Construction Code (NCC), New Zealand Building Code (NZBC)] and the associated referenced Standards. See Appendix E for information on NCC and NZBC.
* (c) Electricity generation, transmission, and distribution systems.
* (d) Safe connection to electricity distribution systems.
  + NOTE: For example, service rules and conditions provided by local electricity distributors.
* (e) Qualifications of electricity workers.

Part 1 (Section 1) of this Standard provides a mechanism for acceptance of design and installation practices that may not be addressed by those given in Part 2 (Sections 2 to 8) of this Standard. This mechanism is only intended to apply where departures from the methods in Part 2 are significant.

* NOTE: A degree of flexibility exists within Part 2.

**1.3 REFERENCED DOCUMENTS**

See Appendix A for a list of documents referred to in this Standard.

**1.4 DEFINITIONS**

**1.4.1 Application of definitions**

Throughout this Standard, the definitions of terms given in Clauses 1.4.2 to 1.4.134 apply. Where an additional term is defined in a particular section or clause, the term has the meaning defined there.  
The definitions apply to both parts of this Standard.

* Exception: Where the context otherwise requires, or the word or term is not specifically defined, the commonly understood meaning applies. Where the terms voltage and current are used without further qualification, they imply r.m.s. values.

**1.4.2 Accessible**

* Capable of being reached for inspection, maintenance, or repairs but does not include the destructive dismantling of structural components.

**1.4.3 Accessible, readily**

* Capable of being reached quickly and without climbing over or removing obstructions, or using a movable ladder, and in any case not more than 2.0 m above the ground, floor, or platform.

**1.4.4 Accessory**

* Any device, such as a switch, fuse, plug, socket-outlet, lampholder, fitting, adaptor, or ceiling rose that is associated with wiring, luminaires, switchboards, or appliances; but not including the lamps, luminaires, appliances, or switchboards themselves.

**1.4.5 Active (or active conductor)**

* Any conductor that is maintained at a difference of potential from the neutral or earthed conductor. In a system that does not include a neutral or earthed conductor, all conductors are considered to be active conductors.

**1.4.6 Adjacent**

* Next to or adjoining without obstruction and within arm's reach.

**1.4.7 Aerial conductor**

* Any stranded conductor (including aerial bundled conductors) that is supported by insulators or purpose-designed fittings above the ground and is directly exposed to the weather.
* Alive (see Clause 1.4.79 Live part).

**1.4.8 Alteration**

* A modification to part(s) of an electrical installation.
  + NOTE: Repairs are not alterations. A repair is defined in Clause 1.4.101.

**1.4.9 Appliance**

* A consuming device, other than a lamp, in which electricity is converted into heat, motion, or any other form of energy, or is substantially changed in its electrical character.

**1.4.10 Appliance, fixed**

* An appliance that is fastened to a support or otherwise secured in a specific location.

**1.4.11 Appliance, hand-held**

* A portable appliance intended to be held in the hand during normal use, the motor, if any, forming an integral part of the appliance.

**1.4.12 Appliance, portable**

* Either an appliance that is moved while in operation or an appliance that can easily be moved from one place to another while connected to the supply.

**1.4.13 Appliance, stationary**

* Either a fixed appliance or an appliance having a mass exceeding 18 kg and not provided with a carrying handle.

**1.4.14 Arc fault detection device (AFDD)**

* A device intended to mitigate the effects of arcing faults, within installation wiring and plug and lead connection of electrical equipment, by disconnecting the circuit when an arc fault is detected.

**1.4.15 Area, hazardous**

* Area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation, and use of equipment [based on AS/NZS 60079 series].

**1.4.16 Arm's reach**

A zone extending from any point on a surface where persons usually stand or move about, to the limits that a person can reach with the hand in any direction without assistance (e.g., tools or ladder) (see Figure 1.1).

**1.4.17 Authority, regulatory**

A government agency responsible for relevant legislation and its application.

**1.4.18 Authorized person**

* The person in charge of the premises, or a competent person appointed or selected by the person in charge of the premises to perform certain duties on the premises.

**1.4.19 Available, readily**

Capable of being reached for inspection, maintenance, or repairs without necessitating the dismantling of structural parts, cupboards, benches, or the like.

**1.4.20 Barrier**

A part providing basic protection from any usual direction of access.  
Basic insulation (see Clause 1.4.73 Insulation system).  
Basic protection (see Clause 1.4.97 Protection, basic).

**1.4.21 Cable**

A single cable core, or two or more cable cores laid up together, either with or without fillings, reinforcements, or protective coverings.

**1.4.22 Cable, armoured**

A cable provided with a wrapping of metal, usually tapes or wires, primarily for the purpose of mechanical protection.

**1.4.23 Cable core**

The conductor with its insulation but not including any mechanical protective covering.

**1.4.24 Cable, flexible**

A cable, the conductors, insulation, and covering of which afford flexibility.

**1.4.25 Cable, mineral insulated metal sheathed (MIMS)**

A cable having compressed powdered mineral insulation enclosed in solid-drawn metal sheathing. Such a cable may be either single-core or multi-core.

**1.4.26 Cable, neutral-screened**

A cable consisting of one or more cores laid up together with or without fillers, surrounded by a concentric wire outer conductor, further protected with an insulating sheath.

**1.4.27 Cable, sheathed**

A cable having a core or cores surrounded by a sheath.  
Cable trunking (see Clause 1.4.127 Trunking, cable).

**1.4.28 Ceiling, suspended**

In accordance with AS/NZS 2785, a suspended ceiling is a ceiling system hung at a distance from the floor or roof above. It does not include a nailed timber ceiling complying with AS/NZS 2589 and timber building Standards.

**1.4.29 Circuit**

A circuit comprises live conductors, protective conductors (if any), a protective device, and associated switchgear, control gear, and accessories.

**1.4.30 Circuit-breaker**

A switch suitable for opening a circuit automatically, as a result of predetermined conditions, such as those of overcurrent or under voltage, or by some form of external control.

**1.4.31 Class I equipment**

Equipment in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in that accessible conductive parts are connected to the protective earthing conductor in the electrical installation in such a way that accessible parts cannot become live in the event of a failure of the basic insulation.  
NOTES:

1. Class I equipment may have parts with double insulation or parts operating at SELV.
2. For equipment intended for use with a flexible cord or cable, this provision includes a protective earthing conductor as part of the flexible cord or cable.

**1.4.32 Class II equipment**

Equipment in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions. Such equipment may be one of the following types:

* (a) Equipment having durable and substantially continuous enclosures of insulating material that envelope all metal parts, with the exception of small parts, such as nameplates, screws, and rivets, that are isolated from live parts by insulation at least equivalent to reinforced insulation. Such equipment is called insulation-encased Class II equipment.
* (b) Equipment having a substantially continuous metal enclosure, in which double insulation is used throughout, except for those parts where reinforced insulation is used because the application of double insulation is manifestly impracticable. Such equipment is called metal-encased Class II equipment.
* (c) Equipment that is a combination of the types described in Items (a) and (b).

NOTES:

1. The enclosure of insulation-encased Class II equipment may form part of the whole of the supplementary insulation or of the reinforced insulation.
2. If the equipment with double insulation or reinforced insulation throughout has an earthing terminal or earthing contact, it is considered to be of Class I construction.
3. Class II equipment may be provided with means for maintaining the continuity of protective circuits, insulated from accessible conductive parts by double insulation or reinforced insulation.
4. Class II equipment may have parts operating at SELV.

**1.4.33 Class III equipment**

Equipment in which protection against electric shock relies on supply at SELV and in which voltages higher than those of SELV are not generated.  
NOTE: Equipment intended to be operated at SELV and which has internal circuits that operate at a voltage other than SELV, is not included in the classification and is subject to additional requirements.

**1.4.34 Competent person**

A person who has acquired, through training, qualification, or experience, or a combination of these, the knowledge and skill enabling that person to perform the required task correctly.

**1.4.35 Conductor**

A wire or other form of conducting material suitable for carrying current, but not including wire or other metallic parts directly employed in converting electrical energy into another form.

**1.4.36 Conductor, bare**

A conductor without covering or insulation.

**1.4.37 Consumer mains**

Those conductors between the point of supply and the main switchboard.

**1.4.38 Contact, direct**

Contact with a conductor or conductive part that is live in normal service (see Figure 1.2 and Clause 1.4.97 Protection, basic).

**1.4.39 Contact, indirect**

Contact with a conductive part that is not normally live but has become live under fault conditions (because of insulation failure or some other cause) (see Figure 1.3 and Clause 1.4.98 Protection, fault).

**1.4.40 Cord, flexible**

A flexible cable, no wire of which exceeds 0.31 mm diameter and no conductor of which exceeds 4 mm² cross-sectional area, and having not more than five cores.

**1.4.41 Current, fault**

A current resulting from an insulation failure or from the bridging of insulation.

**1.4.42 Current, overload**

An overcurrent occurring in a circuit that is electrically sound.

**1.4.43 Current, short-circuit**

A fault current resulting from a fault of negligible impedance between live conductors having a difference in potential under normal operating conditions. The fault path may include the path from active via earth to the neutral.  
NOTE: This current is also referred to as 'prospective short-circuit current' or a 'bolted fault'. It is the maximum value, at the relevant points for the existing installation. Unless otherwise stated, it is the three-phase r.m.s. value.

**1.4.44 Damp situation**

A situation in which moisture is either permanently present, or intermittently present to such an extent as would be likely to impair the effectiveness or safety of an electrical installation that complies with this Standard for ordinary situations.

**1.4.45 De-energized**

* Separated from all sources of supply, but not necessarily isolated, earthed, or out of commission.  
  [Source: AS/NZS 4836]

Degree of protection (see Clause 1.4.70 IP Classification).  
Direct contact (see Clause 1.4.38 Contact, direct).

**1.4.46 Distribution board**

A switchboard other than a main switchboard.  
Distributor, electricity (see Clause 1.4.57 Electricity distributor).  
Domestic electrical installation (see Clause 1.4.53 Electrical installation, domestic).  
Double insulation (see Clause 1.4.73 Insulation system).

**1.4.47 Earthed**

Connected to the general mass of earth, and where relevant, the supply neutral in accordance with the appropriate requirements of this Standard.

**1.4.48 Earthed situation**

A situation wherein there is a reasonable chance of a person touching exposed conductive parts and, at the same time, coming into contact with earth or with any conducting medium that may be in electrical contact with the earth or through which a circuit may be completed to earth. The following situations are deemed to be earthed situations:

* (a) Within 2.5 m in any direction from a conductive floor (such as earthen, concrete, tile or brickwork flooring), permanently damp surface, metallic conduit or pipe, metallic cable sheath or armour, or any other conductive material on which a person may stand.
* (b) External to a building.  
  Exception: An isolated piece of equipment, such as a luminaire that is mounted more than 2.5 m from the ground and from any exposed conductive part or other conductive material that is in contact with earth, is not deemed to be in an earthed situation.
* (c) Within 2.5 m of the ground, floor, or platform in rooms containing socket-outlets, the earthing terminals of which are earthed, and where there is a reasonable chance of a person making simultaneous contact with any exposed conductive part of electrical equipment and any exposed conductive part of an appliance connected to any of the socket-outlets.
* (d) All parts of a bathroom, laundry, lavatory, toilet, or kitchen.

**1.4.49 Earth fault-loop impedance**

The impedance of the earth fault-current loop (active-to-earth loop) starting and ending at the point-of-earth fault.  
NOTE: Clause 5.7 provides a description of the constituent parts of an earth fault-current loop.  
Earthing conductor (see Clause 1.4.81 Main earthing conductor).  
(see Clause 1.4.100 Protective earthing conductor).

**1.4.50 Electrical equipment**

Wiring systems, switchgear, control gear, accessories, appliances, luminaires, and fittings used for such purposes as generation, conversion, storage, transmission, distribution, or utilization of electrical energy.

**1.4.51 Electrical fault**

An electrical failure, defect, or flaw in an electrical circuit, equipment, fixture, or fitting and any situation resulting in an unintentional:

* (a) loss, reduction, or increase of current or voltage;
* (b) voltage exceeding the maximum of the rated voltage;
* (c) overcurrent; or
* (d) arcing fault current.

**1.4.52 Electrical installation**

Electrical equipment installed for the purposes of conveyance, control, measurement, or use of electricity, where electricity is or is to be supplied for consumption. Includes electrical equipment supplied from a distributor's system or a private generating system.  
NOTES:

1. An electrical installation usually commences at the point of supply and finishes at a point (in wiring) but does not include portable or stationary electrical equipment connected by plug and socket-outlet (other than where a socket-outlet is used to connect sections of the fixed installation).
2. Unless the context otherwise requires, the term 'installation' is used to mean electrical installation.

**1.4.53 Electrical installation, domestic**

An electrical installation in a private dwelling or that portion of an electrical installation associated solely with a flat or living unit.

**1.4.54 Electrical installation, multiple**

An electrical installation incorporating:

* (a) a number of domestic electrical installations; or
* (b) a number of non-domestic electrical installations; or
* (c) any combination of domestic and non-domestic electrical installations.

**1.4.55 Electrical installation, residential**

* An electrical installation or that portion of an electrical installation associated with a living unit or units.  
  Example: Residential institutions, hotels, boarding houses, hospitals, accommodation houses, or motels.

**1.4.56 Electric vehicle (EV)**

* Any vehicle propelled by an electric motor drawing current from a rechargeable storage battery, which is manufactured primarily for use on public or private streets, roads, or highways.  
  NOTE: Electric vehicles are all road vehicles, including plug-in hybrid road vehicles (PHEV) that derive all or part of their energy from on-board batteries (see AS IEC 62196.2).

**1.4.57 Electricity distributor**

Any person or organization that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer, or electricity entity, as may be appropriate in the relevant jurisdiction.

**1.4.58 Enclosure**

A part providing an appropriate degree of protection of equipment against external influences and against contact with live parts.  
NOTE: AS 60529 and Appendix G provide further information on appropriate degrees of protection.

**1.4.59 Energized**

Connected to a source of electrical supply.

* [Source: AS/NZS 4836]

Equipment, electrical (see Clause 1.4.50 Electrical equipment).  
Equipment wiring (see Clause 1.4.131 Wiring, equipment).

**1.4.60 Equipotential bonding**

Electrical connections intended to bring exposed conductive parts or extraneous conductive parts to the same or approximately the same potential, but not intended to carry current in normal service.

**1.4.61 Explosive atmosphere**

Mixture with air, under atmospheric conditions, of flammable substances in the form of gas, vapour, dust, fibres, or flyings that, after ignition, permits self-sustaining propagation.  
[Source: AS/NZS 60079.0]

**1.4.62 Exposed conductive part**

A conductive part of electrical equipment that:

* (a) can be touched with the standard test finger as specified in AS/NZS 3100; and
* (b) is not a live part but can become live if basic insulation fails.

Exceptions: The term 'exposed conductive part' does not apply to any of the following:

1. Conductive parts within an enclosure where the parts cannot be touched unless a key or a tool is required to remove the covers of the enclosure.
2. Conductive parts within electrical equipment where the parts cannot be touched in normal use and during the movement of the electrical equipment, because of its configuration and size.
3. Conductive parts that are effectively and permanently separated from live parts by double insulation; or other conductive parts that are earthed.
4. Conductive parts that are in the form of nameplates, screw heads, covers, and similar attachments that cannot become live in the event of failure of insulation of live parts because of the manner in which they are supported and fixed.
5. A removable or hinged conductive panel fitted to a switchboard or other enclosure containing conductors that are so located and/or restrained that, in the event of any conductor becoming detached from a terminal or mounting, the conductor is incapable of making contact with the panel.

**1.4.63 Extraneous conductive part**

A conductive part that does not form part of an electrical installation but that may be at the electrical potential of a local earth.  
NOTE: Examples of extraneous conductive parts include the following:

* (a) Metal waste, water, or gas pipe from outside.
* (b) Cooling or heating system parts.
* (c) Metal or reinforced concrete building components.
* (d) Steel-framed structure.
* (e) Floors and walls of reinforced concrete without further surface treatment.
* (f) Tiled surfaces, conductive wall coverings.
* (g) Conductive fittings in washrooms, bathrooms, lavatories, toilets, etc.
* (h) Metallized papers.

Fault current (see Clause 1.4.41 Current, fault).

**1.4.64 Fault-current limiter**

A circuit-opening device designed or selected to limit the instantaneous fault current.  
Fault protection (see Clause 1.4.98 Protection, fault).  
Final subcircuit (see Clause 1.4.115 Subcircuit, final).

**1.4.65 Fire mode**

A specific mode of operation for building systems that is instigated by a fire alarm being activated within the building.  
Flexible cord (see Clause 1.4.40 Cord, flexible).

**1.4.66 Functional earthing (FE)**

An earthing arrangement provided to ensure correct operation of electrical equipment or to permit reliable and proper functioning of electrical installations.  
NOTE: 'Clean' (low-noise) earths provided for electrical equipment may be considered as FE. Clause 5.2.2 provides further information on FE.

**1.4.67 Functional unit**

Part of a switchboard assembly composing all the electrical and mechanical elements that contribute to the fulfilment of the same function.  
NOTE: Conductors connected to a functional unit that are external to its compartment or enclosed protected space (e.g., auxiliary cables connected to a common compartment) are not considered to form part of the functional unit.  
[Source: AS/NZS 61439 series]

**1.4.68 Fuse**

A device for protecting a circuit against damage from an excessive current flowing in it by opening the circuit on the melting of the fuse element by such excessive current. The fuse comprises all the parts that form the protective device.  
Hazardous areas (see Clause 1.4.15 Area, hazardous).  
Indirect contact (see Clause 1.4.39 Contact, indirect).

**1.4.69 Informative**

For information and guidance only.

**1.4.70 Ingress protection (IP) classification**

A degree of protection in accordance with AS 60529.  
NOTE: Further information is provided in Appendix G.

**1.4.71 Installation coupler**

A connecting device, in accordance with AS/NZS 61535, consisting of an installation socket and an installation plug designed for permanent connection and not intended to be engaged or disengaged under load (see also Clause 4.3.2.2).  
Installation, electrical (see Clause 1.4.52 Electrical installation).  
Installation wiring (see Clause 1.4.132 Wiring, installation).

**1.4.72 Insulated**

Separated from adjacent conducting material by a non-conducting substance or airspace permanently providing resistance to the passage of current, or to disruptive discharges through or over the surface of the substance or space, to obviate danger of shock or injurious leakage of current.

**1.4.73 Insulation system**

NOTE: The term 'insulation system' does not mean that the insulation has to be one homogenous piece. It may comprise several layers that cannot be tested separately as supplementary or basic insulation.  
One, or a combination of, the following:

* (a) Basic insulation: The insulation applied to live parts, to provide basic protection against electric shock.  
  NOTE: Basic insulation does not necessarily include insulation used exclusively for functional purposes.
* (b) Supplementary insulation: An independent insulation applied in addition to basic insulation in order to ensure protection against electric shock in the event of a failure of the basic insulation.
* (c) Double insulation: Insulation comprising both basic insulation and supplementary insulation.  
  NOTE: Sheathed cables in accordance with the AS/NZS 5000 series, sheathed flexible cords in accordance with AS/NZS 3191 other than the 'light duty' type, and sheathed neutral-screened cables in accordance with AS/NZS 4961 are deemed to provide double insulation between the conductors of the cable and any conductive material in contact with the cable. The use of flexible cords of the 'light duty' type as supply flexible cords is covered in equipment Standards.
* (d) Reinforced insulation: A single insulation system applied to live parts that provides a degree of protection against electric shock, equivalent to double insulation under conditions specified in AS/NZS 3100.  
  NOTE: Aerial bundled cables in accordance with AS/NZS 3560 are deemed to provide reinforced insulation.

**1.4.74 Isolated**

* Separated from all possible sources of electrical energy (supply) and rendered incapable of being energized unintentionally.  
  [Source: AS/NZS 4836]

**1.4.75 Isolation (Isolating function)**

Function intended to cut off the supply from the whole installation, or a discrete section of it, by separating it from every source of electrical energy for reasons of safety.

**1.4.76 Lamp**

* A bulb, tube, or similar item that emits light produced by electricity.

**1.4.77 Lift**

* An apparatus or contrivance within or attached to a building or structure, comprising a platform or car running between approximately vertical guides that are capable of raising or lowering persons. This does not include hoists, dumb waiters, escalators, or travelators.

**1.4.78 Live**

* Energized or subject to hazardous induced or capacitive voltages.  
  [Source: ENA-014]

**1.4.79 Live part**

A conductor or conductive part intended to be energized in normal use, including a neutral conductor and conductive parts connected to a neutral conductor.  
Exceptions: Under the multiple earthed neutral (MEN) earthing system this term does not apply to the following:

1. Earthing conductors.
2. The MEN connection and the neutral bar or link at which the MEN connection is made.
3. The neutral bar or link in a switchboard without an MEN connection where the active supply to the switchboard has been isolated.
4. The sheath of an MIMS cable and associated conductive fittings used as a combined protective earthing and neutral (PEN) conductor in an earth sheath return (ESR) system.
5. Conductive supports and enclosures associated with unprotected consumer mains that are earthed in accordance with Clause 5.5.3.5.
6. A submain neutral conductor or final

subcircuit neutral conductor where the active supply to the submain or final subcircuit has been isolated

**1.4.80 Luminaire (Light fitting)**

A complete lighting assembly intended to distribute, filter, or transform the light from one or more lamps, together with such components as ancillary and auxiliary equipment, shades, diffusers, reflectors, and accessories. Such an assembly includes the means of connection to supply circuit wiring, internal and interconnecting wiring, and any associated housings. A lamp holder that is not incorporated in an assembly is not regarded as a luminaire.

**1.4.81 Main earthing conductor**

A conductor connecting the main earthing terminal/connection or bar to the earth electrode or to the earthing system of the source of supply.

**1.4.82 Main switch**

* A switch, the primary function of which is the isolation of a supply of electricity to the electrical installation. This device may also fulfil regulatory requirements provided it is labelled accordingly.

**1.4.83 Multiple earthed neutral (MEN) system**

* A system of earthing in which the parts of an installation, required under this Standard to be earthed, are connected to the general mass of earth and, in addition, are connected within the installation to the neutral conductor of the supply system or the PEN conductor. Within the installation, the protective earthing conductor is separated from the neutral conductor.  
  Multiple electrical installation (see Clause 1.4.54 Electrical installation, multiple).

**1.4.84 Neutral (Neutral conductor or mid-wire)**

The conductor of a three-wire or multi-wire system that is maintained at an intermediate and approximately uniform potential in respect of the active or outer conductors, or the conductor of a two-wire system that is connected to earth at its origin.

**1.4.85 Neutral earthed system**

* A system where the protective earth and neutral conductors from the transformer or generator to the electrical installation are not connected together at any point after the neutral and earth connection at the transformer or generator.  
  Neutral-screened cable (see Clause 1.4.26 Cable, neutral-screened).

**1.4.86 Normative**

* A term used to describe an element of a Standard to which it is necessary to conform in order to be able to claim compliance with the Standard.

**1.4.87 Obstacle**

A part preventing unintentional direct contact, but not preventing direct contact by deliberate action.

**1.4.88 Outbuilding-Individual**

A structure containing a switchboard that is separated by an area of land from the structure containing the switchboard that supplies it.

**1.4.89 Outbuilding-Combined**

* Any number of structures installed or built on the same foundation, or sharing conductive metal roofing or conductive metal frames, with more than one electrical supply, and separated by an area of land from another structure that contains the switchboard from which those electrical supplies are obtained.

**1.4.90 Overcurrent**

A current exceeding the rated value of electrical equipment.  
NOTE: For conductors, the rated value is the current-carrying capacity.  
Overload current (see Clause 1.4.42 Current, overload).

**1.4.91 Plug**

A device intended for insertion into a socket-outlet, cord-extension socket, or plug-socket adaptor to make a detachable connection between the contacts of any such accessory and the conductors of a flexible cord or flexible cable.

**1.4.92 Point (in wiring)**

A termination of installation wiring, intended for the connection of electricity-consuming equipment.

**1.4.93 Point of attachment**

The point at which aerial conductors of a service line or aerial consumer mains are terminated on a consumer's structure.

**1.4.94 Point of entry**

The point at which the consumer mains or the underground service cable enters a structure.

**1.4.95 Point of supply**

The junction of the consumer mains with:

* (a) conductors of an electricity distribution system; or
* (b) output terminals of an electricity generating system within the premises.

**1.4.96 Protected extra-low voltage (PELV)**

An extra-low voltage system that is not electrically separated from earth, but that otherwise satisfies all the requirements for SELV.

**1.4.97 Protection, basic**

Protection against dangers that may arise from direct contact with live parts of the installation (see Figure 1.2 and Clause 1.4.38 Contact, direct).

**1.4.98 Protection, fault**

Protection against dangers that may arise from indirect contact with live parts of the installation (contact with an exposed conductive part that is not normally live but has become live under fault conditions) (see Figure 1.3 and Clause 1.4.39 Contact, indirect).

**1.4.99 Protective earth neutral (PEN)**

Neutral and protective earth functions combined in a single conductor.

**1.4.100 Protective earthing conductor**

An earthing conductor, other than a main earthing conductor, intended to carry earth fault currents and connecting any portion of the earthing system to the portion of the electrical installation or electrical equipment required to be earthed, or to any other portion of the earthing system.  
RCD (see Clause 1.4.102 Residual current device (RCD)).  
Readily accessible (see Clause 1.4.3 Accessible, readily).  
Readily available (see Clause 1.4.19 Available, readily).  
Regulatory authority (see Clause 1.4.17 Authority, regulatory).  
Reinforced insulation (see Clause 1.4.73 Insulation system).

**1.4.101 Repair**

* The work to restore the electrical installation to safe and sound working condition after deterioration or damage has occurred.

**1.4.102 Residual current device (RCD)**

A device intended to isolate supply to protected circuits, socket outlets, or electrical equipment in the event of a current flow to earth that exceeds a predetermined value.

**1.4.103 Ripple-free d.c.**

For sinusoidal ripple voltage, a ripple content not exceeding 10% r.m.s.  
NOTE: The maximum peak value does not exceed 140 V for a nominal 120 V ripple-free d.c. system and 70 V for a nominal 60 V ripple-free d.c. system.

**1.4.104 Safety service**

* A system or component that operates to identify an emergency, or is intended to operate during an emergency, and is primarily associated with the safety of persons evacuating a building, fire-fighting operations, or fire suppression.  
  Safety services include the following:
* (a) Fire detection, warning, and extinguishing systems.
* (b) Smoke control systems.
* (c) Evacuation systems.
* (d) Emergency lifts.  
  NOTE: For the definition of a 'fire safety system' refer to the National Construction Code (Australia) and 'essential service' in the New Zealand Building Code.

**1.4.105 Separated extra-low voltage (SELV)**

An extra-low voltage system that is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock.

**1.4.106 Service protective device**

A fuse or circuit-breaker installed as required by the electricity distributor for interrupting the supply to an electrical installation on a consumer's premises from the supply main.

**1.4.107 Shall**

Indicates a statement is mandatory.

**1.4.108 Should**

Indicates a recommendation.

**1.4.109 Socket, cord-extension**

A device, arranged for attachment to a flexible cord, having contacts whereby a detachable connection may be made with the pins of a plug.

**1.4.110 Socket-outlet**

A device for fixing or suspension at a point, and having contacts intended for making a detachable connection with the contacts of a plug. The term 'socket-outlet' is deemed to include a cord-extension socket attached to a flexible cord that is permanently connected to installation wiring.

**1.4.111 Socket-outlet-Multiple combination**

* A socket-outlet having two or more sets of contacts intended for making detachable connections with the contacts of two or more plugs.

**1.4.112 Socket residual current device (SRCD)**

* An SRCD is either a fixed socket-outlet:
  + (a) with an integral RCD; or
  + (b) with a separate RCD intended to be associated with the socket-outlet and mounted adjacent to the socket-outlet.  
    The RCD may be with or without overcurrent protection. An SRCD may have feed-through facility to enable RCD protection of downstream socket-outlets. Refer to IEC 62640 or the requirements of AS/NZS 3190 and AS/NZS 3112.

**1.4.113 Soft wiring**

* A wiring system using installation couplers installed as a subcircuit or a part of a subcircuit in an installation.

**1.4.114 Source of supply**

Where used in relation to any electrical installation, the generator, converter, transformer, etc., or group of generators, converters, or transformers, to which the supply mains conveying electricity to that particular electrical installation are connected and that generates, converts, or transforms the electrical energy so supplied to that electrical installation.

**1.4.115 Subcircuit, final**

A circuit originating at a switchboard and to which only consuming devices or points will be connected. The origin of a final subcircuit is deemed to be at the connecting devices of the neutral bar or link or at the load terminals of the circuit protective devices provided within or on a switchboard specifically for the connection of the circuit. The termination of a final subcircuit is deemed to be at the supply terminals of consuming devices or points.

**1.4.116 Submains**

A circuit originating at a switchboard to supply another switchboard. The origin of the submains is deemed to be at the connecting devices of the neutral bar or link or at the load terminals of the circuit protective devices provided within or on a switchboard specifically for the connection of the submains. The termination of the submains is deemed to be at the supply terminals of the other switchboard.

**1.4.117 Substation**

An assembly of electrical equipment at one place, including any necessary housing, for the conversion or transformation of electric energy or for connection between two or more circuits.  
NOTE: Measurement transformers and protection transformers are not considered to be transformers for the purpose of this Standard.  
Supplementary insulation (see Clause 1.4.73 Insulation system).

**1.4.118 Supply, alternative**

* A supply system intended to maintain the functioning of an electrical installation or a part or parts thereof, in case of interruption of the normal supply.

**1.4.119 Supply, normal**

* The source of supply that the electrical installation is supplied from under normal conditions of operation.  
  NOTE: The normal supply is usually from a distribution network, but may instead be from a generation system.

**1.4.120 Supply, supplementary**

* A supply system intended to operate in conjunction with the normal supply.  
  Suspended ceiling (see Clause 1.4.28 Ceiling, suspended).

**1.4.121 Switchboard**

An assembly of circuit protective devices, with or without switchgear, instruments, or connecting devices, suitably arranged and mounted for distribution to, and protection of, one or more submains or final subcircuits, or a combination of both.

**1.4.122 Switchboard, main**

A switchboard from which the supply to the whole electrical installation can be controlled.

**1.4.123 Switchgear**

Equipment for controlling the distribution of electrical energy, or for controlling or protecting circuits, machines, transformers, or other equipment.

**1.4.124 Touch current**

Electric current that passes through a human body, or an animal body, when that body touches one or more accessible parts of electrical equipment or an electrical installation, under normal conditions or fault conditions.

**1.4.125 Touch voltage**

Voltage appearing between simultaneously accessible parts.  
NOTES:

1. This term is used only in connection with fault protection.
2. In certain cases the value of the touch voltage may be appreciably influenced by the impedance of the person or livestock in contact with these parts.

**1.4.126 Track system**

A system of enclosed wiring comprising conductors spaced apart by, or supported on, insulating material within a channel and having plug-in facilities along its length.  
Exception: This definition does not apply to busbar trunking systems (busways) complying with AS/NZS 61439.6.

**1.4.127 Trunking, cable**

A trunk or trough for housing and protecting electrical cables and conductors.

**1.4.128 Voltage**

Differences of potential normally existing between conductors or between conductors and earth as follows:

* (a) Extra-low voltage: Not exceeding 50 V a.c. or 120 V ripple-free d.c.
* (b) Low voltage: Exceeding extra-low voltage, but not exceeding 1000 V a.c. or 1500 V d.c.
* (c) High voltage: Exceeding low voltage.

**1.4.129 Wiring, catenary**

A system of wiring consisting of a cable or cables attached at intervals to a suitable support that is suspended between two points.

**1.4.130 Wiring enclosure**

A pipe, tube, duct, conduit, or cable trunking, fixed or supported in position in accordance with the appropriate requirements of this Standard, for the housing or protection of sheathed or unsheathed cables.

**1.4.131 Wiring, equipment**

All wiring of an appliance or item of electrical equipment, provided with supply terminals for the purpose of connection to an electrical installation.

**1.4.132 Wiring, installation**

A system of wiring in which cables are fixed or supported in position in accordance with the appropriate requirements of this Standard.

**1.4.133 Wiring systems**

* An assembly made up of one or more conductors, cables, or busbars and the parts that secure their fixing and, if necessary, their mechanical protection.

**1.4.134 Wiring, underground**

A system of installation wiring in which cables are buried in soil, either directly or in a wiring enclosure beneath the surface of the ground, in accordance with the appropriate requirements of this Standard.

**1.5 FUNDAMENTAL PRINCIPLES**

**1.5.1 Protection against dangers and damage**

The requirements of this Standard are intended to ensure the safety of persons, livestock, and property against dangers and damage that may arise in the reasonable use of electrical installations.  
In electrical installations, the three major types of risk are listed below, along with applicable requirements:

* (a) Shock current: Shock current arising from contact with parts that are live in normal service (direct contact) and contact with parts that become live under fault conditions (indirect contact).  
  NOTES:

1. A 'shock current' is an electric current of sufficient magnitude and duration to cause an electric shock. AS/NZS 60479 provides further information on the effects of shock current through the human body.
2. Protection under normal conditions, designated as 'basic protection' (direct contact), is defined in Clause 1.4.97.
3. Protection under fault conditions, designated as 'fault protection' (indirect contact), is defined in Clause 1.4.98.

* (b) Excessive temperatures: Excessive temperatures likely to cause burns, fires, and other damaging effects.  
  Persons, fixed equipment, and fixed materials adjacent to electrical equipment shall be protected against harmful effects of heat developed by electrical equipment, or thermal radiation, particularly the following effects:
  + (i) Combustion or degradation of materials.
  + (ii) Risk of burns.
  + (iii) Impairment of the safe function of installed equipment.
* (c) Explosive atmospheres: Equipment installed in areas where explosive gases or dusts may be present shall provide protection against the ignition of such gases or dusts.

**1.5.2 Control and isolation**

Electrical installations shall be provided with control and isolation devices to prevent or remove hazards associated with the electrical installation and to allow maintenance of electrical equipment.  
This may incorporate a device that effectively isolates the equipment from all sources of supply external to the equipment.  
The control of safety services shall be arranged so that the control devices are separate from the control of other equipment and are not unintentionally interrupted by the operation of other equipment.  
An isolation device shall interrupt all active conductors and may be required to operate in a neutral conductor.  
NOTE: Clause 2.3.2.1.1 contains requirements for the operation of isolation devices in neutral conductors.  
An isolation device or switch shall not interrupt an earthing conductor or a combined protective earthing and neutral (PEN) conductor.

**1.5.3 Protection against electric shock**

**1.5.3.1 General**

Protection shall be provided against shock current arising from contact with parts that are live in normal service or parts that become live under fault conditions.  
Live parts shall not be accessible without the use of a tool or a key, either under normal conditions or under fault conditions.  
Clauses 1.5.4, 1.5.5, 1.5.6, and 1.5.7 specify requirements regarding protection against electric shock, including basic protection and fault protection. They also deal with the application of these requirements in relation to external influences, such as damp situations.

**1.5.3.2 Methods of protection**

Protection under normal conditions is provided by basic protective provision, and protection under single fault conditions is provided by fault protective provisions. Alternatively, protection against electric shock is provided by an enhanced protective provision that provides protection under normal conditions and under single fault conditions.  
A method of protection shall consist of:

* (a) an appropriate combination of a provision for basic protection and an independent provision for fault protection; or
* (b) an enhanced protective provision that provides both basic protection and fault protection.  
  NOTE: An example of an enhanced method of protection is the use of extra-low voltage or of reinforced insulation.  
  Additional protection is specified as part of a method of protection under certain conditions of external influences and in certain special locations.  
  NOTE: Sections 6 and 7 provide guidance on conditions and special locations requiring additional protection.  
  Different methods of protection applied to the same installation or part of an installation or within equipment shall have no influence on each other such that failure of one method of protection could impair the other methods of protection.

**1.5.4 Basic protection**

**1.5.4.1 General**

Protection shall be provided against dangers that may arise from contact with parts of the electrical installation that are live in normal service.

**1.5.4.2 Methods of protection**

Basic protection shall be provided by one or any combination of the following methods:

* (a) Insulation, in accordance with Clause 1.5.4.3.
* (b) Barriers or enclosures, in accordance with Clause 1.5.4.4.
* (c) Obstacles, in accordance with Clause 1.5.4.5.
* (d) Placing out of reach, in accordance with Clause 1.5.4.6.  
  RCDs are not recognized as a sole means of basic protection against contact with live parts but may be used to augment one of the above methods.

**1.5.4.3 Protection by insulation**

Live parts shall be completely covered with insulation capable of withstanding the mechanical, chemical, electrical, and thermal influences to which they may be subjected in service, and that can only be removed by destruction.  
NOTE: Paints, varnishes, enamels, or similar products alone are not generally considered as providing adequate insulation for basic protection.  
For commercially manufactured electrical equipment, the insulation shall comply with the relevant Standard for the electrical equipment.

**1.5.4.4 Protection by barriers or enclosures**

* (a) Degree of protection: Live parts shall be inside enclosures or behind barriers that provide a degree of protection of at least:
  + (i) IPXXB or IP2X; and
  + (ii) IP4X for horizontal top surfaces that are readily accessible.  
    The IP rating shall suit the environmental conditions and the relevant mounting position as specified by the manufacturer.  
    NOTE: This applies in particular to parts of enclosures that might serve as:
  + (a) a floor; or
  + (b) a surface where objects on surrounding surfaces may be displaced into openings.  
    Larger openings are allowable in electrical equipment where they may be necessary for the proper operation and functioning of electrical equipment, or where they are required for the replacement of parts, such as lamps or fuses. In such cases:
  + (A) Suitable precautions shall be taken to prevent unintentional contact with live parts; and
  + (B) As far as practicable, persons shall be advised that live parts can be touched through the opening and are not to be touched intentionally.
* (b) Constructional requirements: Barriers and enclosures shall be firmly secured in place and shall have adequate stability and strength to withstand any appreciable distortion that might be caused by the stresses likely to occur in normal operation, including external influences, so that the required degrees of protection and separation from live parts are maintained.  
  The removal of barriers, opening of enclosures, or withdrawal of parts of enclosures (doors, casings, lids, covers, and the like) shall not be possible.
  + Exception: The removal of barriers is permitted where one of the following conditions apply:
    1. The use of a key or tool is required.  
       NOTE: Electrical equipment complying with an appropriate standard that allows the removal of barriers or enclosures or an alternative method is not prohibited.
    2. An interlocking device is fitted that requires switching off, or automatic disconnection, of the supply to all live parts protected by the barrier or enclosure that might be touched accidentally during or after the removal, opening, or withdrawal process; and the barrier or enclosure to be replaced or closed before the supply can normally be switched on.
    3. NOTE: Account should be taken of danger that may exist from the stored energy of power capacitors in electrical equipment or the capacitive effect of electrical equipment, such as busways, that have been isolated from the supply.
    4. An intermediate barrier is provided that prevents contact with all live parts when the barrier or enclosure is removed; is permanently in position, or arranged so that it is automatically put in position when the barrier or enclosure is removed; and requires the use of a key or tool to remove

**1.5.4.5 Protection by obstacles**

The method of protection by obstacles shall only be used in installations where access is restricted to:

* (a) competent persons; or
* (b) persons under the supervision of competent persons.  
  Obstacles shall prevent either:
* (i) unintentional bodily approach to live parts; or
* (ii) unintentional contact with live parts during the operation of live electrical equipment in normal service.  
  Obstacles may be removed without the use of a key or tool but shall be secured to prevent unintentional removal.  
  NOTE: Obstacles are intended to prevent unintentional contact with live parts but not intentional contact by deliberate circumvention of the obstacle.

**1.5.4.6 Protection by placing out of reach**

The method of protection 'by placing out of reach' shall only be used in installations where access is restricted to:

* (a) competent persons; or
* (b) persons under the supervision of competent persons.  
  Simultaneously accessible parts at different voltages shall not be within arm's reach.  
  NOTES:

1. Two parts are deemed to be simultaneously accessible if they are not more than 2.5 m apart.
2. Placing out of arm's reach is intended only to prevent unintentional contact with live parts.
3. The term 'arm's reach' is defined in Clause 1.4.16 and illustrated in Figure 1.1.  
   Where a normally occupied position is restricted in the horizontal direction by an obstacle, e.g., handrail or mesh screen, affording a degree of protection less than IPXXB or IP2X, arm's reach shall extend from that obstacle.  
   In the vertical direction, arm's reach shall extend from the surface not taking into account any intermediate obstacle providing a degree of protection less than IPXXB or IP2X.  
   In places where bulky or long conductive objects are normally handled, the distances required by this clause shall be increased to accommodate the relevant dimensions of those objects.

**1.5.5 Fault protection**

**1.5.5.1 General**

Protection shall be provided against dangers that may arise from contact with exposed conductive parts that may become live under fault conditions.  
In each part of an electrical installation, one or more methods of protection shall be applied, taking account of the conditions of external influence.  
The methods of protection applied in the installation shall be considered in the selection and erection of equipment.

**1.5.5.2 Methods of protection**

Fault protection shall be provided by one or any combination of the following methods:

* (a) Automatically disconnect the supply on the occurrence of a fault likely to cause a current flow through a body in contact with exposed conductive parts, where the value of that current is equal to or greater than the shock current, in accordance with Clause 1.5.5.3.
* (b) Prevent a fault current from passing through a body by the use of Class II equipment or equivalent insulation, in accordance with Clause 1.5.5.4.
* (c) Prevent a fault current from passing through a body by electrical separation of the system, in accordance with Clause 1.5.5.5.  
  NOTE: Clause 7.4 provides further guidance on electrical separation.
* (d) Limit the fault current that can pass through a body to a value lower than the shock current.  
  NOTE: The most commonly used method of protection is automatic disconnection of supply.

**1.5.5.3 Protection by automatic disconnection of supply**

The following applies:

* (a) Automatic disconnection of supply is intended to limit the prospective touch voltage arising between simultaneously accessible conductive parts in the event of a fault between a live part and exposed conductive parts or a protective earthing conductor.  
  This method of protection shall be achieved by:
  + (i) provision of a system of equipotential bonding in which exposed conductive parts are connected to a protective earthing conductor; and
  + (ii) disconnection of the fault by a protective device.  
    NOTES:

1. Automatic disconnection of supply may also be required for protection against overcurrents, in accordance with Clause 1.5.9 and Clause 2.5.
2. Clause 5.6 contains requirements for equipotential bonding.
3. Section 2 contains requirements for the disconnection of a fault by a protective device.

* (b) Touch-voltage limits: In the event of a fault between a live part and an exposed conductive part that could give rise to a prospective touch voltage exceeding 50 V a.c. or 120 V ripple-free d.c., a protective device shall automatically disconnect the supply to the circuit or electrical equipment concerned.  
  NOTE: Lower touch-voltage limits are required for special electrical installations or locations by the relevant clauses of Sections 6 and 7.
* (c) Earthing system impedance (earth fault-loop impedance): The characteristics of protective devices and the earthing system impedance shall be such that, if a fault of negligible impedance occurs anywhere in the electrical installation between an active conductor and a protective earthing conductor or exposed conductive part, automatic disconnection of the supply will occur within the specified time.  
  NOTES:

1. Clause 5.7 contains further requirements and Appendix B provides guidance regarding earth fault-loop impedance.
2. Refer to Appendix B, Table B1, for comparison of circuit route length based on impedance and various voltage drops.

* (d) Disconnection times: The maximum disconnection time for 230/400 V supply voltage shall not exceed the following:
  + (i) 0.4 s for final subcircuits that supply:
    - (A) socket-outlets having rated currents not exceeding 63 A;
    - (B) hand-held Class I equipment; or
    - (C) portable equipment intended for manual movement during use.
  + (ii) 5 s for other circuits including submains and final subcircuits supplying fixed or stationary equipment.  
    NOTE: Maximum disconnection times will vary for other voltages and installation conditions. Appendix B provides further guidance regarding installation times.
* (e) Supplementary equipotential bonding: Bonding of extraneous conductive parts and their connection to the earthing system may be used to reduce the earth fault-loop impedance, in order to ensure that the disconnection time of the protective device is sufficient to satisfy the requirements of Items (b) to (d) above.  
  NOTE: This provision does not preclude other measures, such as selection of an alternative protective device that has a lower automatic operating current (Ia) within the required disconnection time, e.g., an RCD.

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

The following applies:

* (a) Protection against the occurrence of dangerous voltages on accessible conductive parts of electrical equipment in the event of a fault in the basic insulation may be achieved by one of the following means:
  + (i) Equipment having double or reinforced insulation (Class II equipment).
  + (ii) Switchgear assemblies having total insulation in accordance with AS/NZS 61439.1.
  + (iii) Equipment having basic insulation with appropriate supplementary insulation applied during installation.
  + (iv) Equipment having uninsulated live parts with appropriate reinforced insulation applied during installation.  
    Where the means of Item (iii) or (iv) is used, the additional insulation and the intended use of the electrical equipment shall provide a degree of safety equivalent to Items (i) or (ii).  
    NOTES:

1. Coatings, such as paint, varnish, enamel, or similar products, are not considered appropriate insulating covering for the purpose of this Clause.
2. In accordance with Clause 1.5.14, where damage to double insulation may be reasonably expected, precautions should be taken to ensure protection. Such precautions may include earthing the enclosure or RCD protection.

* (b) Constructional requirements: Where protection is dependent on a separate covering or enclosure providing supplementary insulation, the following shall apply:
  + (i) Any insulating covering shall not contain any screws or bolts made of insulating material if there is a risk of impairment of the insulation by the replacement of such screws or bolts with metal screws or bolts.
  + (ii) Where lids or doors in any insulating enclosure can be opened without the use of a tool or key, conductive parts shall be located behind an insulating barrier that provides a degree of protection not less than IPXXB or IP2X and shall not be removable only by use of a tool.

**1.5.5.5 Protection by electrical separation**

Separation is intended, in an individual circuit, to prevent shock current through contact with exposed conductive parts that might be energized by a fault in the basic insulation of that circuit.  
Live parts of a separated circuit shall not be connected at any point to earth or to another circuit.  
Any protective bonding conductor associated with a separated circuit shall not be connected at any point to earth.  
NOTE: Clause 7.4 contains requirements for protection by electrical separation.

**1.5.6 Additional protection by the use of RCDs**

**1.5.6.1 Basic protection**

RCDs are not recognized as a sole means of basic protection (in normal service) but may be used to augment one of the means set out in Clause 1.5.4.2.

**1.5.6.2 Fault protection**

RCDs are recognized as a means of providing automatic disconnection of supply in accordance with Clause 1.5.5.3.

**1.5.6.3 Where required**

RCDs for the limitation of earth leakage current shall be capable of interrupting the part of the circuit protected by the RCD when an earth leakage current reaches a predetermined value.  
RCDs shall be installed for additional protection of the following:

* (a) Circuits, socket-outlets, lighting points, and hand-held equipment, as specified in Part 2, Clause 2.6.
* (b) Wiring systems, as specified in Part 2, Clause 3.9.4.4.
* (c) Electric heating cables, as specified in Part 2, Clause 4.10.5.
* (d) Electrical equipment, including socket-outlets, installed in damp situations, as specified in Part 2, Section 6.
* (e) Specific electrical installations, as specified in AS/NZS 3001, AS/NZS 3002, AS/NZS 3003, AS/NZS 3004, AS/NZS 3012, and AS/NZS 4249.  
  NOTE: In areas where excessive earth leakage current could present a significant risk in the event of failure of other measures of protection or carelessness by users, RCDs are designed to provide additional protection against the effects of electric shock by automatically disconnecting supply before serious physical injury can occur.

**1.5.7 Basic and fault protection by use of extra-low voltage**

Separated extra-low voltage (SELV) or protected extra-low voltage (PELV) systems may be used to provide both basic and fault protection subject to the following conditions:

* (a) The nominal voltage shall not be capable of exceeding the limits for extra-low voltage (50 V a.c. or 120 V ripple-free d.c.) and the source of supply is arranged so that it cannot exceed these values.
* (b) Circuits shall be electrically segregated from each other and from circuits at higher voltages.
* (c) Live parts of SELV circuits shall not be connected to earth or to protective earthing conductors that are part of other circuits or to other live parts.
* (d) Live parts of PELV circuits shall be protected from direct contact by barriers or insulation unless the voltage does not exceed 25 V a.c. or 60 V ripple-free d.c. in dry areas where a large contact area with the human body is not expected or 6 V a.c. or 15 V ripple-free d.c. in all other areas.  
  NOTE: Clause 7.5 provides specific deemed-to-comply requirements for the arrangement of ELV circuits.

**1.5.8 Protection against thermal effects in normal service**

Electrical installations shall be arranged so that there is no risk of ignition of flammable materials because of high temperature or electric arc in normal service. During normal operation of the electrical equipment, there shall be no risk of persons or livestock suffering burns.  
The selection and installation of electrical equipment shall be such that the temperature characteristics of the electrical equipment, properly installed and operated, do not adversely affect the electrical equipment, the electrical installation itself, or any other installation, whether electrical or otherwise.  
Adequate ventilation shall be provided where heat is generated in normal operation in order to maintain operating temperatures below the rated or specified limits.  
NOTES:

1. Account should be taken of the influence that temperature might have on the operational or characteristic values of the electrical equipment.
2. Further information on thermal effects associated with the installation of electrical equipment is given in Clause 4.2.

**1.5.9 Protection against overcurrent**

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

* (a) Automatic disconnection on the occurrence of an overcurrent, before this overcurrent attains a dangerous value, taking into account its duration.
* (b) Limiting the maximum overcurrent to a safe value and duration.

**1.5.10 Protection against earth fault currents**

Protective earthing conductors and any other parts intended to carry an earth fault current shall be capable of carrying that current without attaining excessive temperature.

**1.5.11 Protection against abnormal voltages**

**1.5.11.1 General**

Protection shall be provided against any harmful effects of abnormal voltages:

* (a) caused by a fault between live parts of circuits supplied at different voltages;
* (b) induced or otherwise occurring in unused conductors; or
* (c) occurring as a result of any harmful influence between different circuits and installations.

**1.5.11.2 Circuits operating at different voltages**

Protection shall be provided against injury or property damage because of any harmful effects of a fault between live parts of circuits supplied at different voltages.  
Protection may be provided by:

* (a) segregation; or  
  NOTE: Clause 3.9.8.1 provides guidance on the segregation of circuits of different voltage levels.
* (b) installation of devices for protection against overvoltages.  
  NOTE: Clause 2.7 provides guidance on the installation of devices for protection against overvoltages.

**1.5.11.3 Voltage disturbances and electromagnetic influences**

Protection against damage as a consequence of overvoltage, such as that originating from lightning or from switching operations, is not a requirement of this Standard.  
NOTE: Clause 2.7 and Appendix F provide guidance on overvoltage (surge) protection.

**1.5.11.4 Voltage in unused conductors**

Protection shall be provided against injury or property damage because of any harmful effects of voltage that may be induced or otherwise occur in unused conductors. Disconnected, redundant, or unused conductors associated with conductors that remain connected shall be terminated and protected at both ends in the same manner as is required for live conductors.  
NOTE: Such conductors are capable of attaining induced, unwanted voltages that may be dangerous, particularly where in close proximity to high voltage conductors.

**1.5.11.5 Different circuits and installations**

Protection shall be provided against injury or property damage because of any harmful influence between:

* (a) different electrical installations;
* (b) different circuits of the same electrical installation;
* (c) electrical and non-electrical installations; and
* (d) the electrical installation and the structure in or on which it is installed.  
  NOTES:

1. Requirements for the enclosure of telecommunication cables with other wiring systems, including high voltage systems, are contained in AS/CA S009 and for New Zealand, in the NZ Telecommunications Forum (TCF) Premises Wiring Guidelines.
2. AS/NZS 3080 provides guidance on the effects of electrical interference to circuits, such as telecommunications and data transfer.

**1.5.12 Protection against the spread of fire**

Protection shall be provided against fire initiated or propagated by components of the electrical installation.  
Electrical equipment shall be selected, installed, and protected such that the equipment will not:

* (a) obstruct escape routes, either directly or by the products of combustion;
* (b) contribute to or propagate a fire;
* (c) attain a temperature high enough to ignite adjacent material; or
* (d) adversely affect means of egress from a structure.  
  NOTES:

1. Clause 2.10.2.5(h) contains requirements for the placement of switchboards in or near fire exits and egress paths.
2. Clauses 2.10.7, 3.9.9 contain requirements and Appendix E provides guidance on fire safety.

**1.5.13 Protection against injury from mechanical movement**

Protection shall be provided against injury from mechanical movement of electrically actuated equipment, where:

* (a) mechanical maintenance may involve risk of physical injury; or
* (b) emergency stopping may be necessary to remove any unexpected danger.  
  Protection may be provided by the provision of devices to disconnect or isolate electrical equipment, as may be necessary to prevent or remove danger.

**1.5.14 Protection against external influences**

All parts of an electrical installation shall be designed to be adequately protected against damage that might reasonably be expected from environmental and other external influences to which the electrical installation may be exposed under the conditions of its use. These conditions would be those that would be expected during normal operation.  
Damage from such influences may include mechanical damage, and damage because of exposure to weather, water, flora, fauna, seismic activity, excessive dampness, corrosive fumes, galvanic action, accumulation of dust, steam, oil, temperature, explosive atmospheres, vibration, or any other influence to which the electrical installation may be exposed under the conditions of its use.

**1.6 DESIGN OF AN ELECTRICAL INSTALLATION**

**1.6.1 General**

An electrical installation shall be designed to:

* (a) protect persons, livestock, and property from harmful effects;
* (b) function correctly as intended;
* (c) connect, operate safely, and be compatible with the electricity distribution system, or other source of supply, to which the electrical installation is to be connected;
* (d) facilitate safe operation, inspection, testing, and maintenance; and
* (e) reduce inconvenience in the event of a fault.  
  NOTE: Consideration should be given to the provisions of Appendix M concerning the disruption of supply.

**1.6.2 Supply characteristics**

The following characteristics of the electricity supply shall be determined:

* (a) Nature of current, a.c. or d.c.
* (b) Nature and number of conductors, as follows:
  + (i) Active (phase), neutral, and protective earthing conductors for a.c.
  + (ii) Equivalent conductors for d.c.
* (c) Voltage and voltage tolerances.  
  NOTE: The nominal voltage and tolerances for low voltage supply systems and electrical installations are:
  + (a) for Australia, 230/400 V + 10% to -6% (in accordance with AS 60038); [A] and
  + (b) for New Zealand, 230/400 V + 6% to -6% (in accordance with [NZ] IEC 60038).
* (d) Frequency and frequency tolerances.
* (e) Maximum current that can be supplied.
* (f) Prospective short-circuit current.  
  NOTE: Information regarding prospective short-circuit and fault currents at the point of supply may be obtained from the local electricity distributor.
* (g) Protective measures inherent in the supply, e.g., MEN earthing system.
* (h) Limits on the use of equipment.
* (i) Harmonic current or other limitations.

**1.6.3 Maximum demand**

The maximum demand of an electrical installation shall be determined, taking account of the capacity, physical distribution, and intended use of electrical equipment in the electrical installation and the manner in which the present requirements might vary.  
Consumer mains, submains, and other electrical equipment of an electrical installation shall be designed and installed to meet the maximum demand.  
NOTE: Clause 2.2.2 contains acceptable methods of determining maximum demand.

**1.6.4 Utilization voltage**

The electrical installation shall be designed and installed to ensure that the voltage at the terminals of electrical appliances and equipment is suitable for the nominal operating voltage of electrical appliances and equipment to be supplied.  
NOTE: Clause 3.6 contains requirements relating to voltage drop.

**1.6.5 Electrical installation circuit arrangement**

Every electrical installation shall be divided into circuits as necessary to:

* (a) avoid danger and minimize inconvenience in the event of a fault; and
* (b) facilitate safe operation, inspection, testing, and maintenance.  
  NOTE: Clause 2.3 contains requirements for the control and protection of electrical installations.

**1.7 SELECTION AND INSTALLATION OF ELECTRICAL EQUIPMENT**

**1.7.1 General**

Electrical equipment forming part of an electrical installation shall be:

* (a) selected and installed to operate in a safe and reliable manner in the course of normal operating conditions;
* (b) selected and installed so as not to cause a danger from electric shock, fire, high temperature, or physical injury in the event of reasonably expected conditions of abnormal operation, overload, fault, or external influences that may apply in the electrical installation; and
* (c) installed in accordance with the requirements of this Standard and the additional requirements as specified in the manufacturer's instructions.

**1.7.2 Installation work practice**

In order to address the requirement of Clause 1.7.1, electrical equipment shall be installed in accordance with safe and sound work practices, including the following:

* (a) Appropriate construction and operating characteristics of the equipment to protect against the mechanical, environmental, or other external influences, including condensation, to which it is likely to be exposed at the intended point of installation. The means of protection, which shall not be impaired in the process of installation, may be integral to the equipment or an additional enclosure provided as part of the electrical installation.
* (b) Installation instructions provided by the equipment supplier.
* (c) Adequate and safe access or working space is provided to equipment requiring operation or maintenance.
* (d) Adequate strength and durability of fixings, fastenings, and supports.
* (e) Particular needs of the user/operator.
* (f) Installation wiring conductors shall be clearly identified to indicate their intended function as active, neutral, main earthing, protective earthing (PE), or equipotential bonding (EPB) conductors.  
  Conductors with a green or green/yellow (G/Y) combination core insulation colour or sleeving colour are strictly reserved for identifying the main earthing conductor, protective earthing (PE) conductor, or the equipotential bonding (EPB) conductor.  
  Live conductors shall not be insulated or sheathed with green, yellow, or green/yellow combination colours in installation wiring.  
  Exception: In New Zealand only, there is no restriction on sheath colour.
* (g) The polarization of socket-outlets shall be in accordance with the product specification and shall be consistent throughout the installation.
* (h) Semi-enclosed rewireable fuses shall not be installed.
* (i) Condensation issues—a breathing/pressure equalization valve shall be installed to assist with changes in humidity and drainage of moisture.
* (j) Electrical equipment shall be installed to manufacturer's instructions to ensure that the marked IP rating is maintained.

**1.7.3 Equipment selection**

Electrical equipment shall be selected to comply with the requirement of Clause 1.7.1. Equipment is deemed to satisfy that requirement if it satisfies one or more of the following conditions:

* (a) The safety requirements for low voltage electrical equipment specified in AS/NZS 3820.
* (b) The safe design, construction, installation, and performance provisions of:
  + (i) an Australian, New Zealand, or Australian/New Zealand Standard that is appropriate and relevant to the type of electrical equipment; or
  + (ii) where an Australian/New Zealand Standard appropriate and relevant to the type of electrical equipment does not exist, a recognized international or national Standard of another country that is appropriate and relevant to the type of electrical equipment and to the electrical installation conditions in Australia and New Zealand may be applied.  
    NOTES:
  + Appendix A is a numerical listing of Standards referred to within this Standard.
  + Equipment that bears the Regulatory Compliance Mark satisfies the relevant regulatory requirements for electrical safety and can be presumed to comply with the requirements of Clause 1.7.1. The conditions for the use of the mark, including references to specific Standards for which it applies, are set out in AS/NZS 4417.
  + Regulatory authorities may also accept other marks or means of determining that equipment satisfies the relevant regulatory requirements for electrical safety.

**1.7.4 Damp situations**

Electrical equipment used in damp situations shall be selected and installed to:

* (a) operate safely near or within a damp or wet environment;
* (b) provide additional protection against electric shock in locations where the presence of water or high humidity presents an increased risk; and
* (c) provide adequate protection against damage that might reasonably be expected from the presence of water or high humidity.

**1.8 VERIFICATION (INSPECTION AND TESTING)**

All electrical installations and any alterations and repairs to electrical installations shall, prior to being placed in service or use, be inspected as far as practicable and tested to verify that the installation meets the requirements of this Standard.  
Precautions shall be taken to avoid danger to persons and to avoid damage to property and installed equipment during inspection and testing.  
Where the installation is an extension or alteration of an existing installation, it shall be verified that the extension or alteration complies with this Standard and does not impair the safety of the existing installation.  
The correct connection of conductors to protective switching and control devices shall form a part of this verification.  
NOTES:

1. Section 8 sets out requirements for the verification and testing of electrical installations.
2. Appendix K provides a switchboard requirement summary with guidance on inspection and verification of switchboards.

**1.9 MEANS OF COMPLIANCE**

**1.9.1 Compliance with Part 2 of this Standard**

In Australia only, electrical installations that meet all of the relevant requirements of Part 2 of this Standard are deemed to meet Part 1 of this Standard.

**1.9.2 Compliance with the requirements of other standards**

* Refer to Clause 7.8 for standards applicable to specific electrical installations and Appendix A for a list of referenced Standards.

**1.9.3 Alterations and repairs**

**1.9.3.1 Alterations**

Alterations to electrical installations shall comply with all relevant provisions of this Standard.

* Alterations to electrical installations shall not cause any portion of the original electrical installation, or electrical equipment connected thereto, to:
* (a) carry currents or sustain voltages in excess of those permitted by this Standard; or
* (b) be used in any manner that is not in accordance with this Standard.  
  Alterations to an electrical installation constructed to a Part 1 design and installation solution shall not alter the compliance of that installation with Part 1 of this Standard.  
  NOTE: Appendix I provides guidance on the ratings of overload protective devices where alterations or repairs involve the use of existing imperial conductors.

**1.9.3.2 Repairs**

* Repairs to existing electrical installations or parts thereof may be effected using methods, fixtures, and fittings that were acceptable when that part of the electrical installation was originally installed or with methods, fixtures, and fittings currently available as direct replacement, provided that the methods satisfy the fundamental safety principles of Part 1 of this Standard.  
  NOTE: Appendix I provides guidance on the ratings of overload protective devices where alterations or repairs involve the use of existing imperial conductors.

**1.9.4 Compliance by specific design and installation**

**1.9.4.1 Use of a Part 1 design**

In Australia only, this Clause shall not apply to domestic electrical installations.  
Electrical installations or portions of non-domestic electrical installations that do not meet Part 2 of this Standard may use a specific design and installation method as detailed below.  
Such installations may be deemed suitable provided that, having due regard to all the circumstances associated with the intended application, they:

* (a) satisfy the fundamental principles of Part 1 of this Standard;
* (b) will result in a degree of safety from physical injury, fire, and electric shock not less than that which, in other circumstances, would be achieved by compliance with the particular requirements of this Standard; and
* (c) satisfy the other requirements of this Standard as detailed in this Clause.  
  The remaining portions of such installations shall comply with Part 2 of this Standard.  
  If all or part of the design/construction of the electrical installation is not based on the deemed-to-comply methods in Part 2 of this Standard, this choice shall be made prior to final certification of the construction.  
  NOTE: Certain jurisdictions may require approval of proposed deviation.

**1.9.4.2 Acknowledgment by the owner or operator of the electrical installation and retainment of design documentation**

Any departures from Part 2 of this Standard shall be formally acknowledged.  
A copy of the design documentation (see Clause 1.9.4.3) shall be retained on site.

**1.9.4.3 Documentation (by the designer)**

The Part 1 design shall be documented. Such documentation shall be in the English language and detail:

* (a) why Part 2 of this Standard was not adopted;
* (b) the verification requirements that are required to be undertaken to ensure full compliance with this Standard;
* (c) how compliance with Part 1 of this Standard is being achieved;
* (d) the owner or operator's acknowledgment as to any departure from Part 2 of this Standard;
* (e) any requirements where the design requires specific installation use by the owner or operator of the electrical installation, with a copy of these requirements provided to the owner or operator; and
* (f) the verification undertaken to ensure full compliance with this Standard, and the results of this verification.  
  The designer shall keep all documentation for a period of not less than the statutory requirements. All Part 1 design documentation should be provided to the owner/occupier of the installation.

**1.9.4.4 Verification**

All parts of an electrical installation that do not comply with Part 2 of this Standard shall be verified as complying with the specific design and with Part 1 of this Standard prior to being placed in service.

**1.9.4.5 Competency requirements of designers**

Persons undertaking designs that depart from Part 2 of this Standard shall be competent.

**1.9.4.6 Identification**

* On the adoption of a Part 1 solution in relation to an electrical installation, the main switchboard of the installation where the Part 1 solution has been adopted, and any other switchboard that is associated with the Part 1 solution, shall be clearly and permanently marked with the intent of the following words:  
  Example of the wording: **WARNING: PART OR PARTS OF THIS INSTALLATION ADOPT A PART 1 SOLUTION UNDER AS/NZS 3000 AS SHOWN IN THE DOCUMENTATION.**