

Australian/New Zealand Standard™

Electrical installations—Patient areas



AS/NZS 3003:2018

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee HT-021, Wiring of Medical Treatment Areas in Hospitals. It was approved on behalf of the Council of Standards Australia on 16 February 2018 and by the New Zealand Standards Approval Board on 5 March 2018. This Standard was published on 26 March 2018.

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This Standard was issued in draft form for comment as DR AS/NZS 3003:2016.

Australian/New Zealand Standard™

Electrical installations—Patient areas

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee HT-021, Wiring of Medical Treatment Areas in Hospitals, to supersede AS/NZS 3003:2011, *Electrical installations—Patient areas*.

This Standard incorporates Amendment No. 1 (July 2019). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to specify particular requirements for electrical installations in patient areas. These requirements are additional to those specified in AS/NZS 3000 and the New Zealand *Electricity (Safety) Regulations 2010*.

A This Standard may be applied through legislative requirements. This Standard supersedes AS/NZS 3003:2011 from its date of publication. This may not be practicable in some cases, and a transition period, e.g. 6 months, may need to be arranged. For example, where work on an installation was commenced before publication of this edition, the relevant regulatory authority or electricity distributor should be consulted regarding permission for the installation to be completed in accordance with AS/NZS 3003:2011.

NZ Conformance with this Standard is deemed to be in accordance with AS/NZS 3003:2011.

New Zealand has formally consulted on the adoption of IEC 60364-7-710 and determined that the continued use of AS/NZS 3003 is the appropriate option for New Zealand.

NOTE: Refer to Report to Energy Safety, Ministry of Economic Development on New Zealand Electro-medical Area Regulation—Future options—From Standards New Zealand.

Any requirements that may be applicable only in Australia or New Zealand are indicated by the symbol **A** or **NZ** in the margin.

It is recommended that the responsible organization/entity carefully evaluate the procedures undertaken within existing installations and take steps to implement the appropriate electrical safety requirements specified in this Standard for areas that are used for cardiac-type procedures, or for procedures involving the regular use of medical electrical equipment.

Major changes in this edition include the following:

- The decisions made by the responsible organization/entity in determining patient areas need to be based on the classification of the medical procedures undertaken in each area.
- The word ‘point’ has been defined.
- The term ‘Responsible organization/entity’ has been defined.
- The term ‘electrical equipment’ has replaced the term ‘appliance’.
- The word ‘identification’ has replaced the word ‘marking’.
- The word ‘confirm’ has replaced the words ‘verified’ and ‘checked’.
- The term ‘testing and verification’ has replaced the term ‘testing and commissioning’.
- Exceptions have been included throughout this Standard.
- The responsible organization/entity is required to provide documentation outlining patient area locations and classifications.
- Patient area boundaries have been clarified in Figure 4.

- The patient areas, as determined by the responsible organization/entity, in any facility, building, institution or medical practice not wired as cardiac-protected electrical areas are required to be wired as body-protected electrical areas.
- Separation of circuits in cardiac-protected electrical areas has been clarified.
- A clause on extra-low-voltage charging sockets (including USB) has been added, see Clause 2.4.3.1.2.
- The distance required for socket-outlets within the entrance to a body-protected electrical area has been reduced to 2.0 m.
- Access to RCD controls and indicators is clarified in Table 2.1.
- Additional requirements have been included for socket-outlet labelling.
- Additional requirements have been included for socket-outlets requiring isolation switches.
- Additional requirements have been included for identification of socket-outlets protected by LPDs.
- Equipotential earthing terminals have been clarified.
- Equipotential earthing system requirements for nodes connected to the EP junction are now reflected in Figure 8.
- EP test terminals have been clarified.
- EP conductor labelling has been clarified.
- Where fixed electrical equipment rated at or above 2.0 kW is to be installed in a body-protected or cardiac-protected electrical area, the entire patient area is required to conform with this Standard.
- A clause on disability and aged care has been added, see Clause 5.3.
- A clause on reclassification of existing cardiac-protected electrical areas as body-protected electrical areas has been added, see Clause 6.2.5.3.
- Repairs within patient areas not wired as cardiac-protected or body-protected electrical areas in most cases will trigger upgrading to be in accordance with this Standard.
- An identification clause on alterations and additions within a patient area has been added, see Clause 6.2.5.
- Section 7 is now 'Identification of patient areas'.
- Section 8 is now 'Routine inspection and testing of cardiac and body-protected electrical areas'.
- Provisions for magnetic fields are now informative and located in Appendix H.
- Revised guidance tables have been included to illustrate requirements.

The terms 'normative' and 'informative' are used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of the Standard whereas an 'informative' appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Electrical installations—Patient areas

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out the requirements for areas in new electrical installations and for alterations and repairs of patient areas in existing electrical installations where the organization/entity responsible for that electrical installation has determined that low-voltage medical electrical equipment will be used on a patient. It covers special patient areas, including homecare installations and transportable vehicles. It also contains requirements for identification, inspection and testing of patient areas.

1.2 GENERAL

Electrical installations in patient areas shall be carried out in accordance with AS/NZS 3000, except as varied herein, and with the additional requirements of this Standard.

The decisions made by the responsible organization/entity in determining classification of patient areas need to be based on the medical procedures undertaken in each area. Advice on whether particular patient areas should be wired as body-protected or cardiac-protected electrical areas is specified in AS/NZS 2500. The responsible organization/entity should refer to the safe practice code in AS/NZS 2500 for advice on how these decisions should be based on the type of procedures undertaken in each area and the level of protection against electric shock afforded in the medical electrical equipment available for these procedures.

While this Standard is intended to apply to new installations or extensions, some guidance is given concerning conversion of older installations.

Areas other than patient areas are not covered by this Standard, but are covered by the relevant requirements of AS/NZS 3000.

Requirements for mobile trolleys supporting electrical equipment are given in AS/NZS 3551.

Requirements for emergency lighting are given in AS/NZS 2293.1.

Requirements for emergency power systems in hospitals are given in AS/NZS 3009.

NZ In New Zealand, mobile medical connectable installations shall be in accordance with the requirements of this Standard and NZS 6115.

This Standard nominates specific maximum values of electromagnetic interference. This matter needs careful consideration at the design stage. In some patient areas, these values need to be measured.

NOTE: See Section 6 for alterations to equipotential earthing in existing installations.

1.3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1319 Safety signs for the occupational environment
- 3011 Electrical installations—Secondary batteries installed in buildings
- 3011.1 Part 1: Vented cells
- 3011.2 Part 2: Sealed cells

AS/NZS

- 1125 Conductors in insulated electric cables and flexible cords
- 2293 Emergency evacuation lighting for buildings
- 2293.1 Part 1: System design, installation and operation
- 2500 Guide to the safe use of electricity in patient care
- 3000 Electrical installations (known as the Australian/New Zealand wiring rules)
- 3008 Electrical installations—Selection of cables
- 3008.1.1 Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions
- 3008.1.2 Part 1.2: Cables for alternating voltages up to and including 0.6/1 kV—Typical New Zealand conditions
- 3009 Electric installations—Emergency power supplies in hospitals
- 3100 Approval and test specification—General requirements for electrical equipment
- 3111 Approval and test specification—Miniature overcurrent circuit-breakers
- 3112 Approval and test specification—Plugs and socket-outlets
- 3120 Approval and test specification—Cord extension sockets
- 3123 Approval and test specification—Plugs, socket-outlets and couplers for general industrial application
- 3190 Approval and test specification—Residual current devices (current-operated earth-leakage devices)
- 3551 Management programs for medical devices
- 4510 Isolated electrical supply systems for medical use
- 5000 Electric cables—Polymeric insulated
- 5000.1 Part 1: For working voltages up to and including 0.6/1 (1.2) kV
- 60320 Appliance couplers for household and similar general purposes
- 60320.1 Part 1: General requirements (IEC 60320-1, Ed. 2.1 (2007) MOD)
- 60884 Plugs and socket-outlets for household and similar purposes
- 60884.1 Part 1: General requirements (IEC 60884-1, Ed. 3.1 (2006) MOD)
- 60898 Electrical accessories—Circuit-breakers for overcurrent protection for household and similar installations
- 60898.1 Part 1: Circuit-breakers for a.c. operation (IEC 60898-1, Ed. 1.2 (2003) MOD)
- 61008 Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)
- 61008.1 Part 1: General rules (IEC 61008-1, Ed. 3.2 (2013) MOD)
- 61009 Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)
- 61009.1 Part 1: General rules (IEC 61009-1, Ed. 3.2 (2013) MOD)

AS/NZS IEC

60601 Medical electrical equipment

60601.1 Part 1: General requirements for basic safety and essential performance

NZS

6115 Electrical installations—Mobile electro-medical connectable installations

IEC

60309 Plugs, socket-outlets and couplers for industrial purposes (series)

60309-1 Part 1: General requirements

60309-2 Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories

60309-4 Part 4: Switched socket-outlets and connectors with or without interlock

61557 Electrical safety in low-voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c.—Equipment for testing, measuring or monitoring of protective measures

61557-6 Part 6: Effectiveness of residual current devices (RCD) in TT, TN and IT systems

New Zealand Government

Electricity (Safety) Regulations 2010

1.4 ACRONYMS

AC Alternating current

ARTG Australian Register of Therapeutic Goods

CB Circuit breaker

CCU Coronary care unit

CT Computerised tomography

DB Distribution switchboard

DC Direct current

EEG Electroencephalogram

ELV Extra-low-voltage

EMG Electromyography

ENG Electronystagmography

EP Equipotential junction

ICU Intensive care unit

LIM Line isolation monitor

LIOM Line isolation overload monitor

LPD Leakage protective device

LV Low voltage

MCB Miniature circuit breaker

ME Medical electrical

MRI Magnetic resonance imaging

PHC Prospective hazard current

PSOA Portable socket-outlet assembly

RCBO	Residual current operated circuit breakers with integral overcurrent protection
RCD	Residual current device
SRCD	Socket-outlet residual current device
UPS	Uninterruptable power supply
USB	Universal serial bus

1.5 DEFINITIONS

For the purpose of this Standard, the definitions in AS/NZS 3000 and the following apply.

1.5.1 Accessible

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

1.5.2 Applied part

Part of medical electrical (ME) equipment that in normal use necessarily comes into physical contact with the patient for ME equipment or an ME system to perform its function.

[Ref: AS/NZS IEC 60601.1]

NOTES:

- AS/NZS IEC 60601.1—
 - classifies ‘applied part’ as Type B, Type BF or Type CF depending on the degree of protection against electric shock; and
 - requires the equipment to be identified to indicate this classification and whether the applied part is defibrillator-proof, as shown in Figure 1.
- In some medical electrical equipment, one symbol may appear on the equipment to indicate that all applied parts are of the same classification. For equipment with applied parts of different classifications, the appropriate symbol will appear on each applied part or near the point at which the applied part is connected to the equipment, e.g. an ECG patient cable connector.

Applied part	Type B 	Type BF 	Type CF 
Defibrillator-proof applied part	Type B 	Type BF 	Type CF 

FIGURE 1 IDENTIFICATION OF APPLIED PARTS OF MEDICAL ELECTRICAL EQUIPMENT

1.5.3 Body-protected electrical area

A patient area where the electrical wiring system has been installed to enable body type procedures to be safely performed.

NOTE: A body-protected electrical areas may contain one or more patient locations.

1.5.4 Body-type procedure

Any medical procedure where there is no intention of electrical connection to the left or right ventricle of the heart.

NOTE: Refer to AS/NZS 2500 for guidance.

1.5.5 Cardiac-protected electrical area

A patient area where the electrical wiring system has been installed to enable cardiac type procedures to be safely performed.

NOTE: Cardiac-protected electrical areas may contain one or more patient locations.

1.5.6 Cardiac-type procedure

Any medical procedure where an electrical connection is intended to occur to the left or right ventricle of the heart via an externally contactable insulated conductor such as a wire or a liquid-filled tube.

NOTE: Refer to AS/NZS 2500 for guidance.

1.5.7 Class I equipment

For medical electrical equipment—Class I equipment as defined in AS/NZS IEC 60601.1.

For other electrical equipment—Class I equipment as defined in AS/NZS 3100.

NOTE: Class I equipment requires protective earthing and is provided with a protective earthing terminal.

1.5.8 Class II equipment

For medical electrical equipment—Class II equipment as defined in AS/NZS IEC 60601.1.

For other electrical equipment—Class II equipment as defined in AS/NZS 3100.

NOTE: Class II equipment does not require protective earthing if it is identified  or 'DOUBLE INSULATED' and is not provided with a protective earthing terminal.

1.5.9 Class III equipment

For equipment other than medical electrical equipment—Class III equipment as defined in AS/NZS 3100.

NOTES:

- 1 Class III equipment is supplied from an extra-low-voltage supply.
- 2 There is no Class III equipment classification for medical electrical equipment in AS/NZS IEC 60601.1. That Standard treats such equipment as 'internally powered equipment' or combines it with any remote extra-low-voltage supply as a single item of equipment. In the latter case, the combination is classified as Class I equipment if the extra-low-voltage supply requires protective earthing, or as Class II equipment if it does not require protective earthing.

1.5.10 Corridor

A passage in a building from which doors lead into rooms.

1.5.11 Equipotential (EP) junction

The junction of an equipotential earthing system and the return earth(s) in a cardiac-protected electrical area.

NOTE: The EP junction also provides a reference point for resistance and voltage measurements during commissioning testing and routine testing.

1.5.12 Group of socket-outlets

One or more socket-outlets contained within one single surround.

NOTES:

- 1 Socket-outlets that butt up to each other but are not within a single surround are not considered to be a group.
- 2 A group can contain socket-outlets supplied by one or more circuits provided there is clear delineation as to which LPD protects which socket-outlets.

1.5.13 Homecare

Care in a principal private residence that is not a registered healthcare facility or a residential aged care facility.

1.5.14 Leakage protective device (LPD)

The following devices are LPDs:

- (a) Low-voltage isolation transformers in accordance with AS/NZS 4510.
- (b) Type I low-voltage residual current devices (RCDs) in accordance with AS/NZS 3190, AS/NZS 61008.1 or AS/NZS 61009.1.

NOTE: Clauses 2.8.1 to 2.8.8 specify requirements for RCDs that are used as LPDs.

1.5.15 Line isolation monitor (LIM)

An instrument in accordance with AS/NZS 4510 that monitors the prospective hazard current of a transformer-isolated supply and actuates an alarm when this exceeds a set level.

NOTE: The LIM and the overload monitor defined in Clause 1.4.18 are often combined in the same item of equipment.

1.5.16 Medical electrical equipment (ME equipment)

Electrical equipment as determined by the manufacturer having an applied part or transferring energy to or from the patient or detecting such energy transfer to or from the patient and which is—

- (a) provided with not more than one connection to a particular supply mains; and
- (b) intended by its manufacturer to be used—
 - (i) in the diagnosis, treatment, or monitoring of a patient; or
 - (ii) for compensation or alleviation of disease, injury or disability.

[Ref: AS/NZS IEC 60601.1, modified]

NOTES:

- A** 1 In Australia, regulations require that medical electrical equipment that can be used when connected to a low-voltage supply is included on the Australian Register of Therapeutic Goods (ARTG) by way of the issuing of an ARTG number.
- NZ** 2 In New Zealand, importers of medical electrical equipment have an obligation to register medical electrical devices with Medsafe.
- 3 In order for medical or therapeutic devices to be sold legally within Australia or New Zealand, they need to be listed, registered or included on the ARTG or Medsafe register. An accessory that the manufacturer intends to be used with a medical device also needs to be included on the ARTG.

1.5.17 Medical electrical system (ME system)

Combination of either medical equipment or multiple medical devices which may also include other non-medical equipment, having a specified function and connected by either a physical connection or an electrical interconnection. A multiple socket-outlets are example of an electrical connection.

NOTES:

- 1 The Medical electrical system includes those accessories that are needed for operating the system.
- 2 The medical electrical system may also include devices that are not within the patient area e.g. external printer, computer.

[Ref: AS/NZS 3551:2012]

1.5.18 Overload monitor

An instrument in accordance with AS/NZS 4510 that monitors the output current of a low-voltage isolation transformer and actuates an alarm when this exceeds the rating of the isolation transformer.

NOTE: The overload monitor and the LIM defined in Clause 1.5.15 are often combined in the same item of equipment.

1.5.19 Patient

Living being (person) undergoing medical or dental investigation or undergoing a procedure to compensate for or alleviate disease, injury or disability.

NOTE: A person undergoing a cosmetic medical procedure is considered a patient.

1.5.20 Patient area

Areas where it is intended by the responsible organization/entity that low-voltage medical electrical equipment will be used on a patient, see Figure 3.

Patient areas may consist of either a single patient location or multiple patient locations.

If the area consists of multiple patient locations which form a single clinical operational unit (e.g. recovery) the patient area will enclose all these patient locations.

Exceptions:

- 1 *Areas where low-voltage medical equipment is only used in an emergency or for the transportation of patients, e.g. corridors and lifts.*
- 2 *Areas where low-voltage medical electrical equipment is used in conjunction with patients in another area, e.g. a remote monitoring location.*



NOTE: In New Zealand, guidance on the classification of medical procedures enabling the decisions made by the responsible organization in determining patient areas may be found in AS/NZS 2500.

1.5.21 Patient environment

The space shown in Figure 2 extending laterally 1.5 m around all possible patient locations to height of 2.5 m in a cardiac-protected electrical area.

Where adjacent patient environments overlap, the combined area is deemed one patient environment. A patient environment may contain one or more patient locations.

The patient environment does not extend through walls.

NOTES:

- 1 The patient environment is intended to embrace all locations within a cardiac-protected electrical area in which intentional or unintentional electrical contact could occur between the patient and any other object, directly or via another person touching the patient and the object.
- 2 Every possible location of the patient should be considered when determining the extent of the patient location.
- 3 Figure 3 illustrates the relationship between patient area, patient environment and patient location.

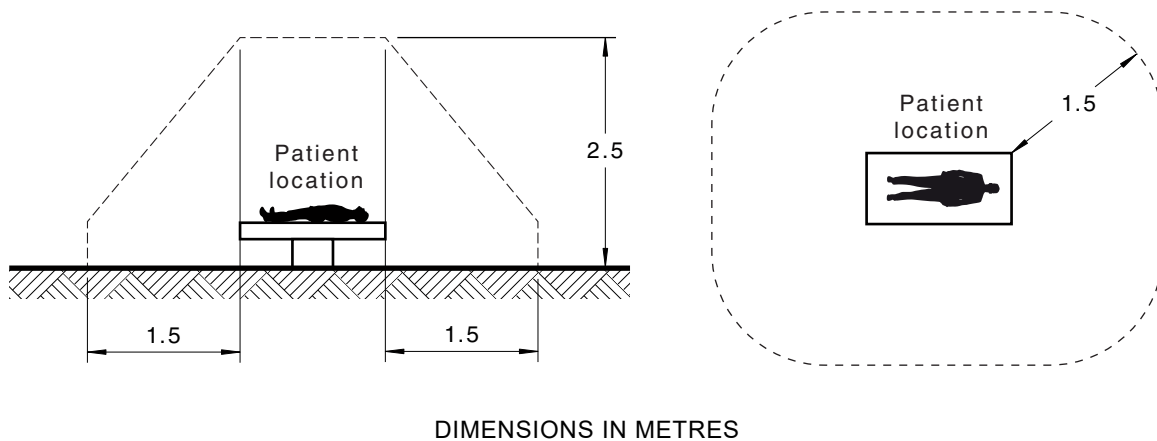


FIGURE 2 PATIENT ENVIRONMENT

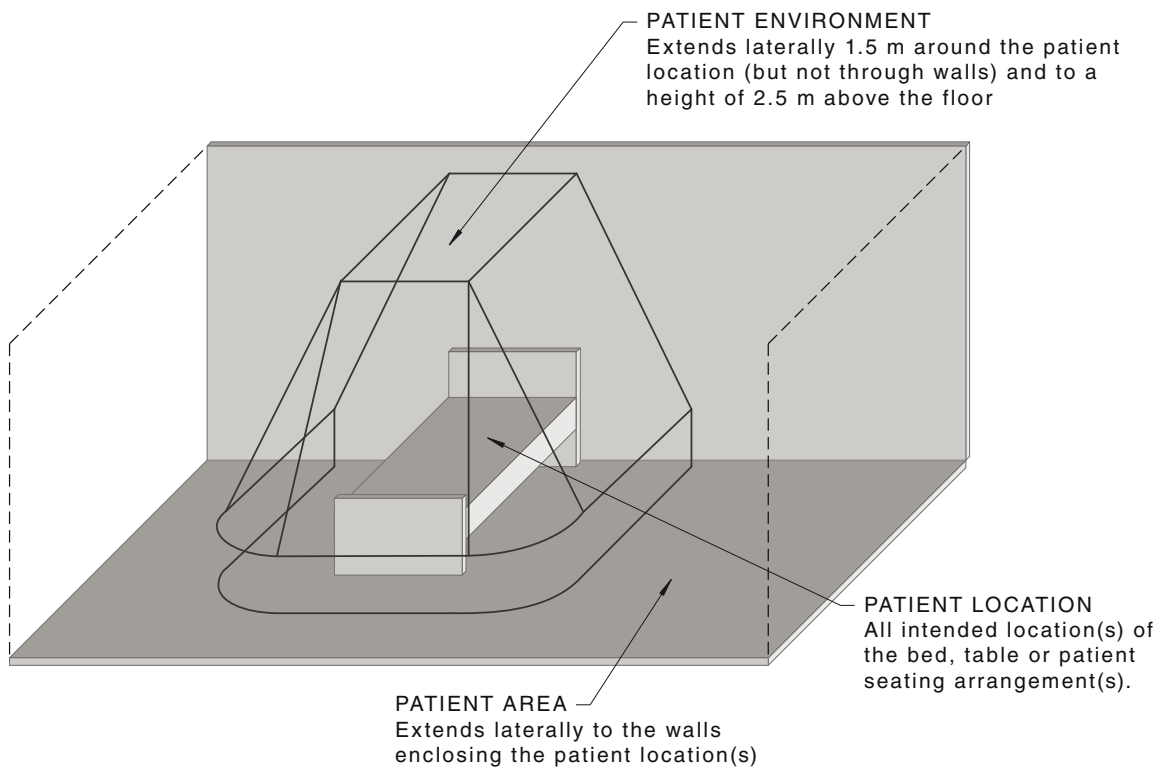


FIGURE 3 PATIENT AREA, PATIENT ENVIRONMENT AND PATIENT LOCATION

1.5.22 Patient location

Any intended location of a patient within a patient area, whether or not occupied by the patient.

Where the location of a patient undergoing a body-type or cardiac-type procedure is likely to vary for different occasions (e.g. in some operating theatres) the patient location extends laterally to the entire room. This includes locations for incubators or cribs in delivery suites.

NOTE: Figure 3 illustrates the relationship between patient area, patient environment and patient location.

1.5.23 Point

Each socket-outlet or each item of permanently wired electrical equipment. A multiple combination socket-outlet is regarded as the same number of points as the number of integral socket-outlets in the combination.

1.5.24 Prospective hazard current

Prospective hazard current is current that would flow, in a transformer-isolated supply, between one of the active conductors and earth if the active conductor were solidly bonded to earth.

NOTE: Although prospective hazard current does not flow until a line-to-earth fault occurs, a line can be described as having a prospective hazard current of a particular value because the cumulative effect of the imperfections in the line isolation will cause current to flow as soon as a line-to-earth fault occurs.

1.5.25 Readily accessible

Capable of being reached quickly and without climbing onto or over any object or removing obstructions, and in any case not more than 2.0 m above the ground, floor or platform.

1.5.26 Responsible organization/entity

The organization/entity responsible for the authorization of the design/redesign, installation/refurbishment, associated infrastructure, use and maintenance of the premises and/or those responsible for medical electrical equipment, a medical electrical system and medical electrical installation.

NOTES:

- 1 For example, the entity may be a hospital or an individual clinician. The owner, operator and responsible entity may be the same person.
- 2 For example, the entity may manage patient care in any facility including the home, the government as the owner of the facility, or a private operator of a facility which requires body-protected or cardiac-protected electrical areas.
- 3 Education and training facilities are to be considered.

1.5.27 Return earth

The earthing conductor(s) that connects an EP junction to the installation earth at the main earthing conductor at the main switchboard, or to the submain earthing conductor(s) at the switchboard(s) from which supply is made available.

NOTE: This Standard does not include requirements for the size of the conductor used for return earths, which should therefore be in accordance with the requirements of AS/NZS 3000.

1.5.28 Supply

1.5.28.1 Essential supply

An electrical supply system that—

- (a) has additional onsite supply that automatically engaged upon failure of the normal supply; and
- (b) is not subjected to load shedding.

NOTES:

- 1 Changeover between the normal supply and an alternative generator supply may take a finite time, which is usually less than 30 s.
- 2 AS/NZS 3009 uses the term 'emergency supply' rather than 'essential supply'.

1.5.28.2 *Normal supply (non-essential)*

An electrical supply system with no alternative onsite supply.

1.5.28.3 *Uninterruptible supply [uninterruptible power supply (UPS)]*

An electrical supply system arranged so that failure of the normal supply or essential supply does not cause any immediate loss of supply to the installation.

NOTE: When charged from the normal supply, a UPS will be available for a limited time only.

1.5.29 Transformer-isolated supply

A low-voltage a.c. supply in which all the live conductors are isolated from earth by means of an isolation transformer in accordance with AS/NZS 4510.

SECTION 2 GENERAL REQUIREMENTS FOR BODY-PROTECTED AND CARDIAC- PROTECTED ELECTRICAL AREAS

2.1 GENERAL

All patient areas shall be body-protected electrical areas or cardiac-protected electrical areas.

Body-protected electrical areas shall be in accordance with the requirements of this Section and Section 3. Cardiac-protected electrical areas shall be in accordance with the requirements of this Section and Section 4. See Clause 2.2.3 to determine where cardiac-protected electrical areas are required.

All locations that form part of the facility and in which it is intended that low-voltage medical electrical equipment will be used on a patient and can be operated while connected to the electrical supply mains (except in emergencies) shall be signposted as body-protected or cardiac-protected electrical areas.

NOTE: Appendix A provides information in relation to planning of patient areas.

A In Australia, body-protected and cardiac-protected electrical areas shall not be provided in the same room.

NZ In New Zealand, notwithstanding the definitions in Clauses 1.5.4 and 1.5.5, body-protected and cardiac-protected electrical areas may be provided in the same room providing that—

- (a) the boundaries of the cardiac-protected electrical areas are clearly and permanently inlaid in the floor;
- (b) each socket-outlet in the cardiac-protected electrical area is separated by not less than 4000 mm from the nearest socket-outlet in the body-protected electrical area; and
- (c) the nominal patient location centres are separated by not less than 4000 mm.

2.2 CLASSIFICATION OF PATIENT AREAS

2.2.1 Documentation

Documentation outlining patient area locations and classifications shall be provided by the responsible organization/entity.

The documentation shall—

- (a) identify the location of patient areas and whether they shall be classified as body-protected, or cardiac-protected areas;
- (b) identify the location of areas that are determined by the responsible organization/entity to not be classified as patient areas (where no medical electrical equipment is used on a patient), and shall provide justification thereof;
- (c) be readily available and retained at the premises;
- (d) be updated to record all alterations, repairs and changes of use in nominated patient areas, and any changes of use where non-patient areas become patient areas.

NOTE: Where there is doubt about the intended use of a particular location, formal clarification should be sought from the responsible organization/entity, and the documentation updated accordingly.

2.2.2 Patient area boundaries

The boundary of the patient area extends to the walls and doors surrounding the patient locations. Where such walls are incomplete at the entry way(s) into a single clinical operational unit, those walls shall be extended to enclose the boundary as shown in Figure 4.

Nursing stations, staff bases, beverage areas, etc. located within the patient area boundary are part of the protected electrical area.



In New Zealand, the responsible organization/entity may determine that nursing stations, staff bases, beverage areas, etc. located within the patient area boundary may not be required to be wired as part of the protected electrical area.

The following shall not be considered as boundaries:

- (a) Nib walls.

NOTE: A nib wall is a short section of a wall that juts out from a building's wall at the full height of the wall.

- (b) Partitions, dividers, screens, benches or moveable walls.

- (c) Curtains.

NOTES:

- 1 Figure 3 illustrates the relationship between patient area, patient environment and patient location.
- 2 Clauses 2.4.3.2, 2.7.3, and 4.4.2.4 contain requirements for LPD protection and equipotential earthing of certain socket-outlets located outside patient areas.
- 3 See Clauses 2.4.3.2.2(b) and 4.4.2.4.1(a)(ii) for socket-outlets installed outside patient area.

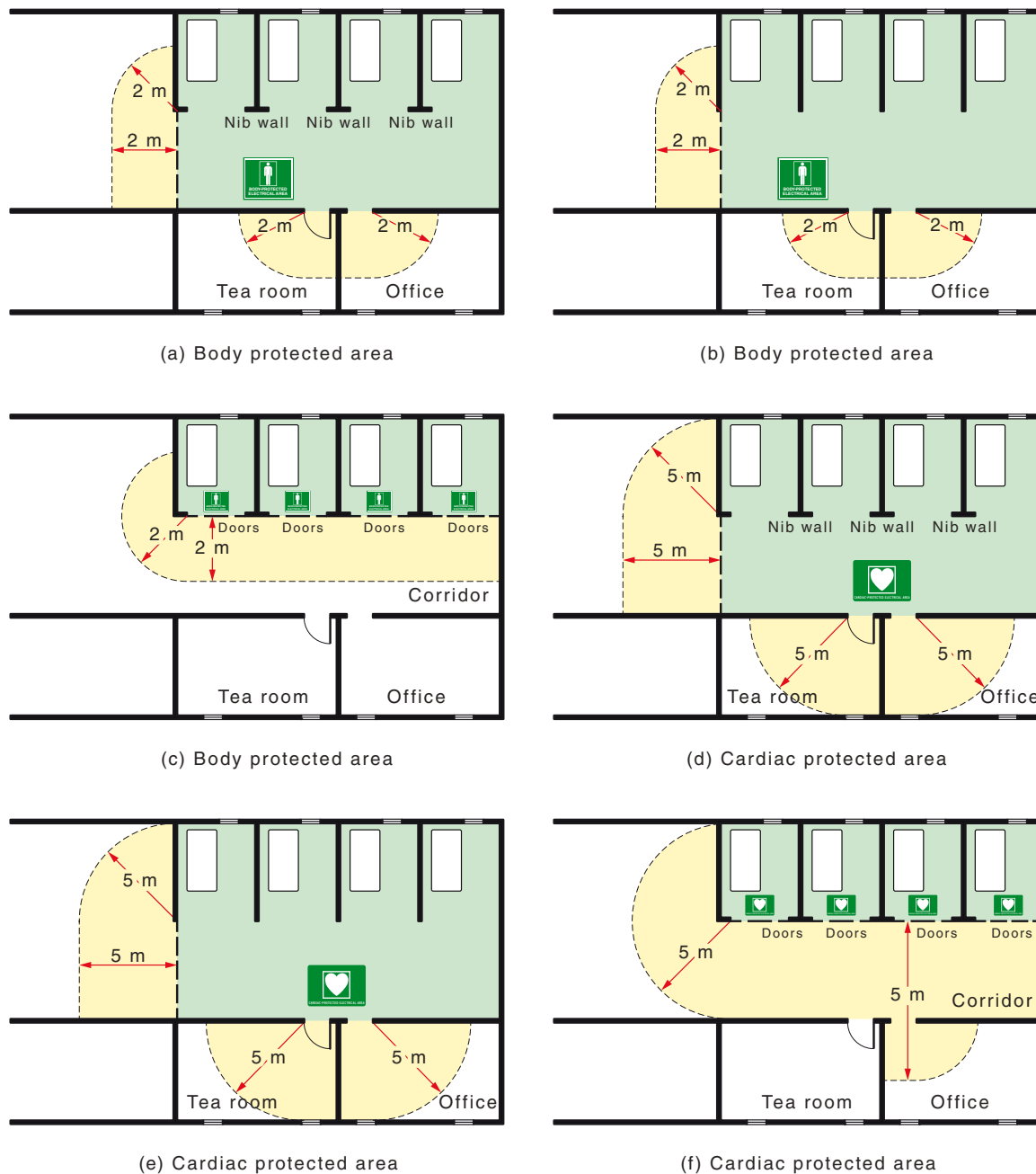
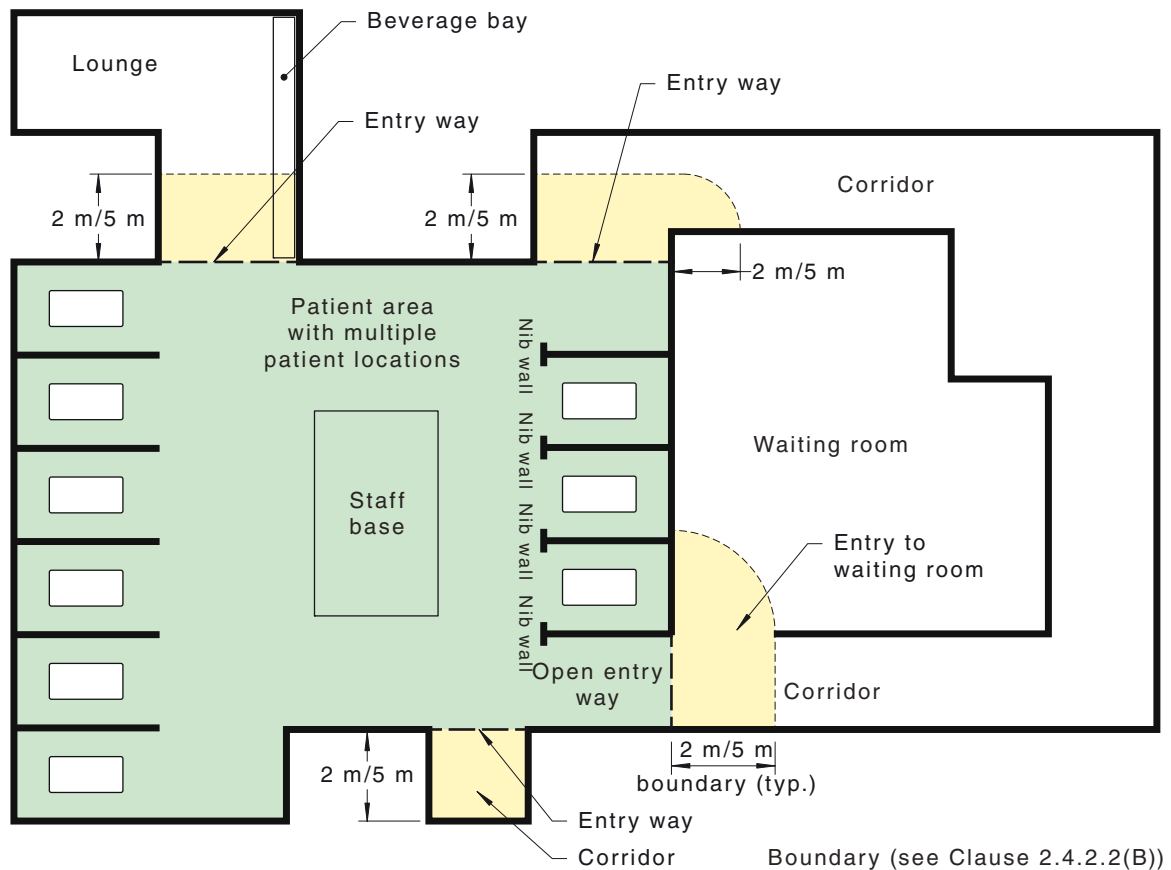


FIGURE 4 (in part) EXAMPLES OF PATIENT AREAS



(g) Cardiac protected area

FIGURE 4 (in part) EXAMPLES OF PATIENT AREAS

2.2.3 Patient areas required to be wired as cardiac-protected electrical areas

A patient area shall only be wired as a cardiac-protected electrical area if cardiac-type procedures as determined by the responsible organization/entity are to be undertaken on a regular and routine basis.

NOTES:

- 1 In emergency circumstances, local earthing protection will suffice if a cardiac-type procedure needs to be carried out in a body-protected electrical area.
- 2 Further advice on electrical safety precautions necessary during cardiac-type procedures is specified in AS/NZS 2500.

The following areas shall be wired as cardiac-protected electrical areas if cardiac-type procedures are undertaken there:

- (a) Cardiac catheter laboratories.
- (b) Cardiac ICU.
- (c) ICU with regular thermodilution Swann-Ganz monitoring.
- (d) Neo natal ICU.
- (e) Operating theatres for cardiac surgery.
- (f) CCU.

Locations other than those listed above, in which cardiac-type procedures will be regularly performed, shall also be wired as cardiac-protected electrical areas. In such cases, the responsible organization shall provide documentation outlining the specific requirements.

2.2.4 Patient areas required to be wired as body-protected electrical areas

The patient areas, as determined by the responsible organization, in any facility, building, institution or medical practice that are not wired as cardiac-protected electrical areas shall be wired as body-protected electrical areas:

These areas may include the following:

- (a) Accident and emergency wards.
- (b) Allied health care providers, e.g. chiropractic, physiotherapy, optometry and naturopathic.
- (c) Anaesthetic bays.
- (d) Audiometry rooms.
- (e) Blood collection areas.
- (f) Day procedure theatres.
- (g) Delivery suites.
- (h) Dental surgeries.
- (i) Dermatology rooms.
- (j) Doctors consulting rooms.
- (k) Endoscopy theatres and procedure rooms.
- (l) General medical and surgical wards.
- (m) High dependency wards.
- (n) Imaging rooms.
- (o) Nurseries.
- (p) Operating theatres intended for non-cardiac surgery.
- (q) Patient examination rooms for outpatients.
- (r) Plasmapheresis areas.
- (s) Plaster rooms.
- (t) Recovery areas or wards associated with operating theatres and imaging rooms.
- (u) Respiratory function laboratories.
- (v) Resuscitation bays.
- (w) Stress test rooms.
- (x) Treatment rooms.
- (y) Ultrasound rooms.

Ensuites, bathrooms, shower rooms and toilets intended for patient use shall be wired as body-protected electrical areas.

NZ

NOTE: In New Zealand, guidance on the classification of medical procedures enabling the decisions made by the responsible organization in determining patient areas may be found in AS/NZS 2500.

2.3 SUPPLY OF ELECTRICITY TO PATIENT AREAS

NZ In New Zealand, care shall be taken to ensure that the safety of a patient area is not compromised by an earth-potential rise created by a neutral current flowing in an earth conductor because of links in switchboards between neutral and earth conductors found in installations constructed prior to 1993.

NOTE: Particular care should also be taken when an earth sheath return system is being used in the installation.

2.4 LOW-VOLTAGE A.C. SUPPLIES

2.4.1 Separation of circuits

2.4.1.1 Body-protected electrical areas

A final sub-circuit used to supply LPD-protected socket-outlets in a body-protected electrical area shall not be used to supply electrical points in another room.

Exceptions:

- 1 *Final sub-circuits supplying socket-outlets in the body protected area may be used to supply the adjoining ensuite LPD.*
- 2 *Final sub-circuits supplying socket-outlets identified 'CLEANING PURPOSES ONLY' in accordance with Clause 2.7.3.*

NOTE: See Section 6 for sub-circuit requirements for alterations, additions and repairs.

2.4.1.2 Cardiac-protected electrical areas

A final sub-circuit used to supply LPD-protected socket-outlets and permanently wired medical electrical equipment in a cardiac-protected electrical area shall only be used in one patient location.

Exceptions:

- 1 *Final sub-circuits supplying non-LPD protected socket-outlets.*
- 2 *Final sub-circuits supplying socket-outlets identified 'CLEANING PURPOSES ONLY' in accordance with Clause 2.7.3.*

NOTE: See Section 6 for sub-circuit requirements for alterations, additions and repairs.

2.4.1.3 Body-protected and cardiac-protected electrical areas

Socket-outlets identified 'CLEANING PURPOSES ONLY' in accordance with Clause 2.7.3 shall not be supplied from any final sub-circuit supplying socket-outlets not identified 'CLEANING PURPOSES ONLY'.

2.4.2 Protection of wiring systems and electrical equipment against mechanical damage

Wiring systems and electrical equipment that are installed in a patient area shall be adequately protected against mechanical damage in accordance with AS/NZS 3000.

NOTE: Particular attention is drawn to the requirement of wiring systems that are fixed into position and concealed within 50 mm from the building surface for wiring and electrical equipment that is not LPD protected.

2.4.3 Leakage protective device protection required

2.4.3.1 General

2.4.3.1.1 Electrical points

Leakage protective device protection shall be provided to the electrical points identified in Clauses 2.4.3.2, 2.4.3.3 and 2.4.3.1.2, except where exempted in Clause 2.4.3.2.2(a), (b) and (c).

2.4.3.1.2 *Extra-low-voltage (ELV) charging sockets-outlets*

Leakage protective device protection shall be provided to permanently installed ELV charging socket-outlets.

NOTE: This includes USB charging socket-outlets.

2.4.3.2 *Socket-outlets requiring LPD protection*

2.4.3.2.1 *General*

Leakage protective device protection shall be provided to all single-phase and multi-phase low-voltage socket-outlets specified in Clauses 2.4.3.2.2 and 2.4.3.2.3. RCDs used as LPDs shall not protect socket-outlets in different rooms, or socket-outlets in different patient areas.

NOTE: Socket-outlets are defined in AS/NZS 3000, which includes cord extension sockets.

2.4.3.2.2 *Locations of socket-outlets requiring LPD protection*

The following requirements apply:

- (a) Leakage protective device protection shall be provided for socket-outlets that are accessible in patient areas without the use of a key or tool.

This applies to socket-outlets that are attached to articulated arms and could be used to supply LV electrical equipment.

NOTE: Articulated arms supporting socket-outlets are considered not to comprise a medical electrical system.

Exceptions:

- 1 *Socket-outlets that are mounted above 2.3 m and are clearly intended for permanently mounted plug-in equipment other than medical electrical equipment.*
- 2 *Unless otherwise stated, these exceptions apply to single-phase and multi-phase socket-outlets.*

- (b) Leakage protective device protection shall be provided for socket-outlets in accordance with AS/NZS 3112 or AS/NZS 60884.1 that are located within 2.0 m of the entrance to a body-protected electrical area and are accessible without the use of a key or tool in any room, corridor, etc., opening directly off a patient area.

This applies to socket-outlets in accordance with AS/NZS 3112 or AS/NZS 60884.1 that are located within 5.0 m of the entrance to a cardiac-protected patient area and are accessible without the use of a key or tool in any room, corridor, etc., opening directly off a patient area.

Exceptions:

- 1 *Multi-phase outlets in accordance with AS/NZS 3123 need not conform.*
- 2 *Socket-outlets provided with LPD protection, within the specified distances above, outside patient areas, do not deem the area they are installed in to be a separate body-protected electrical area or patient area. These areas are not required to be identified in accordance with Section 7.*
- 3 *Socket-outlets that are mounted above 2.3 m and are clearly intended for permanently mounted plug-in equipment other than medical electrical equipment. Unless otherwise stated, these exceptions apply to single-phase and multi-phase socket-outlets.*

- (c) Leakage protective device protection shall be provided for socket-outlets installed outside the patient area but used to supply medical electrical equipment used within the patient area.

Where such a socket-outlet is located in a room, this requirement applies to all other socket-outlet(s) within that room.

Where such a socket-outlet is inaccessible (e.g. a socket-outlet located in a ceiling space), this requirement only applies to the affected socket-outlet.

NOTE: This requirement often applies in control rooms associated with cardiac catheterization laboratories, MRI rooms and other imaging facilities, monitoring systems in staff stations, sleep laboratory recording rooms, etc.

Exceptions:

- 1 *Socket-outlets that are mounted on, and form part of, a permanently installed medical system provided that such socket-outlets are clearly intended to power specified component parts of the medical electrical system.*

2.4.3.2.3 *Types of socket-outlets requiring LPD protection*

The following types of socket-outlets available for general use shall be protected by LPD:

- (a) Socket-outlets in accordance with AS/NZS 3112 or AS/NZS 60884.1.
NOTE: These include single-phase low-voltage socket-outlets with sloping flat live contacts and flat or round earthing contacts.
- (b) Socket-outlets in accordance with AS/NZS 3123 or the IEC 60309 series, except those specified in Clauses 2.4.3.2 to 2.4.3.2.2.
NOTE: AS/NZS 3123 or IEC 60309 series refers to low-voltage socket-outlets primarily intended for general industrial use, including the common round socket-outlets with three to five round pins rated from 10 to 100 A.
- (c) Socket-outlets in accordance with AS/NZS 60320.1 (Standard Sheet C13).
NOTE: These are 'IEC' 10 A mains connectors.
- (d) Cord extension sockets in accordance with AS/NZS 3120.

Exceptions:

- 1 *Permanently installed socket-outlets which are incorporated within medical electrical equipment.*
- 2 *Socket-outlets that are provided specifically for the connection of clocks and will not accept common 10 A plugs conforming to AS/NZS 3112.*

2.4.3.3 *Permanently-wired medical electrical equipment requiring LPD protection*

Leakage protective device protection shall be provided to permanently wired medical electrical equipment with any of the following Type B applied parts—

- (a) electrodes or transducers that contact patients;
- (b) that enter patients;
- (c) that contact liquid that enters patients.

The supply to other permanently wired equipment shall be protected as required in AS/NZS 3000.

2.4.4 Low-voltage uninterruptible supplies (UPS)

2.4.4.1 *General*

Where the switchboard from which the UPS is to be supplied contains an essential supply, then the UPS shall be connected to that essential supply.

2.4.4.2 Leakage protective device protection of uninterruptible supplies (UPS)

Low-voltage a.c. circuits that originate from a UPS and that are required to be LPD protected shall be installed as follows:

- (a) Where the output circuit of the UPS is not earth referenced in every mode of operation, the UPS shall be treated as an isolation transformer and provided with a LIM and (where required) an overload monitor as required in Clause 2.9 (see Figure 5). The output circuit of the UPS shall be isolated from earth to the extent necessary to ensure that the maximum prospective hazard current is less than 2 mA when connected to the circuit wiring and the LIM.

NOTE: The output of such a UPS is known as a 'separated circuit' in AS/NZS 3000.

- (b) Where one output terminal of the UPS is connected to the neutral input terminal earthed within the UPS, the output shall be protected by one or more RCDs as specified in Clause 2.8, or by one or more isolation transformers provided with LIMs and (where required) overload monitors as required in Clause 2.9 (see Figures 6 and 7).

NOTES:

- 1 The output of such a UPS is considered a supply with an earthed neutral.
- 2 This configuration will result in loss of supply whenever the residual current device (RCD) trips.

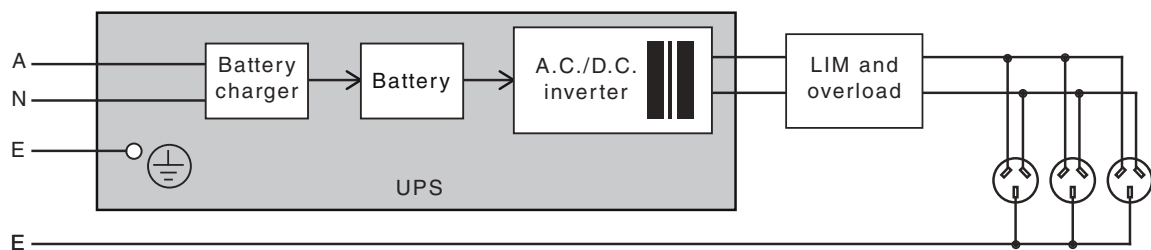


FIGURE 5 UNINTERRUPTIBLE POWER SUPPLY WITHOUT EARTH REFERENCED OUTPUT PROVIDED WITH LINE ISOLATION MONITOR AND OVERLOAD MONITOR

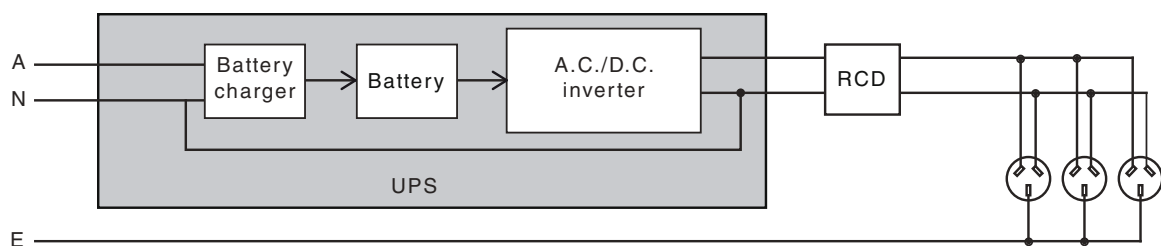


FIGURE 6 UNINTERRUPTIBLE POWER SUPPLY WITH INTERNALLY EARTHED OUTPUT PROTECTED BY RCD

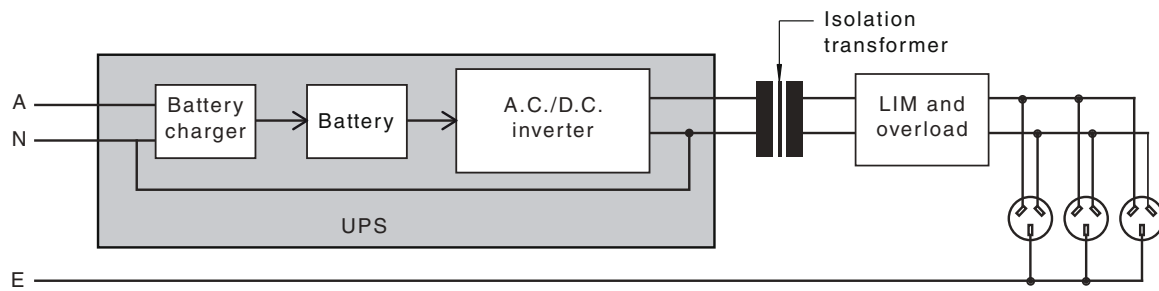


FIGURE 7 UNINTERRUPTABLE POWER SUPPLY WITH INTERNALLY EARTHED OUTPUT PROTECTED BY LINE ISOLATION MONITOR AND OVERLOAD MONITOR

2.4.4.3 Uninterruptable power supply status indicators

A suitably located UPS status indicator shall be provided where socket-outlets or permanently wired equipment are connected to a UPS and there is continuous patient observation, including in—

- (a) each operating theatre; and
- (b) staff stations in recovery wards, intensive care units, isolation rooms and other special care areas.

Uninterruptable power supply status indicators shall be provided with synchronized, pulsating, audible and visual alarms to indicate when the UPS is operating in battery mode. The audible alarm shall continue until muted; however, there shall not be a 'master' muting facility. The visual alarm shall continue until the supply is restored to the UPS or the UPS is exhausted.

Uninterruptable power supply status indicators shall be identified 'UPS STATUS' in accordance with Clause 2.12.1.

Where the UPS status indicator is provided with an alphanumeric display, the message 'UPS IN EMERGENCY MODE' shall be displayed when supply to the UPS is lost.

2.5 LOW-VOLTAGE D.C. SUPPLIES

Reticulated separated low-voltage d.c. circuits supplying socket-outlets or permanently wired equipment, including d.c. emergency supplies, shall not be earth referenced to the extent that it will deliver less than 10 mA between either supply conductor and earth.

Exception:

- 1 *Low-voltage d.c. circuits that are reticulated between separate parts of a single equipment system.*

2.6 ACCESS TO CONTROLS AND INDICATORS

Controls and indicators of RCDs, line isolation monitors and overload monitors that are provided to satisfy the requirements of Clause 2.4 shall—

- (a) be readily accessible;
- (b) be located in accordance with Table 2.1;
- (c) not be mounted under benches, or structures that protrude more than 250 mm out from a wall and less than 1200 mm above the ground floor or platform;
- (d) be located in a visible position;
- (e) not be within cupboards or cabinets;

- (f) not be behind bulky equipment in such manner as to inhibit easy access to the controls and indicators; and
- (g) where mounted near the entrance of a room, be separated by at least 500 mm from any wall-mounted light switch.

Exceptions:

- 1 *RCDs protecting socket-outlets that are identified 'CLEANING PURPOSES ONLY' in accordance with Clause 2.7.3.*
- 2 *Socket-outlet RCDs (SRCDs) mounted in ensuite vanities/cupboards.*
- 3 *Self harm patient area in accordance with Clause 5.4.*

TABLE 2.1

LOCATION OF CONTROLS AND INDICATORS OF RCDs, LINE ISOLATION MONITORS AND OVERLOAD MONITORS

Location of socket-outlet(s) or permanently connected equipment requiring LPD protection	Location of controls and indicators of associated RCD or line isolation monitor and overload monitor
Within patient area	Within patient area
Accessible outside a patient area	Within the room, corridor, staff base, etc. in which the associated socket-outlets are located
Inaccessible outside a patient area protected by an LPD e.g. in ceiling space	Within patient area

2.7 SOCKET-OUTLETS

2.7.1 Number of socket-outlets

The number and disposition of socket-outlets in a patient area shall be such as to eliminate the need for the use of cord extension sets, electrical portable outlet devices and adaptors, and shall be determined in consultation with the responsible organization.

NOTE: A minimum spacing of 60 mm horizontally and 100 mm vertically between socket-outlets should be considered when plug packs are likely to be used.

2.7.2 Socket-outlets requiring isolating switches

Socket-outlets that are not readily accessible and are not protected by a dedicated LPD shall be provided with a separate, readily accessible isolating switch that operates in all live (active and neutral) conductors in accordance with Clause 2.10.

Socket-outlets mounted under benches or in cupboards are not readily accessible if they are obstructed by equipment. Socket-outlets that are not readily accessible and that are protected by a dedicated LPD shall be provided with a readily accessible test facility in accordance with Clause 2.8.7. Isolation switches shall not be located within 500 mm of the light switch at the entrance of the room.

2.7.3 Socket-outlets for cleaning equipment

2.7.3.1 Location of socket-outlets identified 'CLEANING PURPOSES ONLY'

Socket-outlets identified 'CLEANING PURPOSES ONLY' shall be provided as follows:

- (a) For body-protected electrical areas, at least one such socket-outlet shall be provided, either in each patient area or in a position to service several patient areas, if any part of the patient area is within 15.0 m of the socket-outlet.

NOTE: The socket-outlet may be in another room or in a corridor provided it meets the 15.0 m distance requirement.

- (b) For cardiac-protected electrical areas, at least one such socket-outlet shall be provided within the patient area.

Exception:

- 1 *Socket-outlets identified 'CLEANING PURPOSES ONLY' are not required in MRI scanning rooms.*

2.7.3.2 Protection of socket-outlets identified 'CLEANING PURPOSES ONLY'

Socket-outlets that are identified 'CLEANING PURPOSES ONLY' shall be protected by LPDs.

These LPDs shall not be used to protect any socket-outlets that are not identified 'CLEANING PURPOSES ONLY'.

The requirements of Clause 2.6 for access to controls and indicators of protective devices do not apply to these LPDs.

These LPDs may be used to protect socket-outlets identified 'CLEANING PURPOSES ONLY' in any other areas.

If an RCD is used as an LPD it shall be a Type 1 RCD.

2.7.4 Identification of socket-outlets

2.7.4.1 Identification of socket-outlets protected by LPDs

Socket-outlets protected by LPDs shall be identified by the specific words—

- (a) 'RCD PROTECTED' or 'ISOLATION TRANSFORMER PROTECTED';
- (b) 'from RCD X' or 'from LIM X'; and
- (c) 'CLEANING PURPOSES ONLY', where applicable.

Exception:

- 1 *Item (a) need not apply to socket-outlets identified 'CLEANING PURPOSES ONLY'.*

Each socket-outlet or group of socket-outlets shall be identified (numbered or lettered) in accordance with Clause 2.12.1 to identify the appropriate LIM and overload monitor or the appropriate RCD.

Socket-outlets protected by an LPD shall not have DB/CB identification affixed.

2.7.4.2 Switch indication

Each socket-outlet that is protected by an LPD shall indicate when the socket-outlet switch is on, e.g. by a red-coloured luminous indicator or red identification.

2.7.4.3 Colour coding

2.7.4.3.1 Low voltage (LV) socket-outlets

Socket-outlets that are protected by LPDs and that accept 10 A, 15 A or 20 A plugs conforming to AS/NZS 3112 shall be colour-coded as follows:

- (a) Socket-outlets connected to a normal supply shall be colour-coded white.
- (b) Socket-outlets connected to an essential supply shall be colour-coded red.
NOTE: Attention is drawn to the definition of essential supply which excludes supplies that are subject to load shedding (see Clause 1.5.28).
- (c) Socket-outlets connected to an uninterruptible supply shall be colour-coded dark blue.
- (d) Socket-outlets identified 'CLEANING PURPOSES ONLY' shall be colour-coded beige.