Electrical Testing Company Pty Ltd

A Guide to AS/NZS 3003: 2018

Electrical installations – Patient areas (Body and Cardiac)

Subject	***Page***
AS/NZS 3000 Wiring Rules requirement	2
Classification of Patient Electrical Areas	3
Categories index	4
Understanding of the term 'Readily Accessible'	5
Body-protected electrical areas 	6
Cardiac-protected electrical areas 	35
Low-voltage isolated supplies	69
Wall elevation applications of AS/NZS 3003	72

Electrical Testing Company Pty Ltd

Est: 1969

Unit 15, 10 Victoria Ave
Castle Hill NSW 2154

T: 1300 TEST IT
1300 8378 48

electricaltestingcompany.com.au

AS/NZS 3000 Wiring Rules includes:

Clause 7.8 Specific Electrical Installation Standards – which outlines those standards that are applicable to specific electrical installations.

Clause 7.8.2.2 states electrical installations in electromedical treatment areas shall comply with AS/NZS 3003.

Standard AS/NZS 3003 is an additional requirement of AS/NZS 3000 and requirements that, when fully satisfied, are deemed to comply with AS/NZS 3000. The states and territories of Australia may have legislated the application of the wiring rules, therefore AS/NZS 3003 would be included in this legislation.

AS/NZS 3003 Clause 2.1:
All patient areas shall be body-protected electrical areas or cardiac-protected electrical areas.

Note for reader:

Throughout this guide there may be text highlighted by a yellow background.

This indicates a ruling change or addition to the standard from the previous 2011 edition.

(may not be conclusive)

- ***Classification of Patient Electrical Areas***

Classification of patient areas as either ***Body or Cardiac electrically protected*** is carried out by the organization/entity responsible for the electrical installation, whom have determined that low voltage medical electrical equipment will be used on a patient.

(comment)
Electricians are responsible for the correct wiring and protection systems being installed based on the classification by the responsible entity.

AS/NZS 3003: 2018 discusses this protocol in Section 1 Scope and General clauses and advises the responsible entity to refer to standard ***AS/NZS 2500*** for advice.

AS/NZS 3003: 2018 has mandatory classification for nominated areas, refer clause 2.2.3 (cardiac) and clause 2.2.4 (body) for this requirement.

(part of Clause 1.2 in AS/NZS 3003: 2018 on advice for area classification)

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 Guide to the safe use of electricity in patient care.***

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.

- ***Record Keeping***

The responsible organization / entity is now required to retain as records the documentation outlining patient area classifications and inspection records.
AS/NZS 3003 Clause 2.2.1 Documentation
Documentation outlining patient area locations and classifications shall be provided by the responsible organisation / 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 organisation/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.

- ***Magnetic Fields***

*(Provisions for magnetic fields are now **informative**)*

The responsible organisation should ensure that magnetic fields do not exceed safe limits in sensitive areas.
Prior to and at completion of the work, arrangements should be made for tests to be carried out to confirm that the installation conforms (refer Appendix G of AS/NZS 3003 for detail).

AS/NZS 3003:2018

Understanding of the term 'Readily Accessible' (page 5)

Body Protected Electrical Areas  (page 6)

Subject

- Final sub-circuits, (page 7)
- Socket-outlets (GPOs), (page 8)
- Earthing (page 14)
- Mechanical protection of wiring systems ASNZS 3000, (page 14)
- Electrical areas, (page 15)
- RCDs, (page 19)
- Testing and Verification, (page 23)
- Definitions, (page 25)
- Cleaners socket-outlets, (page 26)
- Marking / Labelling, (page 27)
- Permanently wired equipment, (page 28)
- Self-harm patient, (page 32)
- Alterations, additions and repairs, (page 33)

Cardiac Protected Electrical Areas  (page 35)

Subject

- Final sub-circuits, (page 36)
- Socket-outlets (GPOs), (page 37)
- Electrical areas, (page 42)
- Mechanical protection of wiring systems ASNZS 3000, (page 44)
- RCDs, (page 45)
- Testing and Verification, (page 49)
- Definitions, (page 51)
- Cleaners socket-outlets, (page 52)
- Marking / Labelling, (page 53)
- Permanently wired equipment, (page 54)
- Earthing / EP bonding, (page 57)
- Alterations, additions and repairs, (page 67)

Information provided may be duplicated in both BODY and CARDIAC sections of this document, this is done to enable the user to reference their specific electrical area requirements.

This information is primarily applicable to Australian installations.

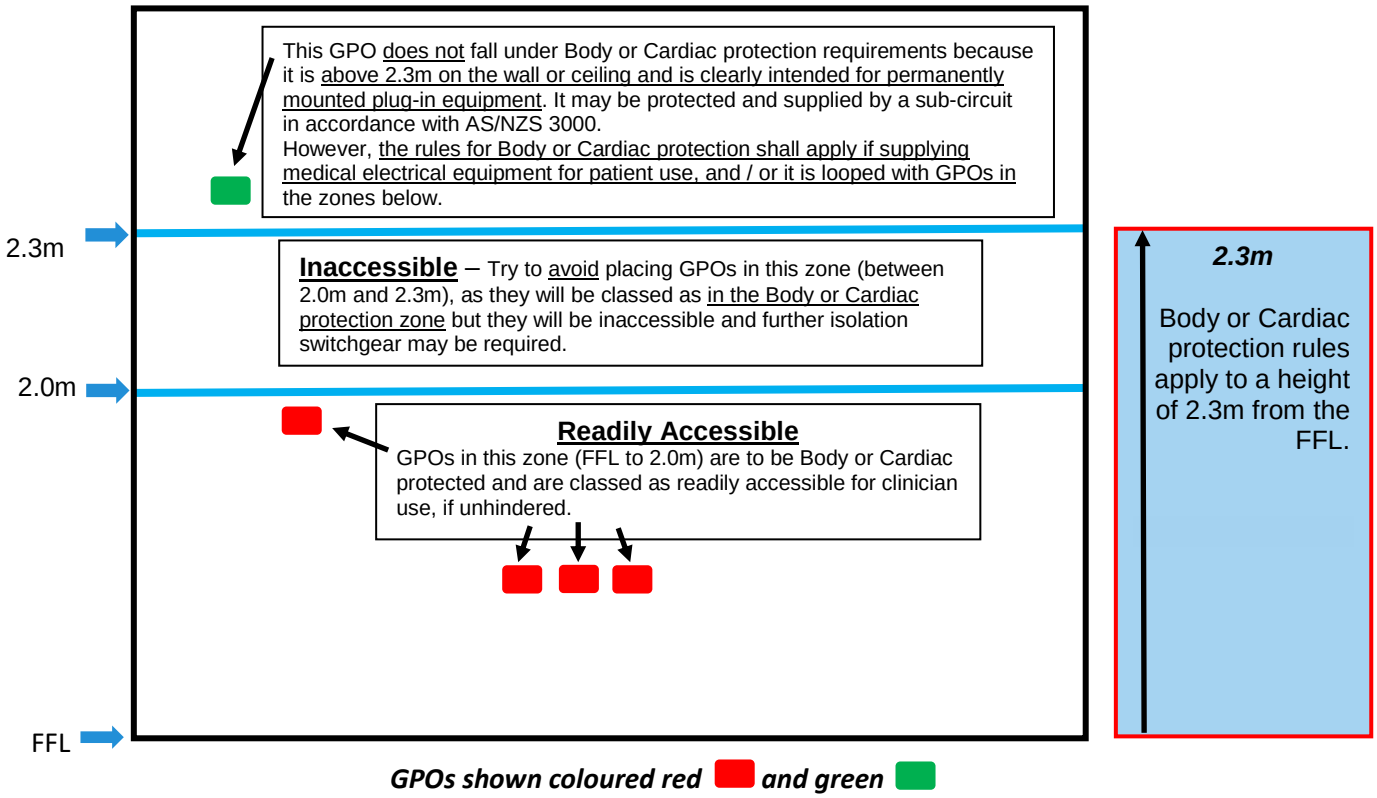
Guidance here specifically highlights RCDs used as LPDs.

Isolation transformers used as LPDs also have specific requirements stated in the standard which must be followed, refer page 69.

*** ***Readily Accessible*** ***

- Understanding of the term ***'readily accessible'*** in respect to the clinician, nurse, operator, practitioner occupying and controlling the body or cardiac protected electrical area.

Body or Cardiac protected patient area, typical wall elevation



GPOs shown coloured red and green

This electrical standard is quite specific in that the body-protected or cardiac-protected electrical areas medical electrical equipment ***must be in the control of the clinician within the area:***

- The clinician ***must*** be able to access all the electrical controlling switchgear to enable isolation of socket-outlets and resetting of RCDs.
- The clinician is ***unable*** to reach above 2 metres.
- The clinician ***cannot*** by accident turn off RCDs when switching light circuits.
- The clinician is ***unable*** to reach below benches, desks, shelves or enter cupboards to reset RCDs.
- The clinician is ***unable*** to move bulky equipment to access GPOs and RCDs.
- The clinician may ***not*** use a ladder or chair for standing on to access GPOs.
- So therefore, RCDs must be positioned below 2 metres above the ground, floor or platform, and at least 500mm from a light switch.
- So therefore, RCDs must be located in a visible position.
- RCDs ***must be above*** structures which are 1200mm or less from the ground and protrude more than 250mm out from a wall (such as a shelf).
- So therefore, socket-outlets located behind bulky equipment must have an accessible ***double pole*** isolator.
- So therefore, socket-outlets behind or inhibited by flat screen monitors must have an accessible ***double pole*** isolator.
- So therefore, socket-outlets above 2 metres which are looped with other socket outlets in the area below 2 metres must have an accessible ***double pole*** isolator below 2 metres.
- A dedicated RCD for an inhibited or inaccessible socket-outlet requires a readily accessible test facility (round pin earth, white GPO).

(The statements above must be clarified by consulting the relevant clauses in the standard)

AS/NZS 3003:2018

Body Protected Electrical Areas (shall comply with Section 2 and Section 3 of the standard)

The following is a guide for electricians involved with electrical installations for patient areas in hospitals and medical facilities which are deemed to comply with AS/NZS 3003:2018 Body Protected Electrical Areas.

This guide in no way replaces the need to consult and understand the relevant standard and it is not endorsed or approved by any authority.

This document has been produced by persons with relevant industry experience who have seen a need to give some basic advice and direction for electricians prior to them undertaking electrical installations in patient areas.

This documents only high lights the areas of common mistakes or misinterpretation and provides an easy reference by category and relevant clause identification, it in no way replaces the need to consult and understand the whole standard.

The relevant clause is listed first in the topic sentence, and the statements or sentences here are not necessarily a direct representation of the clause.

Subject

- Final sub-circuits, (page 7)
- Socket-outlets (GPOs), (page 8)
- Protection of wiring systems ASNZS 3000, (page 14)
- Earthing, (page 14)
- Electrical areas, (page 15)
- RCDs, (page 19)
- Testing and Verification, (page 23)
- Definitions, (page 25)
- Cleaners socket-outlets, (page 26)
- Marking / Labelling, (page 27)
- Permanently wired equipment, (page 28)
- Self-harm patient, (page 32)
- Alterations, additions and repairs, (page 33)

AS/NZS 3003:2018

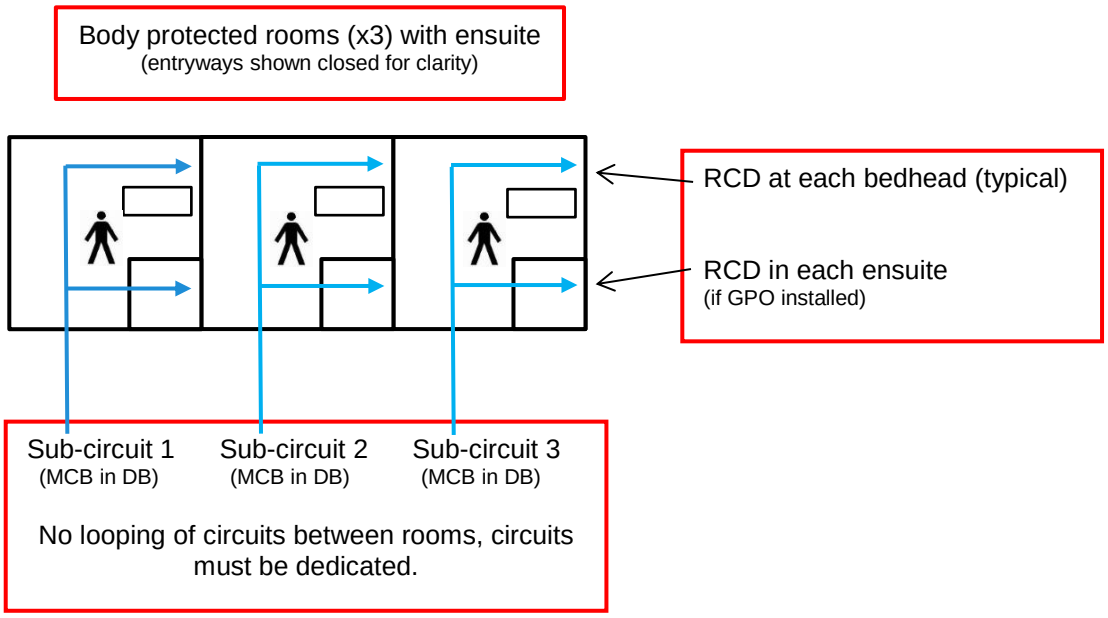
Body Protected Electrical Areas

Shall comply with:

- Section 2 – General requirements for Body-protected and Cardiac-protected electrical areas.
- Section 3 – Additional requirements for Body-protected electrical areas.

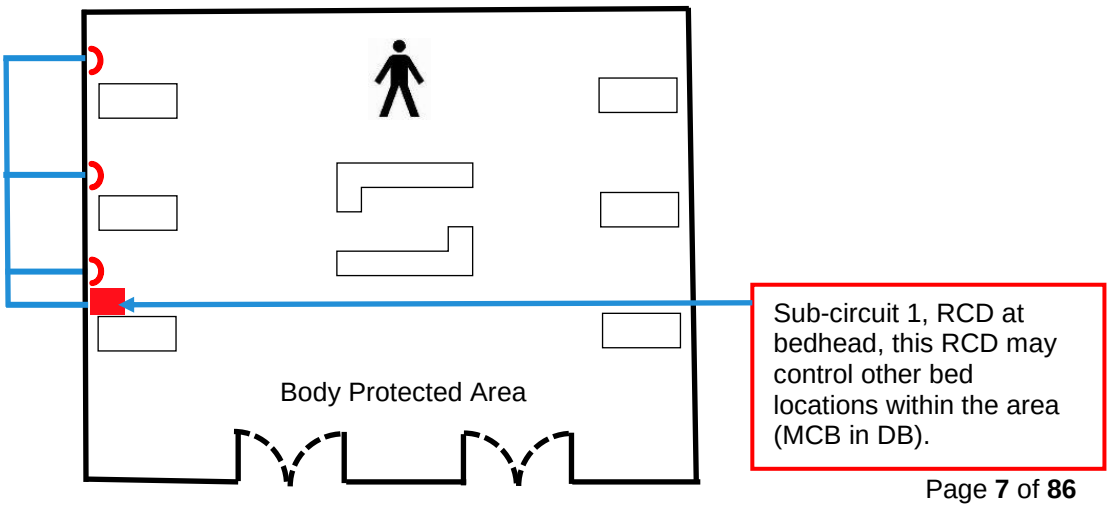
- ***Final sub-circuits***

CL.2.4.1.1 – (final sub-circuits) Only supply one body protected room and its adjoining ensuite, not looped from room to room. (The ensuite still requires a separate RCD, 10mA double pole)



Multiple bed locations in a body protected room (e.g. Recovery) may be fed by the same dedicated final sub-circuit.
The loading of the circuit would be in accordance with AS/NZS3000.

One RCD may be used to control multiple bed locations in the same room, to a maximum of 12 GPOs / points.



- ***Socket-outlets***

CL.2.4.3.2.1 – (socket-outlets) RCD 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 shall not protect socket-outlets in different rooms, or socket-outlets in different patient areas or areas that are not a patient area.
LPD protection shall be provided for socket-outlets that are accessible in patient areas without using a key or tool.

- 3 pin types (including round pin earth).

- IEC industrial type with 3 to 5 round pins rated 10 to 100A.
  (RCD protection not required if the socket location is based on the 2m rule)

- IEC appliance type C13

CL.2.4.3.1.2 – ELV charging socket-outlets shall be RCD protected, including USB charging socket-outlets.

A dedicated RCD for a charging socket-outlet shall include a white round pin earth GPO to enable testing of the RCD.

A charging socket-outlet (USB or similar) placed in the same circuit as other GPOs shall be provided with a double pole switch to enable isolation.

- ***Socket-outlets (cont.)***

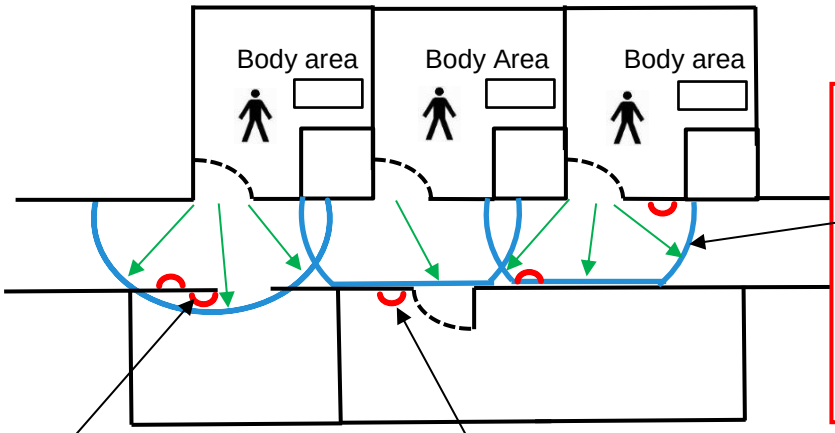
CL.2.4.3.2.2(b) – (socket-outlets) ***2m RULE*** – GPOs within 2m of a body protected area and are accessible without the use of a key or tool are to be RCD protected. (RCD shall be 10mA double pole).

The 2m rule GPOs could be located in rooms or corridors ***opening directly off*** the classified body protected area.

(The process of accessing the 2m rule GPO through a ***second door*** other than a door opening directly off or associated with the classified body protected area may ***exclude*** this GPO from the ruling).

The 2m rule RCD must be located with the socket-outlets they are controlling (not located in the switchboard), and the maximum of 12 socket-outlets per RCD applies.
The 2m rule socket-outlet must also be colour coded, have a PA neon and the mandatory labelling.

2m RULE –
GPOs shall be RCD protected, 10mA double pole.



2m rule boundary.

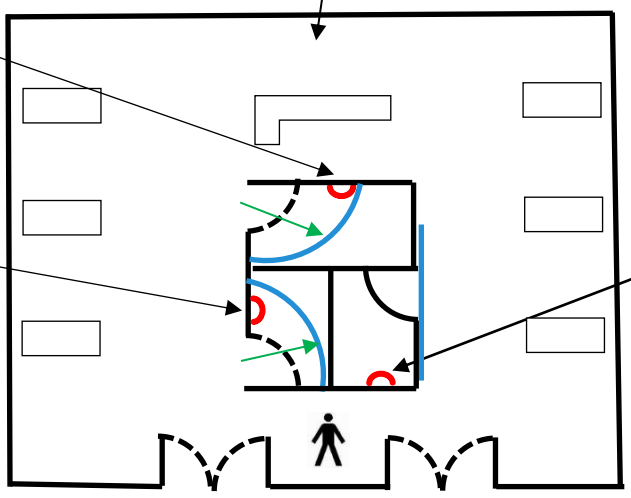
(a taut 2m flexible lead is plugged into the suspected GPO and if the socket end passes into the entryway or doorway of the Body protected area the GPO is then deemed to fall within the boundary).

This GPO falls under the rule as the opening to the room is not provided with a door.

This GPO is ***excluded*** from the rule as the room ***does not open directly off*** the Body protected area (second doorway).

Body Protected area

These GPOs fall under the rule as the rooms open directly off the body protected area and the doors are not locked.



This GPO is ***excluded*** from the rule as the door is locked with key or card access only.

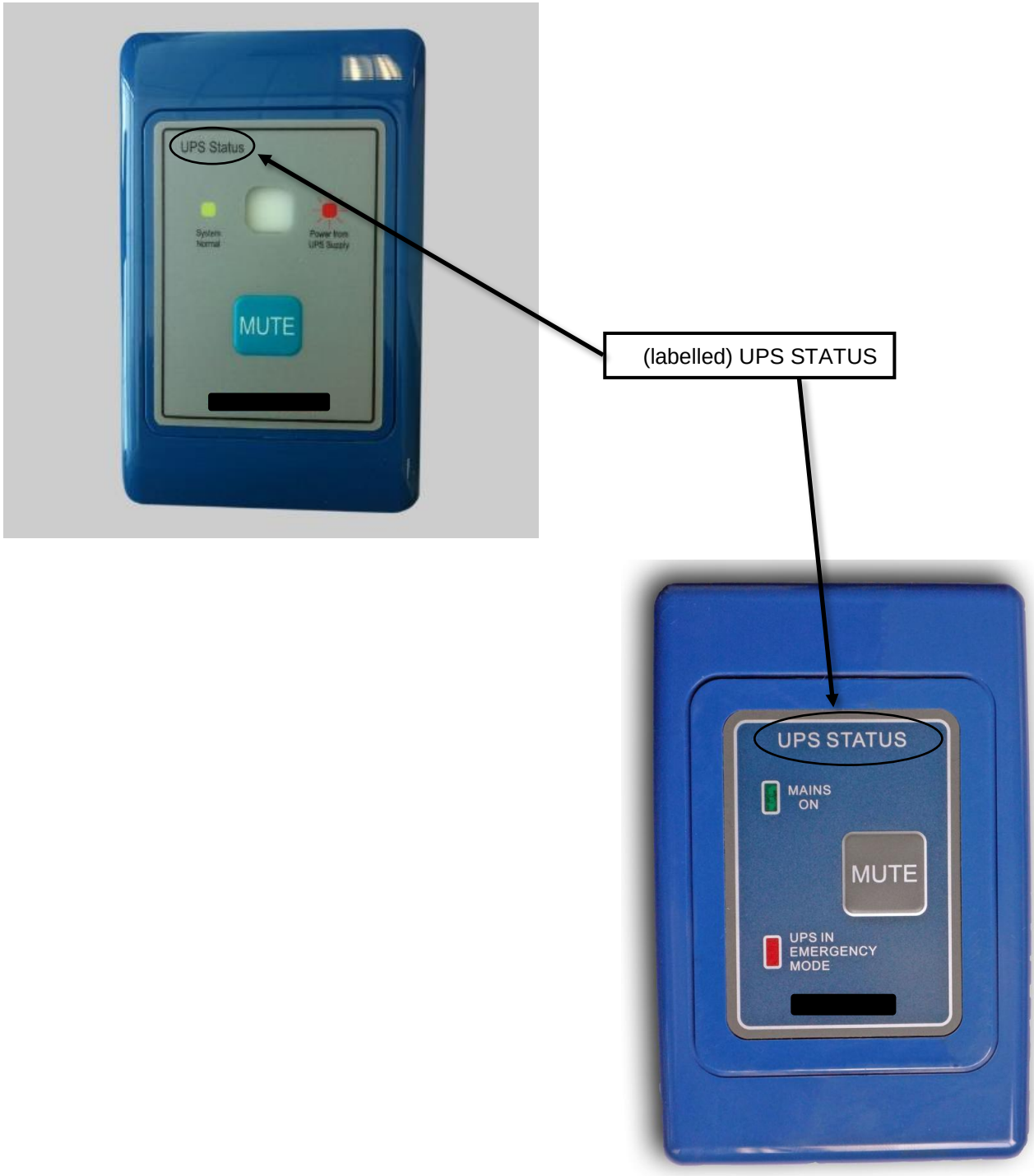
- ***Socket-outlets (cont.)***

CL.2.4.4.3 – (socket-outlets) GPOs backed up by a UPS system, require a UPS status indicator where there is continuous patient observation by medical staff, including in –

each operating theatre, staff stations in – recovery, ICU, isolation, special care etc.

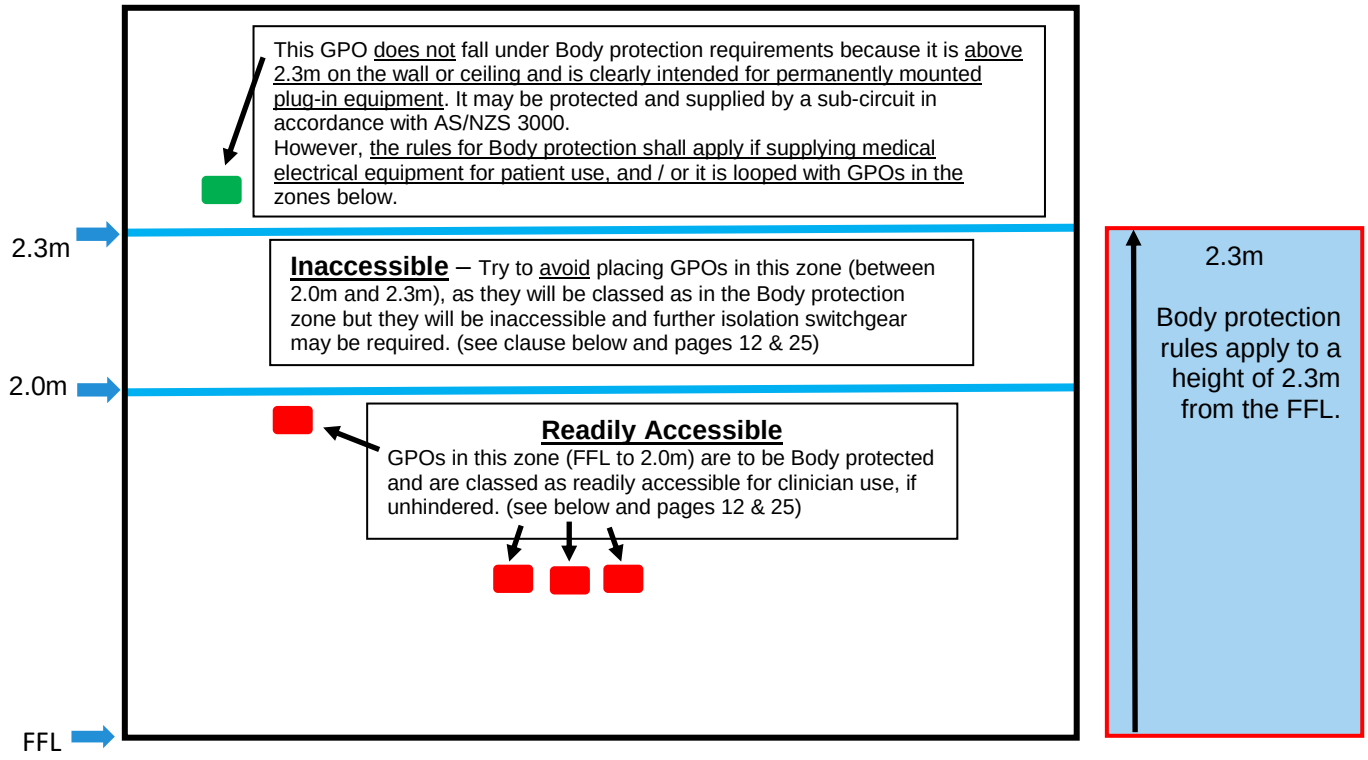
The status indicator must be connected to the UPS battery system to indicate loss of mains supply to the UPS.

There ***shall not*** be a master 'muting' facility, controlling multiple status alarms.



- ***Socket-outlets (cont.)***

****** (Readily Accessible) ******
Body protected patient area typical wall elevation



(GPOs shown coloured red and green)

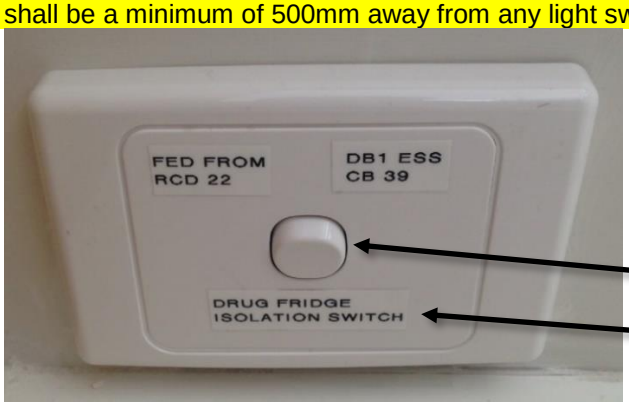
CL.2.7.2 – (socket-outlets) GPOs ***not readily accessible*** and not protected by a dedicated RCD require a separate readily accessible double pole isolation switch (height of switch no more than 2m from the ground, floor or platform).

The purpose of this is to provide easy isolation of the equipment by the staff in the area, to enable resetting of RCDs should there be an equipment fault.

GPOs must be below 2m to be classed as readily accessible and not obstructed by equipment.
If they are mounted under benches or in cupboards they are not considered readily accessible if they are obstructed by equipment.
Double pole isolators shall be independent of the equipment they are controlling, to allow for removal and service of equipment.

RCDs that are dedicated to protect an inaccessible GPO shall have a readily accessible test facility being a white round earth pin GPO in accordance with clause 2.8.7.

Do not place isolation switches for GPOs in the same switch plate as light switches. GPO isolators shall be a minimum of 500mm away from any light switch if near the entrance to the room.



CL. 2.10 – where permanently wired electrical equipment is supplied from an RCD that also supplies socket-outlets or other equipment, the electrical equipment shall be provided with a separate, individual, readily accessible double pole isolation switch. Not readily accessible GPOs shall be treated in the same manner.

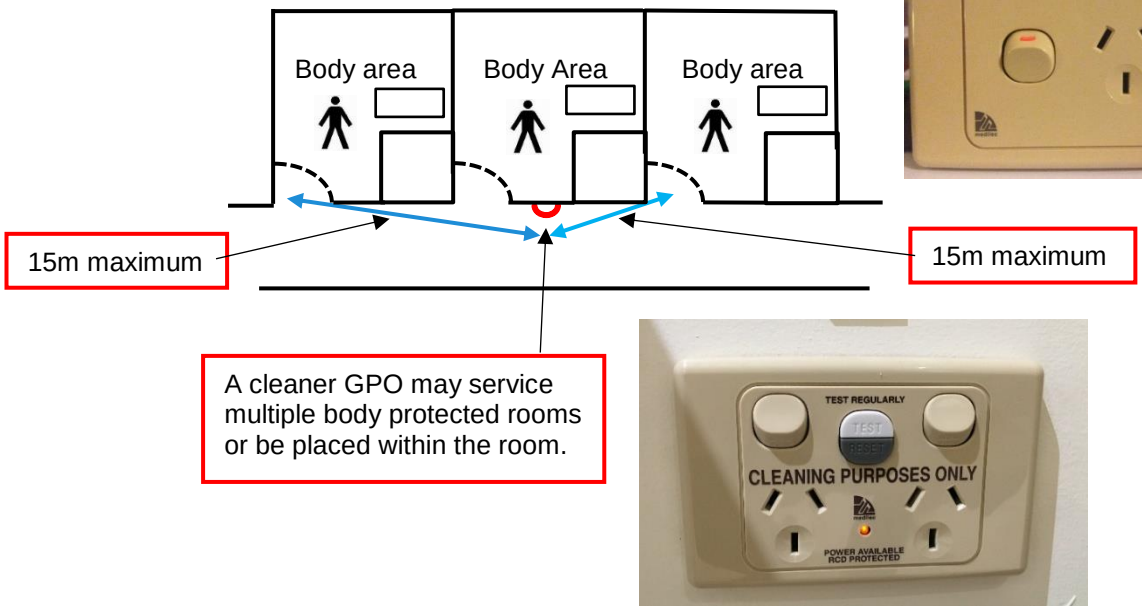
Isolation switches must be double pole.

Labelled accordingly.

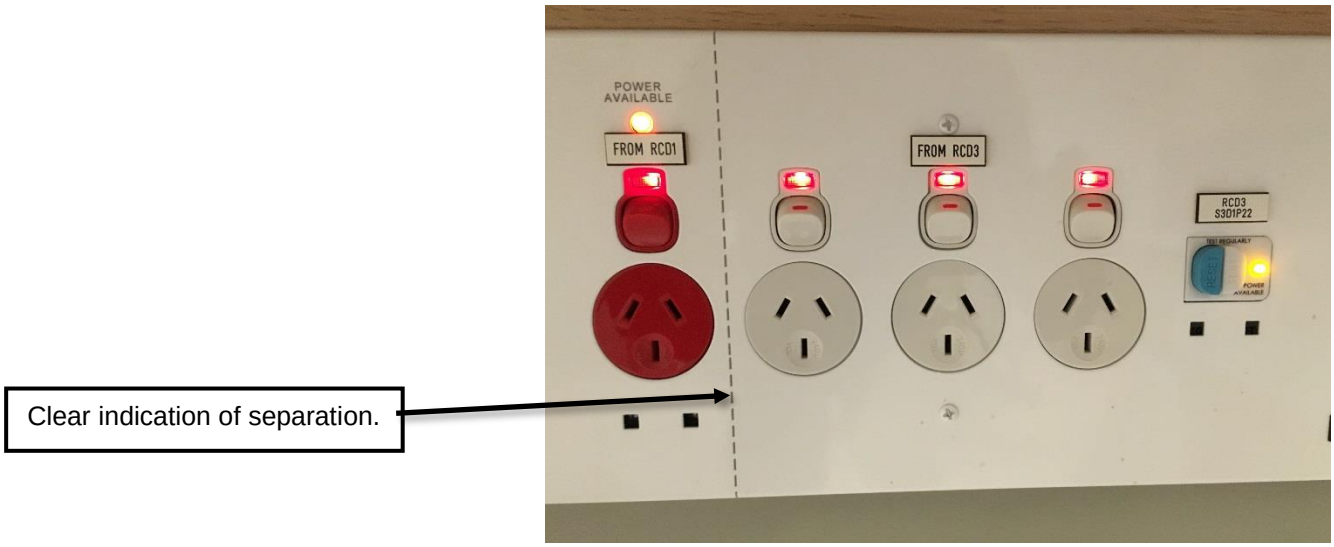
- ***Socket-outlets (cont.)***

CL.1.5.25 – (socket-outlets) Refer this clause for definition of ***'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 2m above the ground, floor or platform***.

CL.2.7.3.1 – (socket-outlets) Cleaner GPOs to be within ***15m*** of a body protected area or within the patient area (the GPO may be placed in a location to service multiple body protected rooms such as a corridor).



CL.1.5.12 – (socket-outlets) Groups of socket-outlets must have clear delineation (e.g. stainless steel medical panel with a combination of different GPO supplies, an engraved line between GPO services or clear separation for easy user understanding).



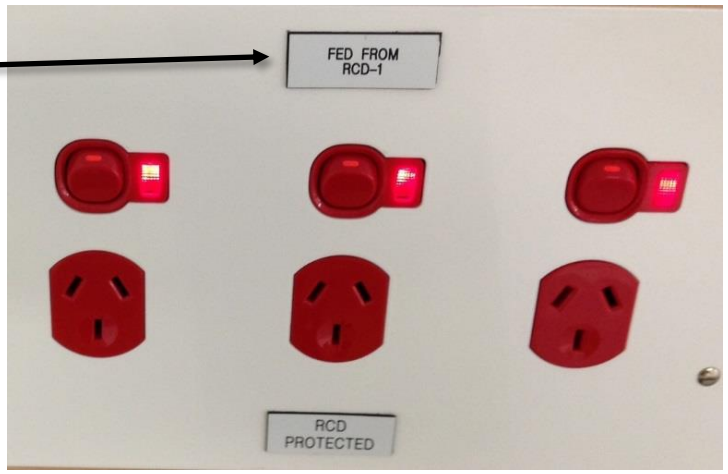
CL.2.4.3.2.2(c) – (socket-outlets) GPOs in ceiling spaces or imaging control rooms to be protected if supplying medical electrical equipment used within the patient area.
Where such socket-outlet is located in a room, this requirement applies to ***all other socket-outlets*** in that room. (RCD shall be 10mA double pole).

- ***Socket outlets (cont.)***

GPOs shall be labelled to indicate their controlling RCD.

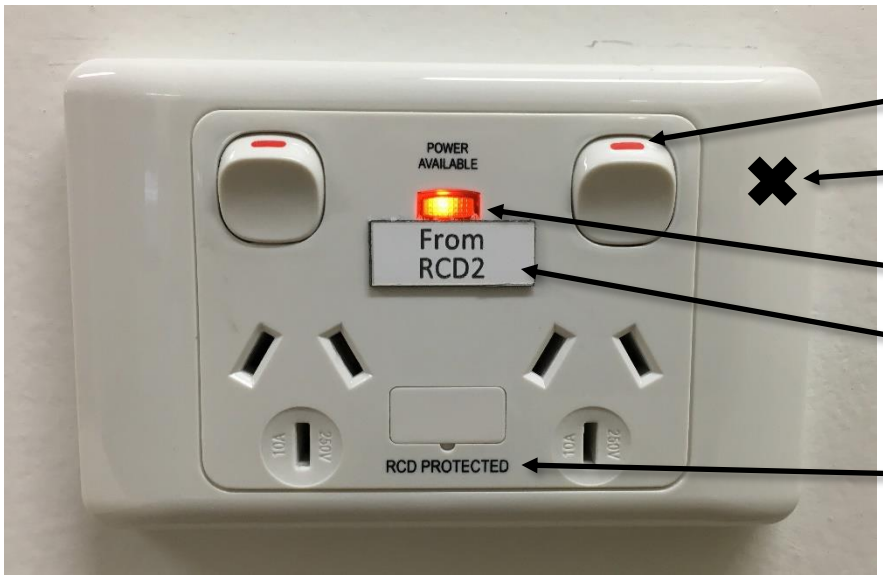
*The word **'FROM'** is mandatory.*

Socket-outlets shall not have DB/CB identification affixed.



CL.2.7.4.1 – (socket-outlets) socket-outlets on RCD protected supplies (including 2m rule) shall be:

- Fitted with one amber, yellow or orange indicator light to show when supply is available (CL. 2.7.4.4).
- (indicator light not required for ELV / USB charging socket-outlets)
- Marked 'RCD Protected'.
- Marked 'From RCD X'
- The switch shall indicate when on, by a red marking or red indicator light (CL.2.7.4.2).
- Socket-outlets ***shall not*** have DB/CB identification affixed.



Red marking on switch

***NO labels** to be fixed to clip on surrounds, see page 27.*

Amber neon

Controlling RCD label

'RCD Protected' label

CL.2.7.4.3.1 – (socket-outlets) Colour coding of socket-outlets as follows (for 10A, 15A, 20A and ELV):

- Normal supply shall be ***white***
- Essential supply shall be ***red***
- UPS supply shall be ***dark blue***
- ELV socket plates and covers ***shall be colour coded as above*** (cl. 2.7.4.3.2)
- Cleaning Purposes Only shall be ***beige***

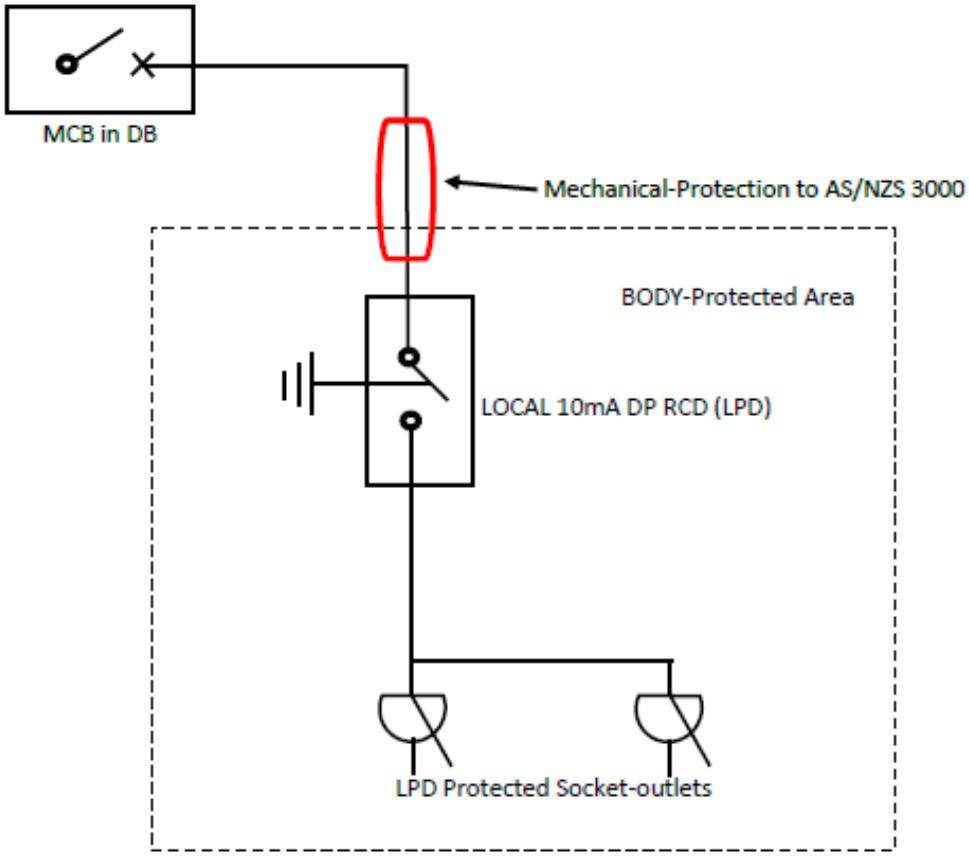
CL.2.7.5 – (socket-outlets) Each socket-outlet shall be individually controlled by its own accessible manual switch.

- ***Mechanical protection of wiring systems***

CL.2.4.2 – 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.

Ensure 30mA RCDs do not back up RCDs used in areas classified as Body protected electrical areas.

Therefore, a 30mA RCD cannot be used in the switchboard in lieu of mechanical protection to enable compliance to section 3.9.4 of AS/NZS 3000.



Protection methods (clause 3.9.4.4 of AS/NZS 3000:2018)

- (a) provided with adequate mechanical protection at a minimum of WSX3 (appendix H, paragraph H5.4).

  OR

- (b) provided with an earthed metallic armouring, screen, covering or enclosure, to operate a short circuit protective device under fault conditions.

- ***Earthing***

CL.3.2 – Earthing in body-protected electrical areas shall be carried out in accordance with the requirements of AS/NZS 3000.

- ***Electrical Areas***

CL.2.2.1 – (electrical areas) 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.

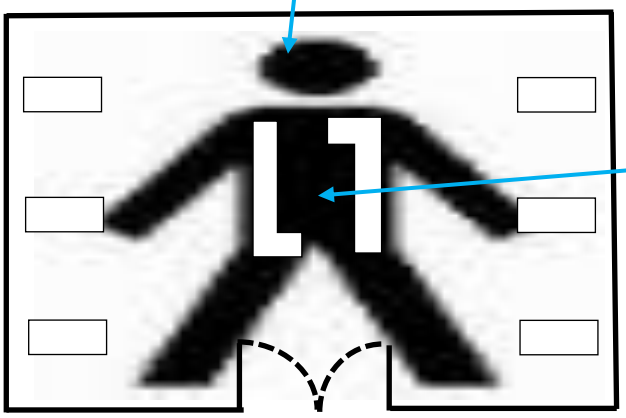
Note:
Where there is doubt about the intended use of a particular location, formal clarification should be sought from the responsible organization, and the documentation updated accordingly.

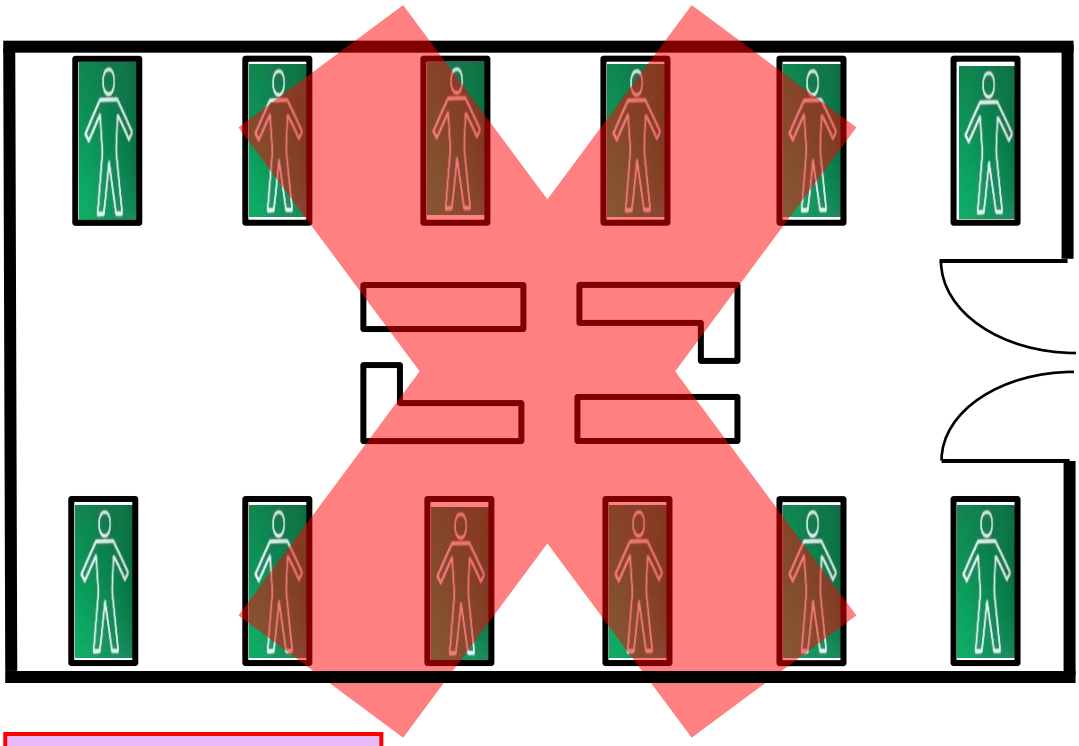
CL.2.2.2 – (electrical areas) Nurse / staff stations and beverage bays etc. if in the body protected area form part of the area (***therefore body protection rules apply***).

In general terms ***Body protected electrical areas are bound by full height walls and doors only.*** (This would normally account for the whole room)

The following ***are not*** boundaries:

- Bed curtains
- Staff stations
- Partitions/dividers
- Benches/desks
- Moveable walls
- Screens
- Nib walls





In general terms ***Body protected electrical areas are bound by full height walls and doors only.***

(This would normally account for the whole room)

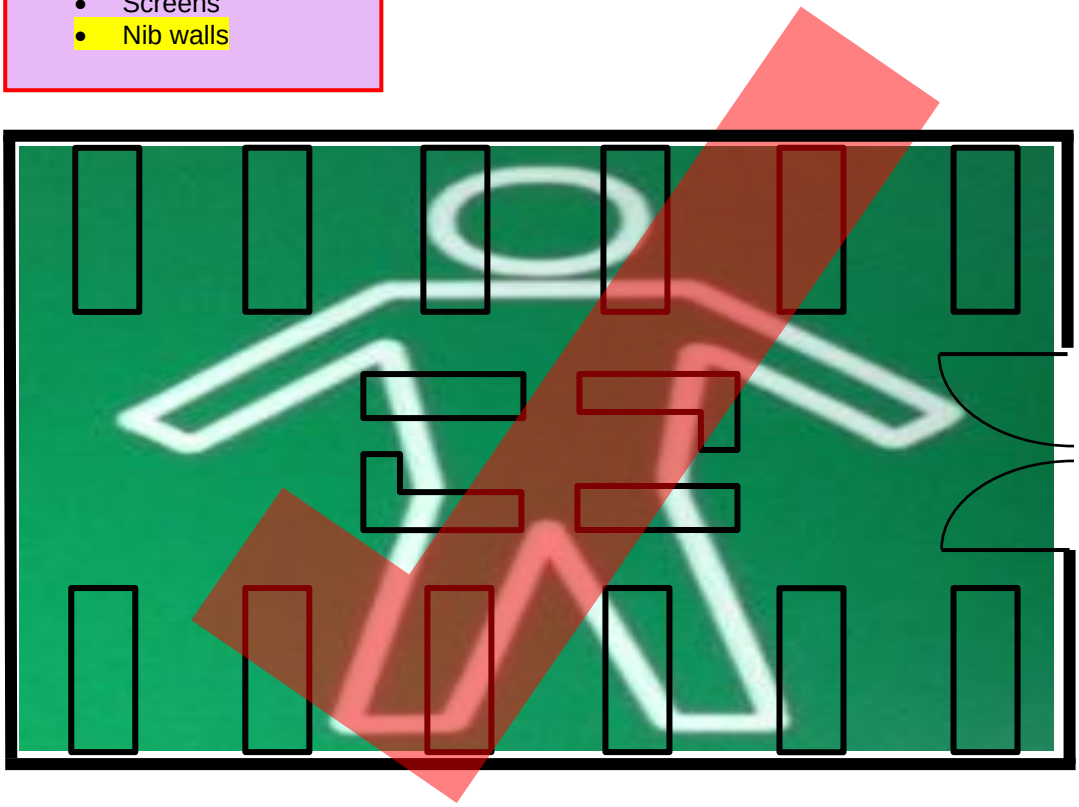
The following ***are not*** boundaries:

- Bed curtains
- Staff stations
- Partitions/dividers
- Benches/desks
- Moveable walls
- Screens
- Nib walls

CL.2.2.2 – (electrical areas) Nurse / staff stations and beverage bays etc. if in the body protected area form part of the area (***therefore body protection rules apply***).

Where walls are incomplete at the entry way(s) into a single clinical operational unit, those walls shall be extended to enclose the boundary (refer the full statement of clause 2.2.2).

Design engineers should indicate on drawings that the whole room / area is body-protected, not individual bed spaces.

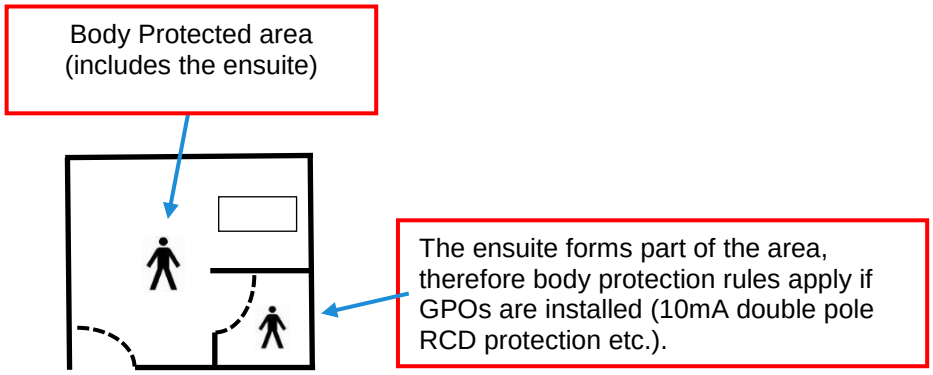


- ***Electrical Areas (cont.)***

CL.2.2.4 – (electrical areas) Refer this clause for a list of locations required to be wired as body protected electrical areas – these areas may include the following:

Anaesthetic bays	***Outpatient exam rooms***
Audiometry	***Physiotherapy***
A&E wards	***Plasmapheresis***
Allied health care	***Plaster rooms***
Blood collection	***Procedure rooms***
Chiropractic	***Recovery***
Dermatology	***Respiratory labs***
Day procedure theatres	***Resuscitation bays***
Delivery suites	***Stress test***
Dental surgeries	***Treatment***
Doctors consult	***Ultrasound***
Endoscopy theatres / procedure	
HDU	***CL. 5.3 Disability & Aged Care***
Imaging	Where the responsible organisation
Medical & surgical wards	has not nominated any patient areas,
Naturopathic	the installation shall comply with
Nurseries	AS/NZS 3000.
Operating theatres for non-cardiac	
Optometry	

CL.2.2.4 – (electrical areas) Ensuites, bathrooms, shower rooms and toilets intended for patient use shall be wired as body protected areas.

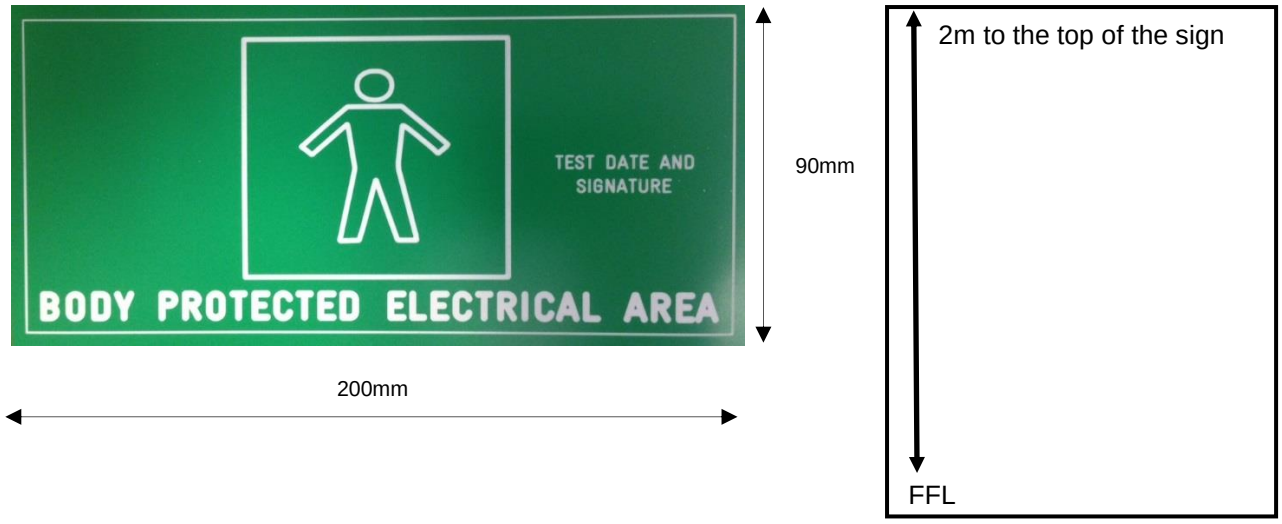


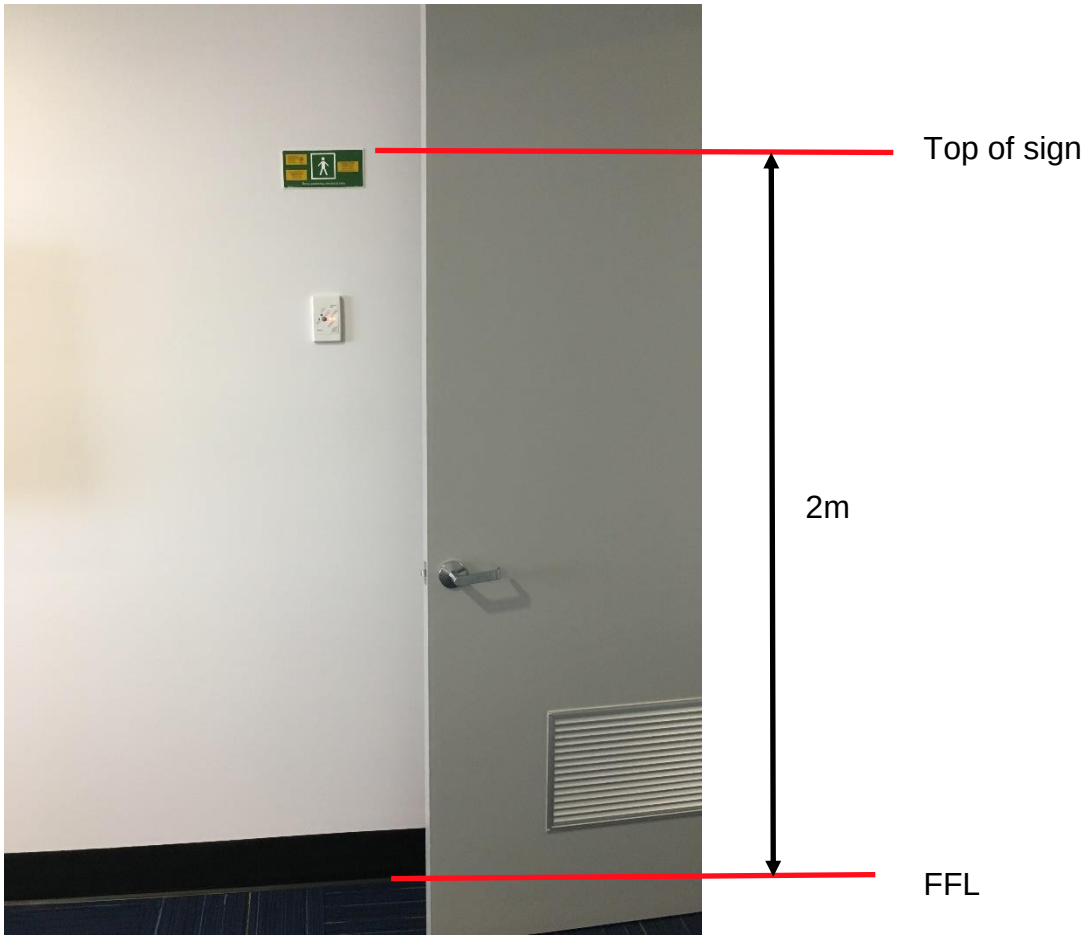
Typical combination 10mA RCD/DGPO installed in patient ensuite.

CL.2.6 (exception) – combination RCD/GPOs ***may*** be mounted in ***ensuite*** cupboards / vanities.

- ***Electrical Areas (cont.)***

CL.2.12.2 – (electrical areas) Green area sign to be installed on a wall and be readily visible in the patient area, and at a height of 2m to the top of the sign.



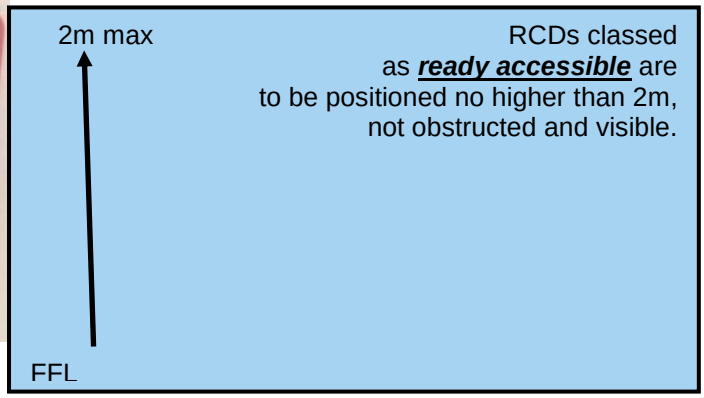


- ***RCDs***

CL.2.4.3.2.3 – (RCDs) Socket-outlets requiring RCD protection include single phase and multi-phase LV socket-outlets of type:

- 3 pin types (including round pin earth).
- IEC industrial type with 3 to 5 round pins rated 10 to 100A.
  (RCD protection not required if the socket location is based on the 2m rule)
- IEC appliance type C13


CL.2.6 (a) – (RCDs) Readily accessible and no more than 2m above the floor.



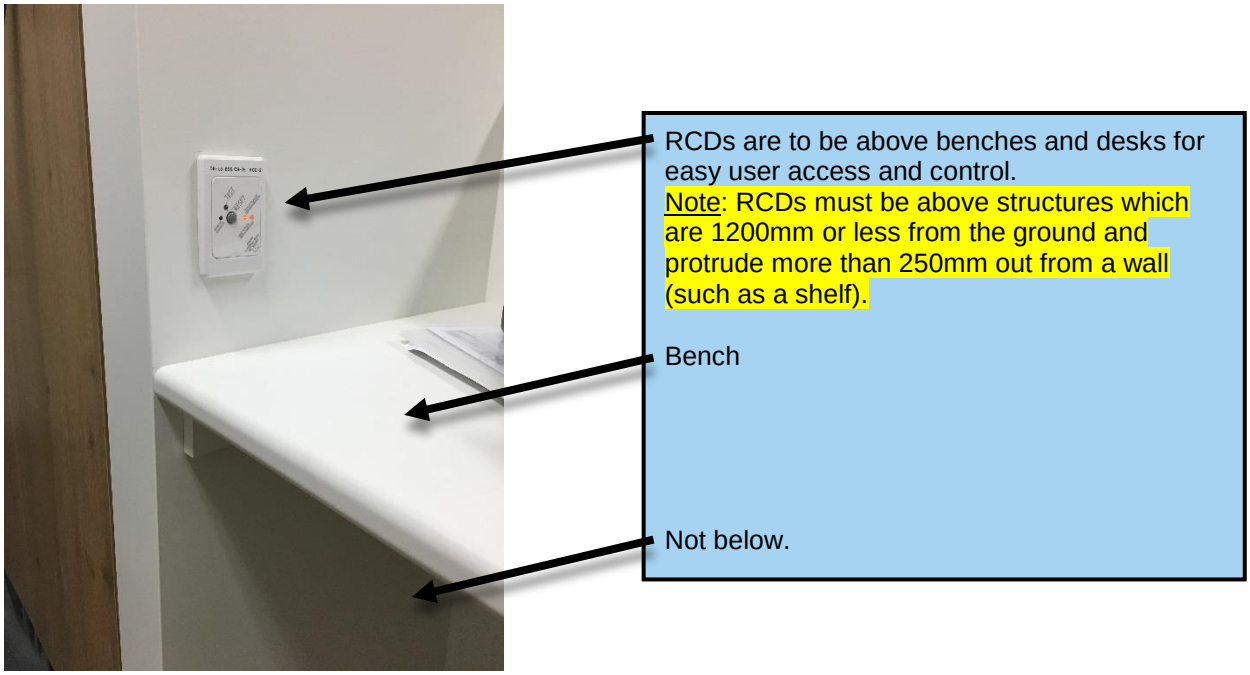
CL.2.6 (b) – (RCDs) Be located in accordance with Table 2.1:

Location of protected socket or equipment	***Location of RCD***
Within patient area	Within patient area
Accessible outside a patient area	Located within the area of the socket-outlet
Inaccessible outside a patient area, RCD protected (if controlling medical electrical equipment used within the patient area)	Within patient area

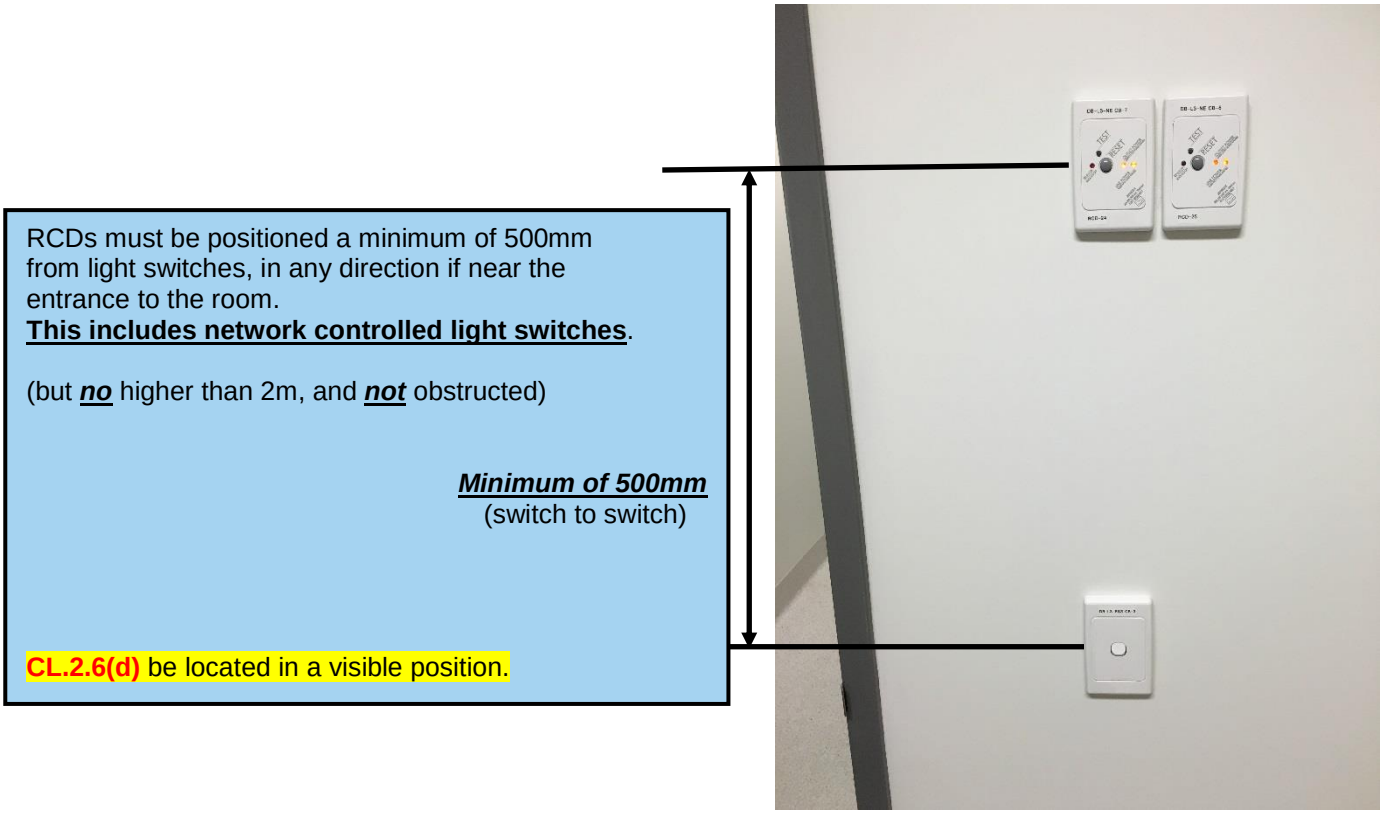
- ***RCDs (cont.)***

CL.2.6(c) – (RCDs) ***Not*** mounted under benches and,

RCDs ***must be above*** structures which are 1200mm or less from the ground and protrude more than 250mm out from a wall (such as a shelf).



CL.2.6(g) – (RCDs) Located 500mm from any wall mounted light switch, if near the entrance to the room.



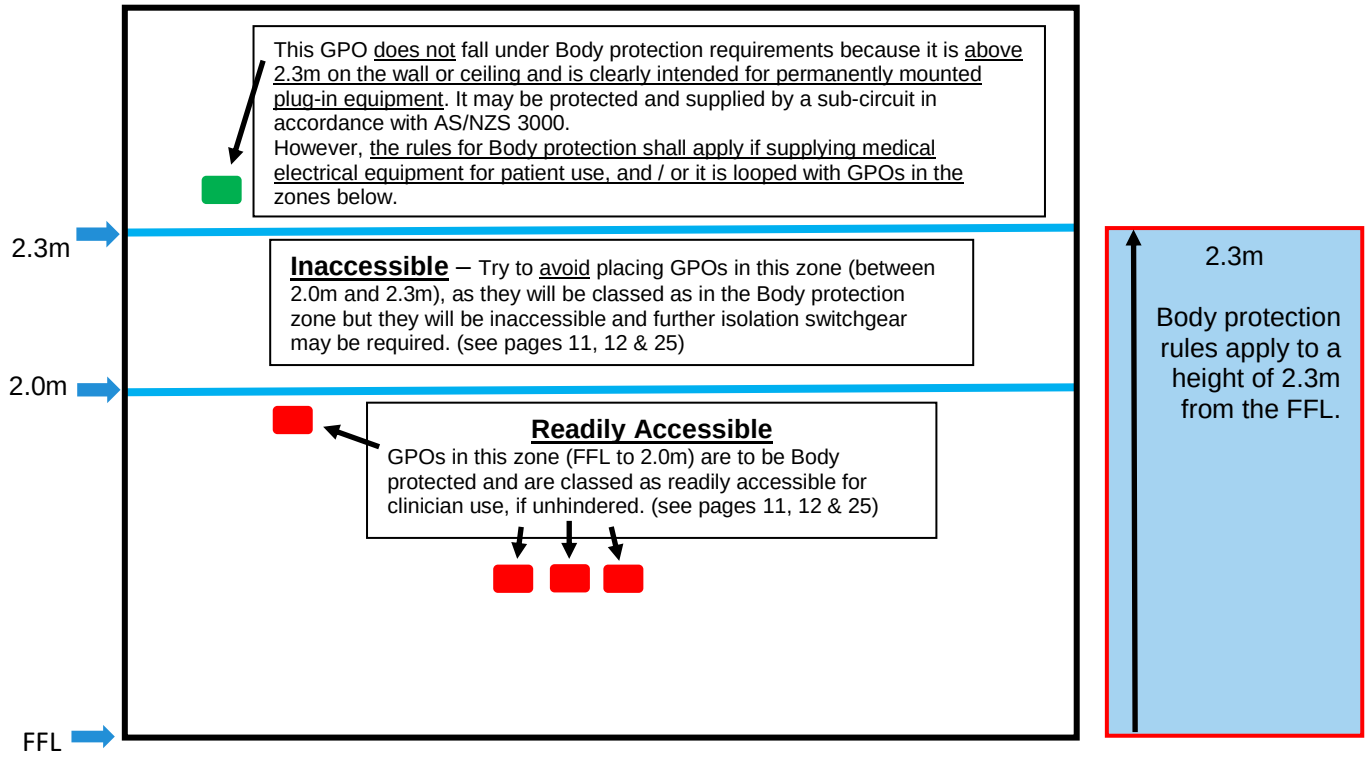
CL.2.6 exception – (RCDs) Cleaners RCDs are excluded from the above requirements.

- ***RCDs (cont.)***

CL.2.4.3.2.2 exception– (RCDs) ***Not*** required for GPOs mounted on a medical electrical system, for powering that system.

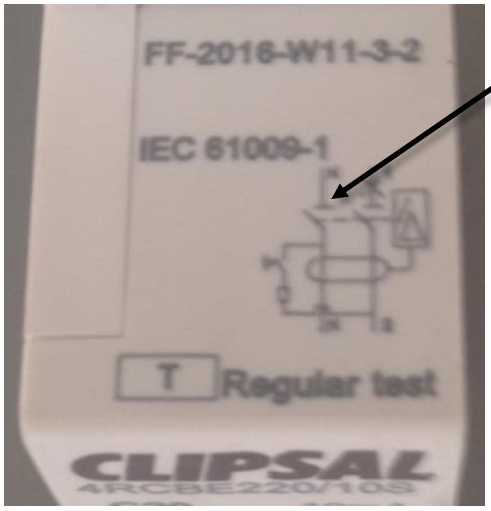
CL.2.4.3.2.2 exception– (RCDs) ***Not*** required for GPOs above 2.3m and clearly intended for permanently mounted plug-in equipment other than medical electrical equipment. (Do not use the patient circuits in this case)

Body protected patient area typical wall elevation



(GPOs shown coloured red and green)

CL.2.8.1 – RCDs must be ***double pole*** (single pole switchboard busbar chassis RCDs do not comply). All active and neutral conductors are 'live' conductors (see note 1 of clause).



*RCDs must isolate the **neutral** conductor as well as the active conductor.*

CL.2.8.1 – Each RCD shall be a Type 1 RCD, rated 10mA & max. trip time of 40ms.
Complying with:
AS/NZS 3190
AS/NZS 61008.1
AS/NZS 61009.1

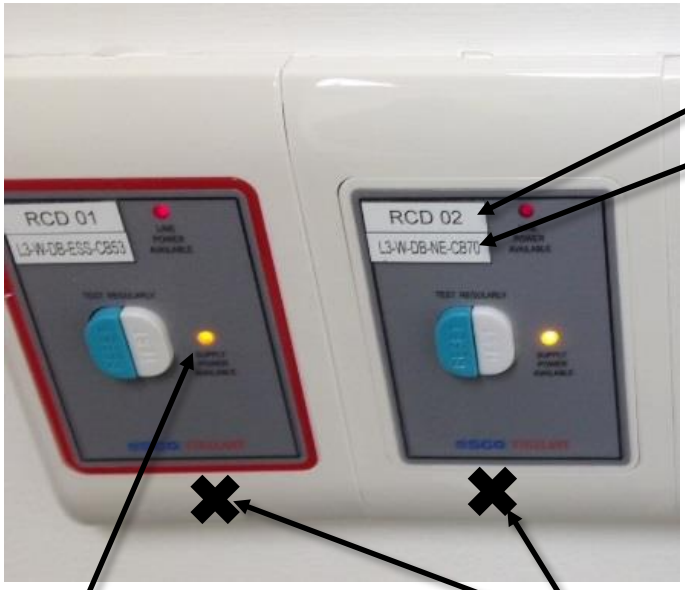
CL.2.8.3(a) – (RCDs) Supply no more than 12 points (GPOs and hard-wired equipment).

CL.2.8.3(b) – (RCDs) Shall not supply points in different rooms (circuits must be dedicated to the room, see drawing page 7).

- ***RCDs (cont.)***

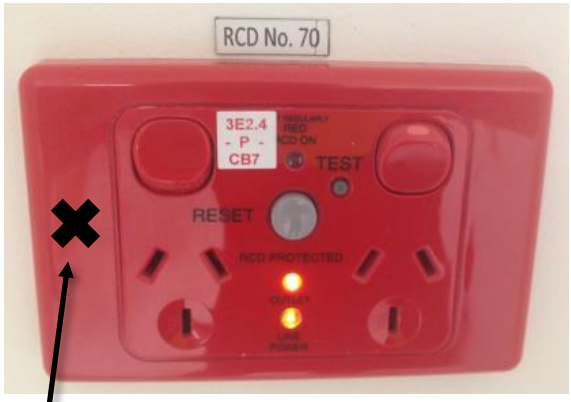
CL.2.8.4 – (RCDs) If the RCD is remote from the GPOs it controls, it shall be fitted with an amber, yellow or orange indicator light to show when ***supply is available to the socket outlets*.**

CL.2.8.5 – (RCDs) Labelled with ***SW/BD*** and ***MCB*** reference (letter height, minimum 1.5mm high), and RCD number i.e. ***'RCD 1***' etc. (letter height, minimum 2.0mm high).
Note: The RCD reference / number shall be unique within the patient area.



RCD number label

SW/BD MCB label



Amber indicator light to show supply available to GPOs.

***CL.2.12.1**- Labelling **shall not be fixed to removable surrounds** of RCDs or socket-outlets unless duplicate identification is permanently affixed to the body of the RCD or socket-outlet and visible when the surround is removed.*
The label maybe adjacent, e.g. on the wall.

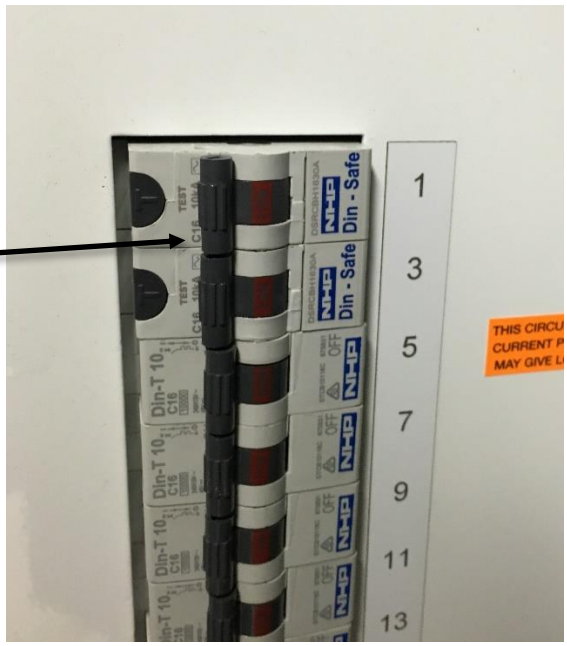
CL.2.8.2 – (RCDs) 10mA RCDs ***shall not be backed up*** by 30mA RCDs.

Ensure 30mA RCDs do not back up RCDs used in areas classified as Body protected electrical areas.

Ensure your switchboard builder (if applicable) does not load the busbar chassis with 30mA RCDs for classified areas under this standard.

A 30mA RCD upstream of a 10mA RCD will not provide adequate discrimination.

Therefore, a 30mA RCD cannot be used in the switchboard in lieu of mechanical protection.
– refer section 3.9 of AS/NZS 3000, clause 3.9.4.3.2 and 3.9.4.4.



- ***Testing and Verification***

CL.2.13 – (Testing and verification) Prior to placing an electrical installation into service, it shall be inspected, tested and verified, that the installation is safe to energize and complies with the requirements of AS/NZS 3000 and AS/NZS 3003.

Verification is defined as being the confirmation, corroboration, proof, substantiation, authentication and certification of an electrical installation following construction, alteration, addition or repair.

The electrical installation shall be –

- ✓ Inspected as far as is practicable; and
- ✓ Tested and verified in accordance with Appendix B (Commissioning Inspection Checklist) of AS/NZS 3003

Normally carried out by an independent body with defined experience and certified, compliant and calibrated electrical testing equipment and regime.

Contact:

Electrical Testing Company Pty Ltd

Unit 15, 10 Victoria Ave

Castle Hill NSW 2154

T: 02 8850 1380

F: 02 8850 1384

E: david@electricaltestingcompany.com.au

NATA

WORLD RECOGNISED ACCREDITATION

; and

- ✓ Tested in accordance with AS/NZS 3000.

Verification documentation:

The electrical installation worker / contractor will provide a written statement of compliance.

See next page for statement template.

This form needs to be completed and handed to the person responsible for final verification prior to inspection and electrical testing against the requirements of AS/NZS 3003.

Statement of Conformity with AS/NZS 3003:2018

☐ **Cardiac-protected electrical area**

☐ **Body-protected electrical area**

☐ **Repair to electrical installation**

☐ **New patient area**

☐ **Alteration or addition to electrical installation**

Institution: ……..

Address: ……

Location: ……..

Description of electrical work: ……

……..

Date completed: …… **Date of statement: ……..**

I, the licensed electrical installation worker, who carried out the work described above, states that:

• **The work has passed all the required tests and conforms in all respects with the current edition of AS/NZS 3000.**	**O Yes**	**O No**	**O N/A**
• **The work has followed a formal specification prepared by or on behalf of the health care institution or practice.**	**O Yes**	**O No**	**O N/A**
• **I/We have discussed the number of socket-outlets required with the medical or nursing personnel who will be responsible for work in each area and verified the likely loading on each circuit.**	**O Yes**	**O No**	**O N/A**
• **I/We have verified that the isolation transformer, line isolation monitor and overload monitor comply with AS/NZS 4510.**	**O Yes**	**O No**	**O N/A**
• **I/We are in possession of manufacturers' statement(s) of compliance or have otherwise verified that each ELV supply conforms with a suitable standard ensuring double insulation from LV supplies.**	**O Yes**	**O No**	**O N/A**

Name: ……..

Company: ……..

Address: ……..

……

Signed: …….. **Electrical licence number: ……..**

- ***Definitions***

CL.1.5.2 – Applied part.

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

- **Type B**  (non-isolated, equipment has a protective earth terminal)

- **Type BF**  (floating, equipment is separated from earth)

- **Type CF**  (floating, equipment is separated from earth)

CL.1.5.16 - Medical electrical equipment (ME equipment)

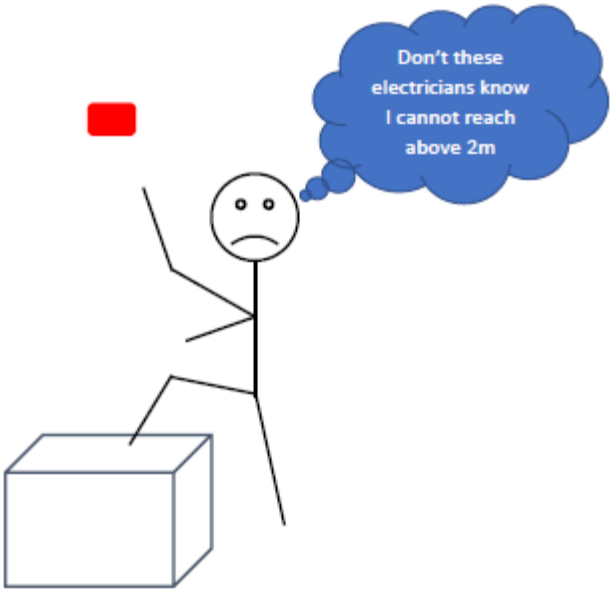
Electrical equipment having an 'applied part' for transferring energy to or from the patient or detecting such energy transfer to or from the patient and which is –

a) Provided with not more than one connection to a particular supply mains, and
b) Is intended by its manufacturer to be used – in diagnosis, treatment or monitoring of a patient, or
- for compensation or alleviation of disease, injury or disability.

CL.1.5.24 - '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 2m above the ground, floor or platform***.

This electrical standard is quite specific in that the body-protected electrical areas medical electrical equipment ***must be in the control of the clinician within the area*:**

- The clinician must be able to access all the electrical controlling switchgear to enable isolation of socket-outlets and resetting of RCDs.
- The clinician is ***unable*** to reach above 2 metres.
- The clinician cannot by accident turn off RCDs when switching light circuits.
- The clinician is ***unable*** to reach below benches or desks or enter cupboards to reset RCDs.
- The clinician is ***unable*** to move bulky equipment to access GPOs and RCDs.
- The clinician may ***not*** use a ladder or chair for standing on to access GPOs.
- So therefore, RCDs must be positioned below 2 metres but above benches or desks, and at least 500mm from a light switch.
- So therefore, socket-outlets located behind bulky equipment must have an accessible ***double pole*** isolator.
- So therefore, socket-outlets behind or inhibited by flat screen monitors must have an accessible ***double pole*** isolator.
- So therefore, socket-outlets above 2 metres which are looped with other socket outlets in the area below 2 metres must have an accessible ***double pole*** isolator below 2 metres.
- A dedicated RCD for an inhibited or inaccessible socket outlet requires a readily accessible test facility (round pin earth, white GPO).



- ***Cleaners socket-outlets***

CL.2.4.1.3 – (cleaner GPO) ***Shall not be*** supplied from any final sub-circuit supplying other sockets in the area.

CL.2.7.4.3.1(d) – (cleaner GPO) Colour beige, marked 'Cleaning Purposes Only' (letter height minimum 5.0mm high)

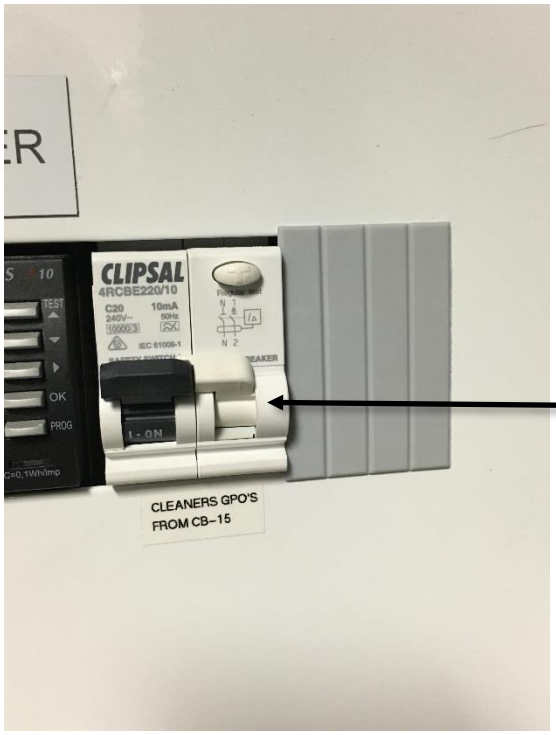
CL.2.7.3.1(a) – (cleaner GPO) Body protected electrical area – one placed within the area or within 15m of the area (see drawing page 12).

Exception – socket-outlets for cleaning equipment are not required in MRI scanning rooms.

CL.2.7.3.2 – (cleaner GPO) Shall be RCD protected, this RCD shall only protect these sockets.

CL.2.8.1 – Cleaner RCD must be 10mA and double pole. (Good practise is to install these RCDs within the switchboard area/cupboard for easy reset by hospital staff),

(note - single pole switchboard busbar chassis RCDs do not comply)



All RCDs associated with this standard shall be ***double pole***, including cleaners RCDs, which shall also be 10mA.

Ensure your switchboard builder (if applicable) supplies you with double pole RCDs.

- ***Marking / Labelling***

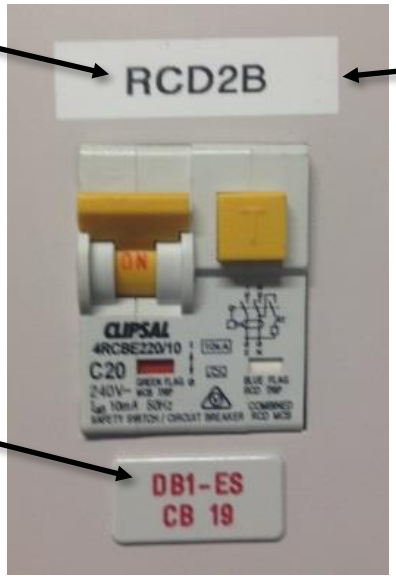
CL.2.12.1(ii) – (labels) DB/CB identification labels for RCDs shall be not less than 1.5mm for the lettering height.

CL.2.12.1(iii) – (labels) RCD identification for RCDs shall be not less than 2.0mm for the lettering height.

CL.2.12.1(A) – (labels) Portable adhesive tape labels (Brother type) shall include a ***clear top laminate overlay*** in order to protect the printed lettering (tape labels without the laminate overlay are not acceptable).

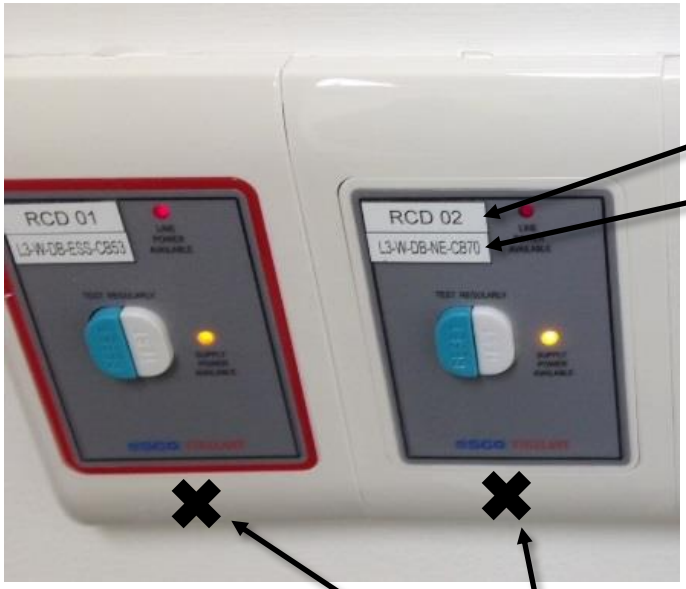
RCD ID minimum 2mm letter height

DB/CB ID minimum 1.5mm letter height



*Tape labels must have a **clear top laminate overlay.***

*Socket-outlets to be labelled with their controlling RCD: **'From RCD X'***



RCD number label

SW/BD MCB label

***CL.2.12.1** - Labelling **shall not be fixed to removable surrounds** of RCDs or socket-outlets unless duplicate identification is permanently affixed to the body of the RCD or socket-outlet and visible when the surround is removed.*
The label maybe adjacent, e.g. on the wall.

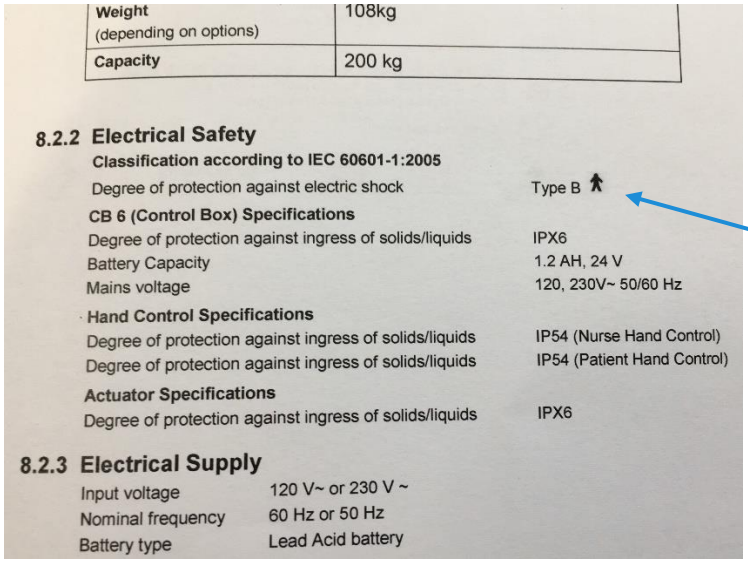
- ***Permanently-wired medical electrical equipment requiring LPD protection***

CL.2.4.3.3 – 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 enter patients

- shall be RCD protected (10mA double pole).

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



Weight (depending on options)	108kg
Capacity	200 kg

8.2.2 Electrical Safety

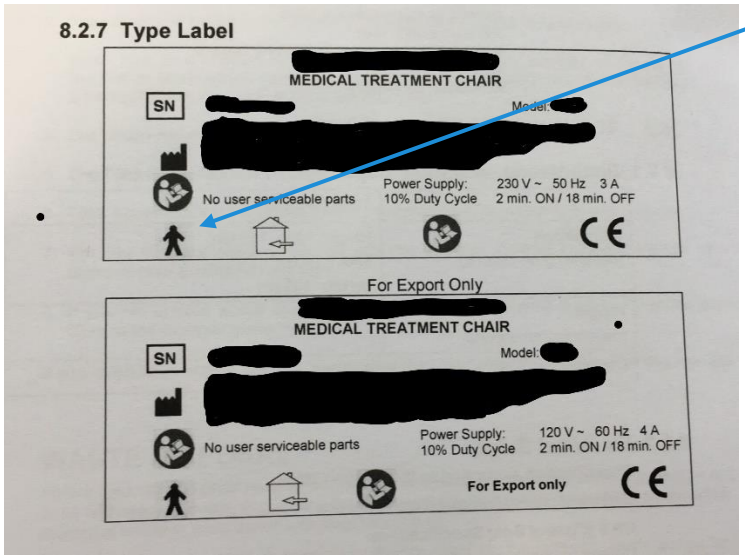
Classification according to IEC 60601-1:2005

Degree of protection against electric shock	Type B
CB 6 (Control Box) Specifications	
Degree of protection against ingress of solids/liquids	IPX6
Battery Capacity	1.2 AH, 24 V
Mains voltage	120, 230V~ 50/60 Hz
Hand Control Specifications	
Degree of protection against ingress of solids/liquids	IP54 (Nurse Hand Control)
Degree of protection against ingress of solids/liquids	IP54 (Patient Hand Control)
Actuator Specifications	
Degree of protection against ingress of solids/liquids	IPX6

8.2.3 Electrical Supply

Input voltage	120 V~ or 230 V ~
Nominal frequency	60 Hz or 50 Hz
Battery type	Lead Acid battery

Typical medical electrical equipment specification page, indicating the equipment is classified as *Type B – degree of protection against electrical shock.*



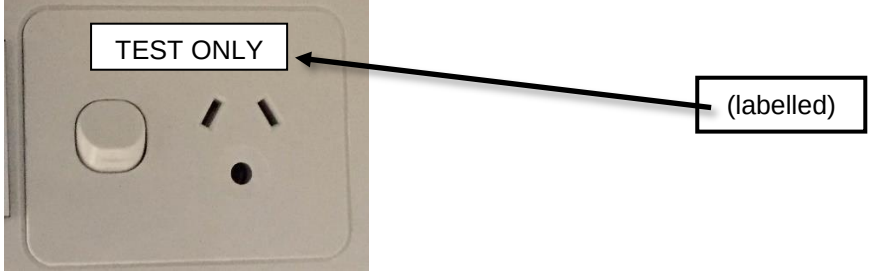
8.2.7 Type Label

MEDICAL TREATMENT CHAIR
SN [redacted] Model: [redacted]
No user serviceable parts
Power Supply: 230 V ~ 50 Hz 3 A
10% Duty Cycle 2 min. ON / 18 min. OFF

For Export Only
MEDICAL TREATMENT CHAIR
SN [redacted] Model: [redacted]
No user serviceable parts
Power Supply: 120 V ~ 60 Hz 4 A
10% Duty Cycle 2 min. ON / 18 min. OFF
For Export only

The corresponding rating plate with the 'Type B' symbol.

CL.2.8.6 - If a dedicated RCD is connected to permanently wired equipment, ***a white round earth pin GPO shall be provided in an accessible position to enable testing of the RCD, and labelled 'Test Only'.***
The RCD shall be labelled to identify the equipment it controls.



(**information**)

The patient electrical area classifications of ASNZS 3003 (Electrical installations – Patient areas) is based on the application of medical electrical equipment as defined in ASNZS 3200 (Medical electrical equipment) and referenced in ASNZS 2500 (Guide to the safe use of electricity in patient care).

ASNZS 3200 defines medical electrical equipment with conductive 'applied parts' i.e. electrical connections to the patient, into the following classes:

- **Type B**  (non-isolated, equipment has a protective earth terminal)
- **Type BF**  (floating, equipment is separated from earth)
- **Type CF**  (floating, equipment is separated from earth)

ASNZS 3003 defines patient areas as locations where it is intended that low-voltage medical electrical equipment will be used in contact with patients while connected to the electrical supply mains.

ASNZS 3003 states that all patient areas shall be:

- Body-protected electrical areas

or

- Cardiac-protected electrical areas

Note: Standards may change, including the adoption of the IEC equivalent

(**information**)

There is a direct correlation between the patient area electrical classification (ASNZS 3003) and the type of medical procedure (ASNZS 2500) when using medical electrical equipment applied parts (ASNZS 3200) in contact with patients, categorized as follows:

AS/NZS 3200 Medical Equipment – Applied Part	***AS/NZS 2500 Medical Procedure Type***	***AS/NZS 3003 Patient Electrical Area***
Type B	Body	Body-protected
Type BF	Body	Body-protected
Type CF	Cardiac	Cardiac-protected

Body-type medical procedures as defined by ASNZS 2500:

- (summation) Applied parts not involving the heart, a patient is considered to be undergoing a body-type procedure when connected to a piece of medical electrical equipment in such a manner that the impedance of the skin is either reduced by electrode paste or gel, or by-passed by the entrance of conducting fluids, metal needles, saline-filled catheters and similar, through natural or artificial openings in the patient's body, but where direct contact with the heart is not possible.

Cardiac-type medical procedure as defined by ASNZS 2500:

- (summation) Applied parts involving the heart, a patient is considered to be undergoing a cardiac-type procedure when an in dwelling electrical conductor is accessible outside the patient's body and there is risk of microshock. In this context, an electrical conductor includes electrical wires, such as cardiac-pacing electrodes and intracardiac ECG electrodes, intracardiac catheters, or intracardiac insulated tubes filled with conducting fluids.

ASNZS 2500 defines the following protection levels against electric shock for electrical wiring in patient areas:

- (summation) Body-protected electrical area: where parts of medical electrical equipment are fastened to parts of a patient other than the heart, the use of a RCD or an isolation transformer with LIM monitor will ensure, that if any contact is made between a live conductor and earth (either directly or as a function of leakage currents), 'macroshock electrocution' is very unlikely.

- (summation) Cardiac-protected electrical area: where the procedure involves direct connection to the heart, RCD or isolation transformer protection, similar to that required for a body-protected electrical area, is supplemented with special earthing facilities to also provide protection against 'microshock electrocution'. Such a system not only protects against any fault or leakage currents posing a macroshock hazard, but also reduces the potential difference appearing between any conducting surfaces in the vicinity of the patient (electrically-operated equipment, plumbing, structural metal and similar) to a level well below that which would produce microshock electrocution.

(**information**)

This document has been produced to clear some confusion with respect to whether certain ceiling mounted electrical-operated equipment in Body and Cardiac protected electrical areas are required to have accessible 10mA RCD protection located in the protected electrical area, specifically supplies for electrical-operated equipment such as examination lights and monitor arms.
This type of equipment typically does not have conductive 'applied parts' electrical connections to the patient, so therefore it is not included in the definition for medical electrical equipment as described above under standards ASNZS3200, ASNZS 2500 and ASNZS 3003.

The supply power LV is normally located in the ceiling space and may be a power socket.

This power socket may be protected by an RCD located at the switchboard and be rated at 30mA.

The supply power is typically transformed from LV to ELV before entering the patient area.

This condition would be suitable for a body-protected electrical area without further protection.

However, if the equipment is to be located in a cardiac-protected electrical area the addition of supplementary bonding is required.

Such earthing is achieved by connecting the protective earth terminal to the EP junction (if protectively earthed equipment).

For non-protectively earthed parts, such earthing is achieved by connecting the mounting point of the equipment or the point in which it contacts structural metal to the EP junction.

The equipotential bonding (cardiac area) of the equipment would be tested and certified as part of the ASNZS 3003 commissioning process.

On the flip-side, contractors need to be aware of the type of electrical equipment, especially fixed electrical equipment they are terminating in body and cardiac protected electrical areas.

If the fixed electrical equipment is classified as medical electrical equipment with applied parts **Type B**  , all aspects of ASNZS 3003 are applicable, clause 2.4.3.3 specifically, and 10mA RCD protection is required including an RCD test point being a round earth pin white GPO.

ASNZS 3003 does not mention the same requirements for fixed medical electrical equipment with applied parts **Type BF**  **and Type CF**  .

Type BF  **and Type CF**  fixed medical electrical equipment would also fall under the installation requirements of ASNZS 3000, but supplementary bonding (ASNZS 3003) may be applicable in cardiac areas if the equipment contacts structural metal.

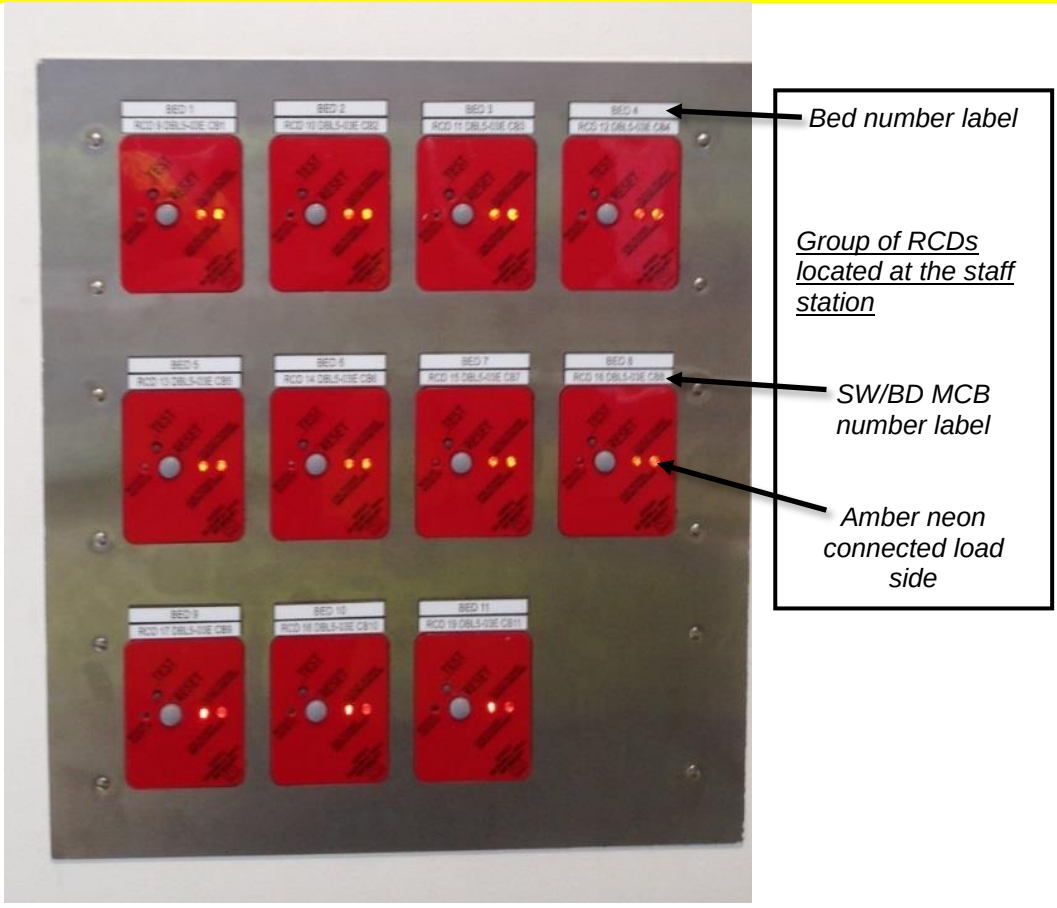
If the fixed electrical equipment is not medical electrical equipment with applied parts **Type B**  , ASNZS 3000 requirements are applicable, unless in a cardiac-protected electrical area then supplementary bonding (ASNZS 3003) may be required.

CL. 2.10 – where permanently wired electrical equipment is supplied from an RCD that also supplies socket-outlets or other equipment, the electrical equipment shall be provided with a separate, individual, readily accessible double pole isolation switch.
Not readily accessible GPOs shall be treated in the same manner.

- ***Installations for self - harm patients (intentional or unintentional)***

CL.5.4.1 – (self-harm) Areas intended for the care of patients who are susceptible to self-harm shall be wired as body-protected electrical areas, except for the following:

CL.5.4.1(a) – (self-harm) RCDs ***shall*** be located in an area readily accessible only to staff, e.g. at the staff station.



CL.5.4.1(b) – (self-harm) Socket-outlet power available neons need not be provided.

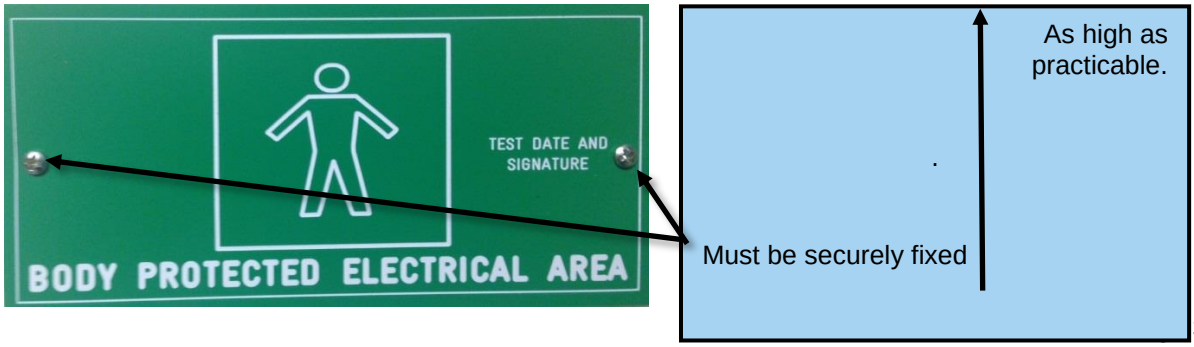
CL.5.4.1(c) – (self-harm) The RCD shall be fitted with an amber light indicator, fed from the load side of the RCD.

CL.5.4.1(d) – (self-harm) The colour requirements of socket-outlets need not apply.

CL.5.4.2 – (self-harm) RCDs located outside the patient area shall be labelled with the bed number.

CL.5.4.2 – (self-harm) Area signs should be located immediately ***outside*** the entrance to the patient area, external to the room.

CL.5.4.2 – (self-harm) Area signs shall be ***securely fixed*** as high as practicable.



- ***Alterations, additions and repairs*** (shall comply with Section 6 of the standard)

CL. 6.2.1 – (alterations and additions) Every alteration of, or addition to, the electrical installation in an existing patient area shall comply with the relevant provisions of AS/NZS 3003: 2018.
This requirement applies to all alterations and additions, ranging from the install of new socket-outlets to the installation or replacement of fixed electrical equipment such as dental chairs and CT scanners.

CL. 6.2.2 – (alterations and additions) Patient areas that are ***not already signposted as body-protected or cardiac protected electrical areas*** shall be upgraded to comply with AS/NZS 3003: 2018, prior to or during the alteration or addition to the electrical installation, or to permanently wired equipment.
Separate circuits to patient areas need not apply to alterations to areas not wired as body-protected electrical areas.
Old signs indicating CLASS A or CLASS B areas are not body or cardiac protected areas.

CL. 6.2.3 – (alterations and additions) Alterations or additions to electrical installations in patient areas shall not proceed unless the patient area has been subjected to routine testing within the previous 12 months.
The green area sign shall have a current in-date sticker attached, if not the area needs to be retested prior to the works.

CL. 6.2.4 – (alterations and additions) If the installation of additional socket-outlets in a patient area increases the overall number by more than 10%, all socket outlets shall comply with the colour coding requirements of AS/NZS 3003: 2018, clause 2.7.4.3.

a) White – normal supply
b) Red – essential supply
c) Blue – UPS

CL. 6.2.5.1 – (alterations and additions) ***IN CARDIAC Protected electrical areas*** the following requirements shall be applied prior to the alteration:

1. Where the EP junction cannot be identified, or is inaccessible for new connections, the entire EP earthing system shall be upgraded to comply with AS/NZS 3003: 2018.

2. Where the EP junction or EP test point is not marked ‘EP TEST POINT’ an EP test facility shall be installed to comply with clause 4.4.2.9.

3. If the EP test point is remote from the EP junction the linking cable shall be sized to ensure the resistance measurements comply with the standard.

4. New EP earthing connections shall comply with this standard when installing new electrical accessories, fixed equipment rated below 2.0kW, and non-electrical structural metal connected fittings.

CL.6.2.5.2 – Where fixed electrical equipment rated at or above 2.0kW is to be installed in a body-protected or cardiac-protected electrical area, the entire patient area shall comply with AS/NZS 3003: 2018 prior to or during alteration or addition to the electrical installation.

CL.6.2.5.3 – If cardiac-protected areas are to be reclassified as body-protected areas, they shall comply with sections 2 and 3.
Have all EP studs or receptacles removed and be tested and verified.

CL. 6.3.1 – (repairs) Patient areas that ***are not*** wired as cardiac or body-protected electrical areas should be upgraded to comply with AS/NZS 3003, prior to or immediately after repairs of RCDs and socket outlets or permanently wired electrical equipment. (The requirement for separate circuits need not apply to repairs CL.2.4.1)

Alterations, additions and repairs (cont.)

CL. 6.3.2 – (repairs) Patient areas wired as cardiac or body-protected shall have a current test sticker attached to the area sign before repairs proceed.

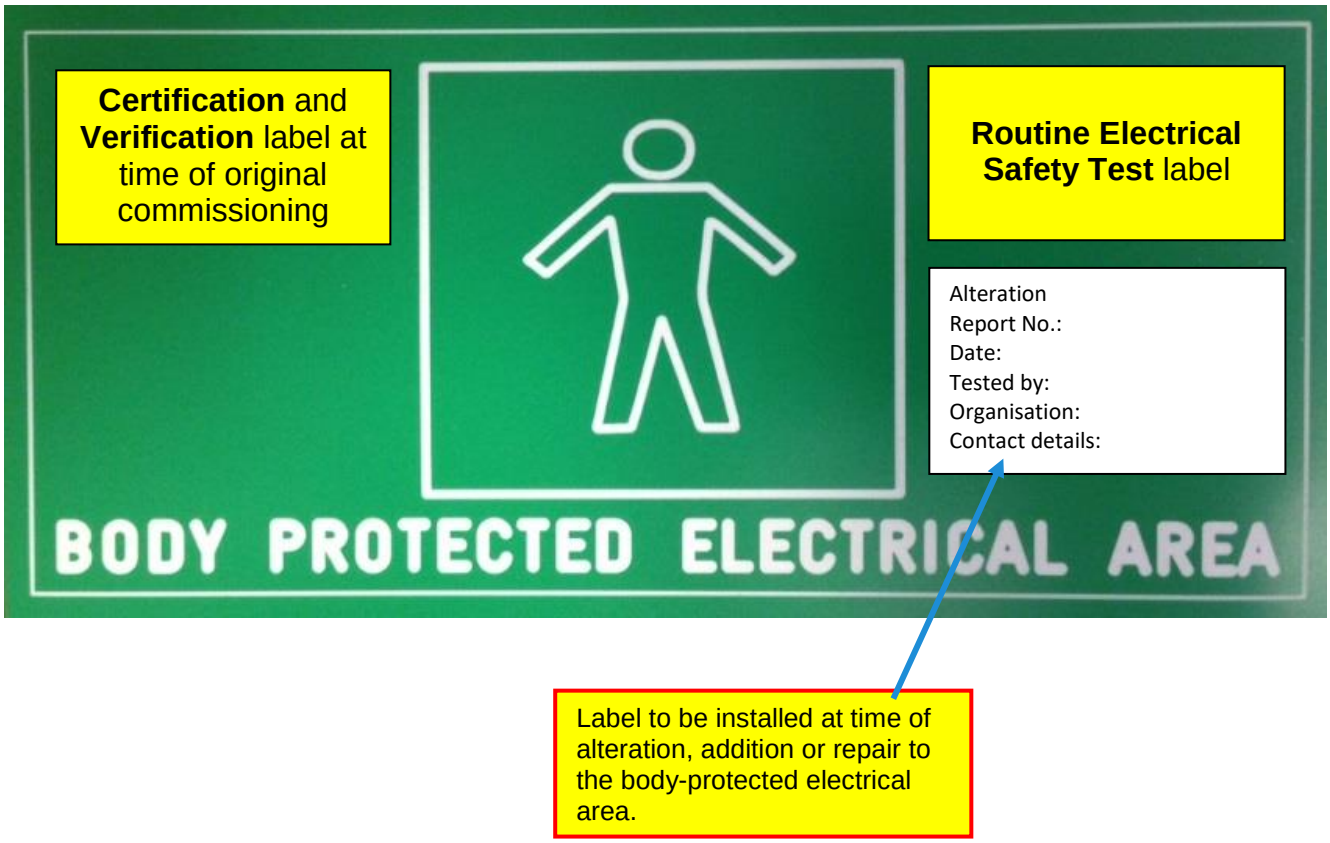
If the methods satisfy the fundamental safety principles of Part 1 AS/NZS 3000 the following work may be carried out to electrical installations with the original install method:

- Repairs to or replacement of accessories (as defined in AS/NZS 3000) forming part of the existing electrical installation or replacement of such accessories with equivalent fittings.
- Replacement of component parts of fixed equipment with equivalent components.

Replacement of a complete item of fixed electrical equipment in a patient area constitutes an alteration to the electrical installation and shall comply with clause 6.2.

The replaced item shall be tested against the applicable compliance requirements of this standard.

CL.6.4 – Where alterations occur, a label shall be added below the routine test label stating that alterations have occurred and indicating the report number, date, name of test person, organization responsible and contact details. The label shall not cover any existing labels and shall be removed at the time of the next routine inspection.



AS/NZS 3003:2018

Cardiac Protected Electrical Areas (shall comply with Section 2 and Section 4 of the standard)

The following is a guide for electricians involved with electrical installations for patient areas in hospitals and medical facilities which are deemed to comply with AS/NZS 3003:2018 Cardiac Protected Electrical Areas.

This guide in no way replaces the need to consult and understand the relevant standard and it is not endorsed or approved by any authority.

This document has been produced by persons with relevant industry experience who have seen a need to give some basic advice and direction for electricians prior to them undertaking electrical installations in patient areas.

This documents only high lights the areas of common mistakes or misinterpretation and provides an easy reference by category and relevant clause identification, it in no way replaces the need to consult and understand the whole standard.

The relevant clause is listed first in the topic sentence, and the statements or sentences here are not necessarily a direct representation of the clause.

Subject

- Final sub-circuits, (page 36)
- Socket-outlets (GPOs), (page 37)
- Electrical areas, (page 42)
- Protection of wiring systems ASNZS 3000, (page 44)
- RCDs, (page 45)
- Testing and Verification, (page 49)
- Definitions, (page 51)
- Cleaners socket-outlets, (page 52)
- Marking / Labelling, (page 53)
- Permanently wired equipment, (page 54)
- Earthing / EP bonding, (page 57)
- Alterations, additions and repairs, (page 67)

AS/NZS 3003:2018

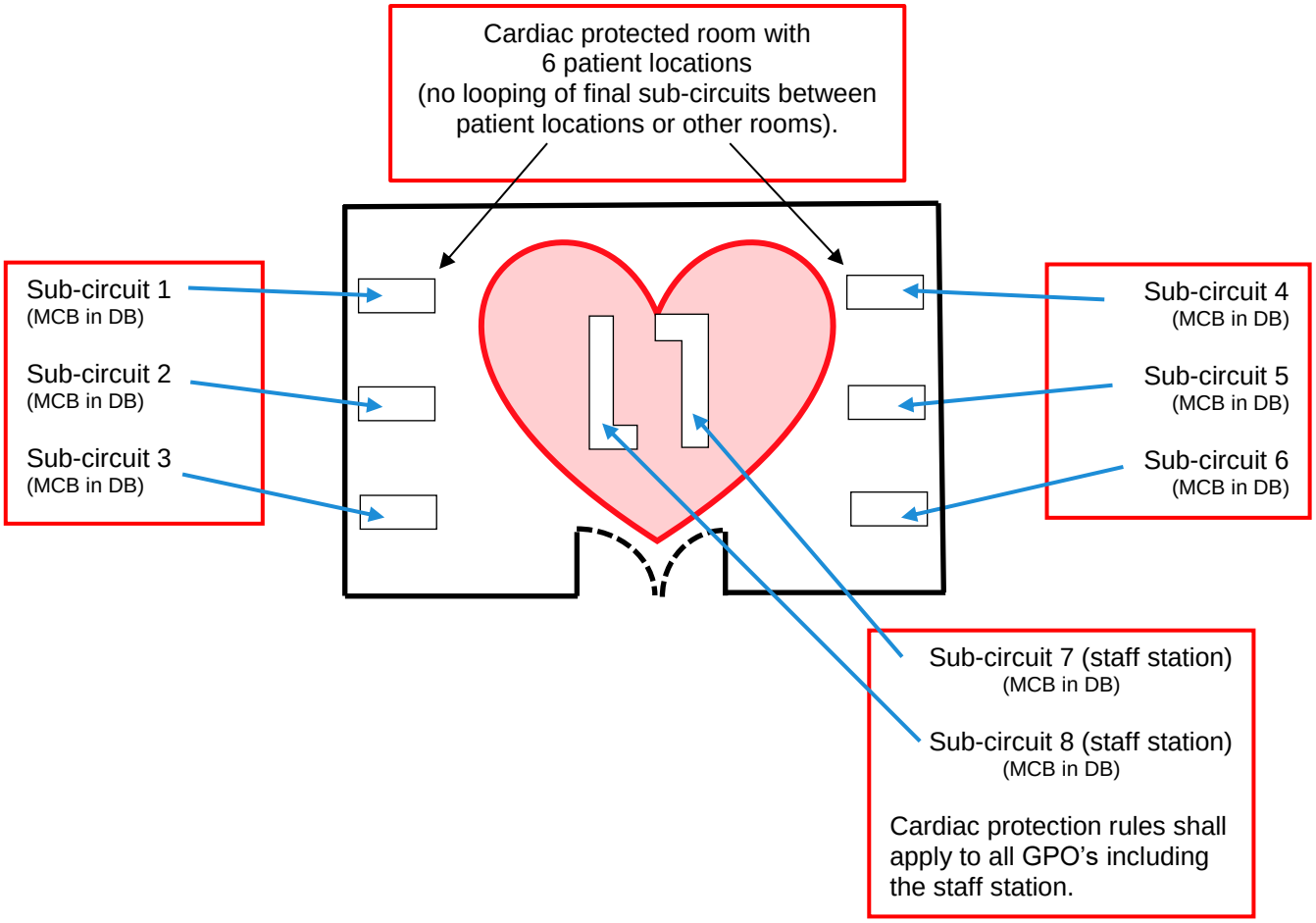
Cardiac Protected Electrical Areas

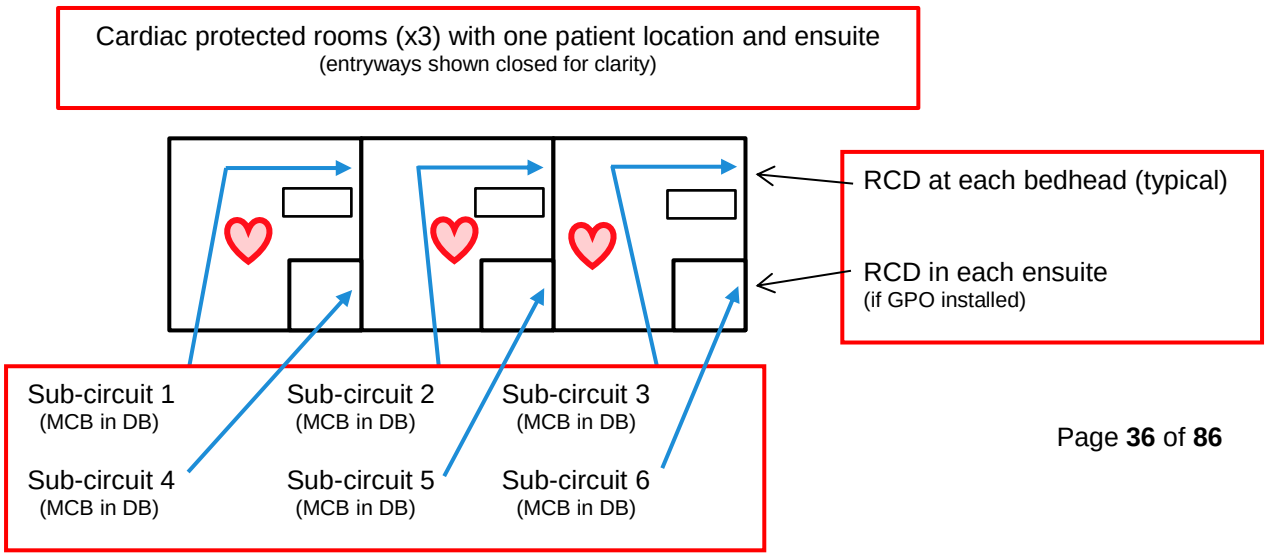
Shall comply with:

- Section 2 – General requirements for Body-protected and Cardiac-protected electrical areas.
- Section 4 – Additional requirements for Cardiac-protected electrical areas.

- ***Final sub-circuits***

CL.2.4.1.2 – (final sub-circuits cardiac) Only supply one patient location / bed, ***not*** looped from patient to patient or to another room, therefore ***the ensuite cannot share the sub-circuit***, it requires a separate sub-circuit.





- ***Socket outlets***

CL.2.4.3.2.1 – (socket outlets) RCD 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 shall not protect socket-outlets in different rooms, or socket-outlets in different patient areas or areas that are not a patient area.

- 3 pin types, (including round pin earth).

- IEC industrial type with 3 to 5 round pins rated 10 to 100A.
(RCD protection not required if the socket location is based on the 5m rule)

- IEC appliance type C13

CL.2.4.3.1.2 – ELV charging socket-outlets shall be RCD protected, including USB charging socket-outlets.

A dedicated RCD for a charging socket-outlet shall include a white round pin earth GPO to enable testing of the RCD.

A charging socket-outlet (USB or similar) placed in the same circuit as other GPOs shall be provided with a double pole switch to enable isolation.

- ***Socket outlets (cont.)***

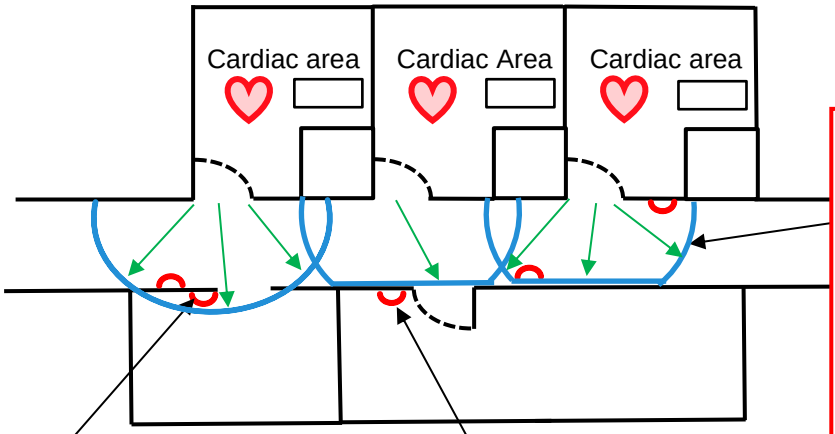
CL.2.4.3.2.2(b) – (socket-outlets) ***5m RULE*** – GPOs within 5m of the entrance to a cardiac protected area and are accessible without the use of a key or tool are to be RCD protected. (RCD shall be 10mA double pole).

The 5m rule GPOs could be located in rooms or corridors ***opening directly off*** the classified cardiac protected area.

(The process of accessing the 5m rule GPO through a ***second door*** other than a door opening directly off or associated with the classified cardiac protected area may ***exclude*** this GPO from the ruling).

The 5m rule RCD must be located with the socket-outlets they are controlling (not located in the switchboard), and the maximum of 12 socket-outlets per RCD applies.
The 5m rule socket-outlet must also be colour coded, have a PA neon and the mandatory labelling.

5m RULE –
GPOs shall be RCD protected, 10mA double pole
and bonded back to the corresponding EP junction or node.

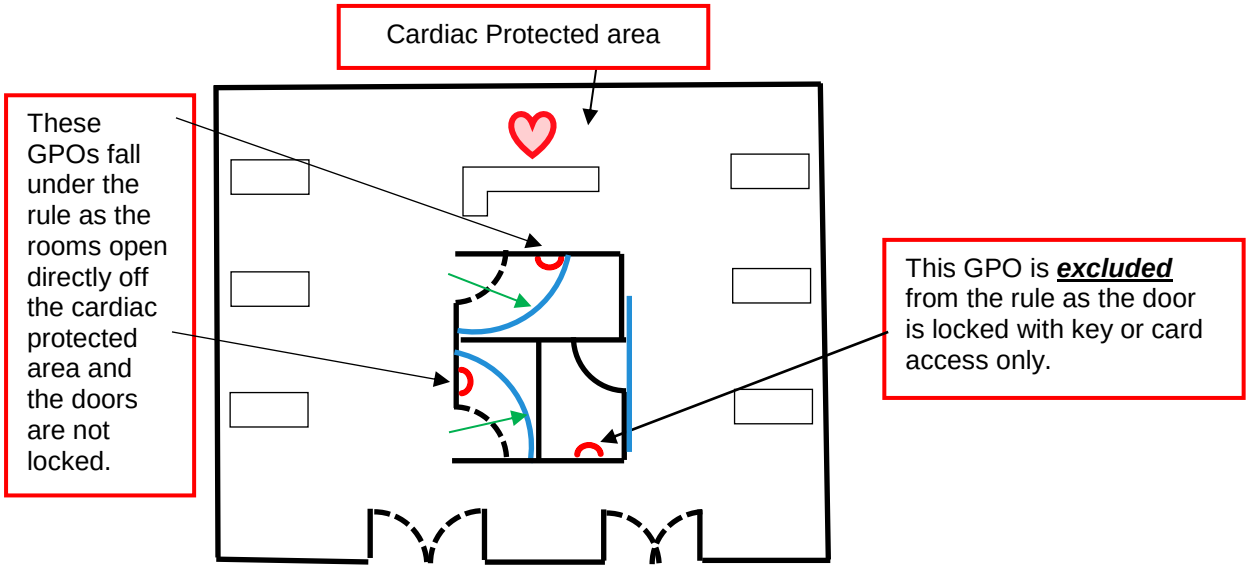


5m rule boundary.

(a taut 5m flexible lead is plugged into the suspected GPO and if the socket end passes into the entryway or doorway of the Cardiac protected area the GPO is then deemed to fall within the boundary).

This GPO falls under the rule as the opening to the room is not provided with a door.

This GPO is ***excluded*** from the rule as the room ***does not open directly off*** the Cardiac protected area (second doorway).

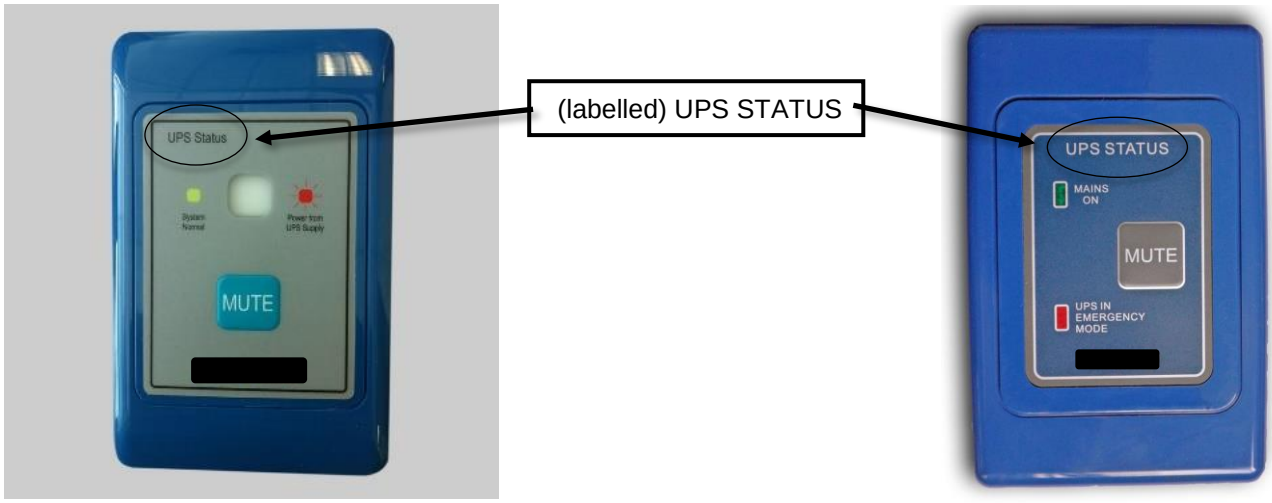


- ***Socket-outlets (cont.)***

CL.2.4.4.3 – (socket-outlets) GPOs backed up by a UPS system; require a UPS status indicator where there is continuous patient observation by medical staff, including in –

each operating theatre, staff stations in – recovery, ICU, isolation, special care etc.

The status indicator must be connected to the UPS battery system to indicate loss of mains supply to the UPS.
There ***shall not*** be a master 'muting' facility, controlling multiple status alarms.



****** (Readily Accessible) ******

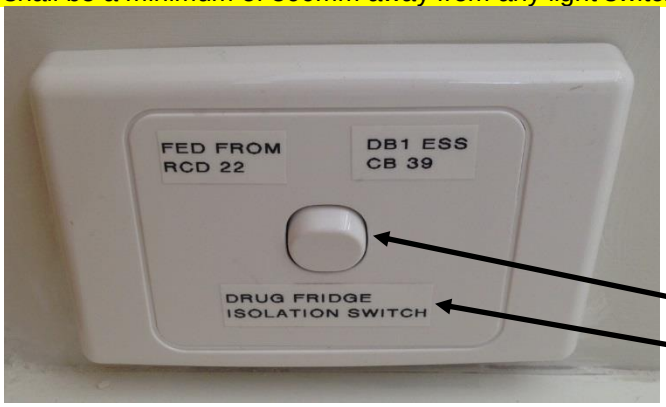
CL.2.7.2 – (socket-outlets) GPOs ***not readily accessible*** and not protected by a dedicated RCD require a separate readily accessible double pole isolation switch (height of switch no more than 2m from the ground, floor or platform).

The purpose of this is to provide easy isolation of the equipment by the staff in the area, to enable resetting of RCDs should there be an equipment fault.

GPOs must be below 2m to be classed as readily accessible and not obstructed by equipment.
If they are mounted under benches or in cupboards they are not considered readily accessible if they are obstructed by equipment.
Double pole isolators shall be independent of the equipment they are controlling, to allow for removal and service of equipment.

RCDs that are dedicated to protect an inaccessible GPO shall have a readily accessible test facility being a white round earth pin GPO in accordance with clause 2.8.7.

Do not place isolation switches for GPOs in the same switch plate as light switches. GPO isolators shall be a minimum of 500mm away from any light switch if near the entrance to the room.



CL. 2.10 – where permanently wired electrical equipment is supplied from an RCD that also supplies socket-outlets or other equipment, the electrical equipment shall be provided with a separate, individual, readily accessible double pole isolation switch. Not readily accessible GPOs shall be treated in the same manner.

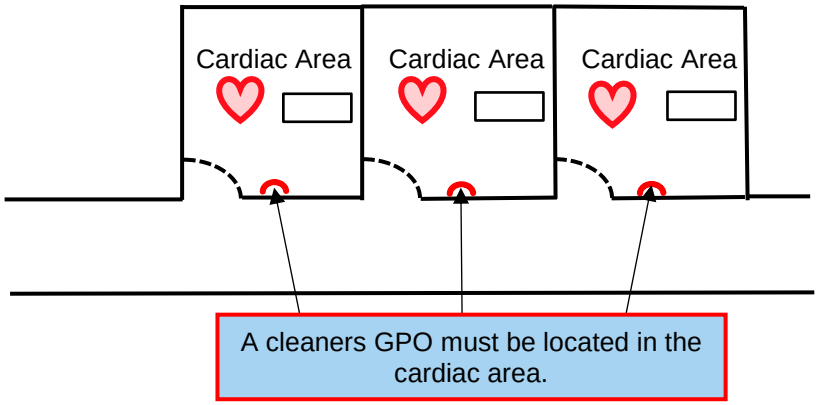
*Isolation switches must be **double** pole.*

Labelled accordingly.

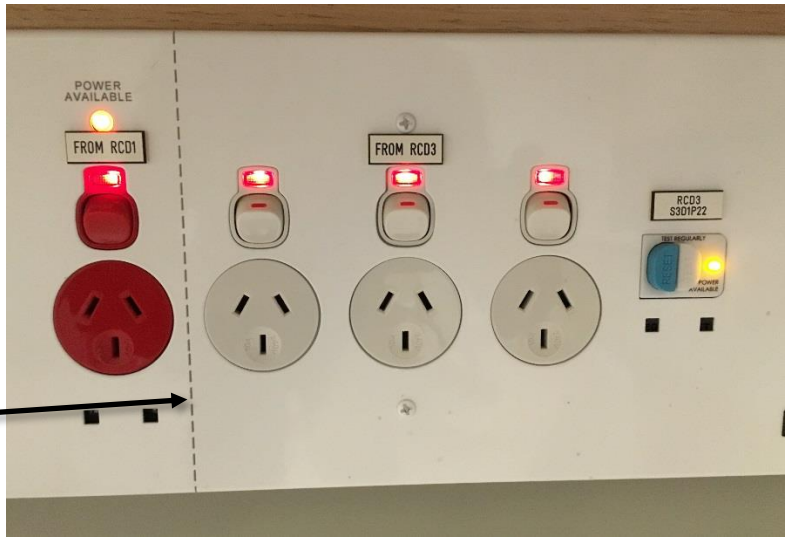
- ***Socket-outlets (cont.)***

CL.1.4.24 – (socket-outlets) Refer this clause for the definition of '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 2m above the ground, floor or platform***.

CL.2.7.3.1 – (socket-outlets cardiac) Cleaner GPO to be located ***within*** the patient area (the RCD may be located out of the patient area).

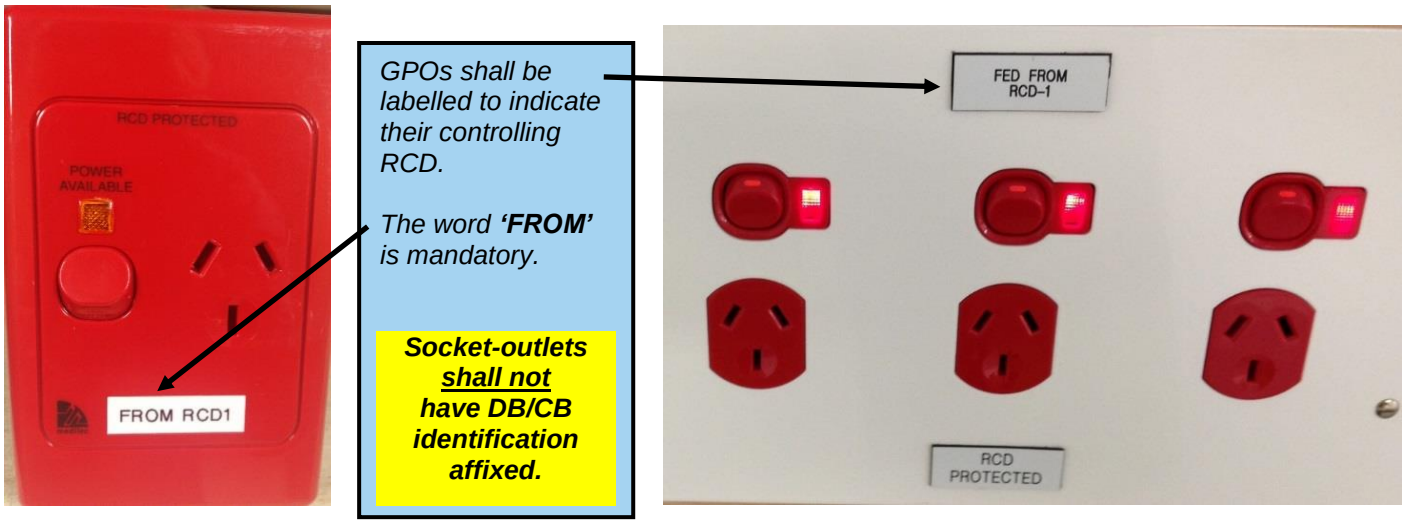


CL.1.5.12 – (socket-outlets) Groups of socket-outlets must have clear delineation (e.g. stainless steel medical panel with a combination of different GPO supplies, an engraved line between GPO services or clear separation for easy user understanding).



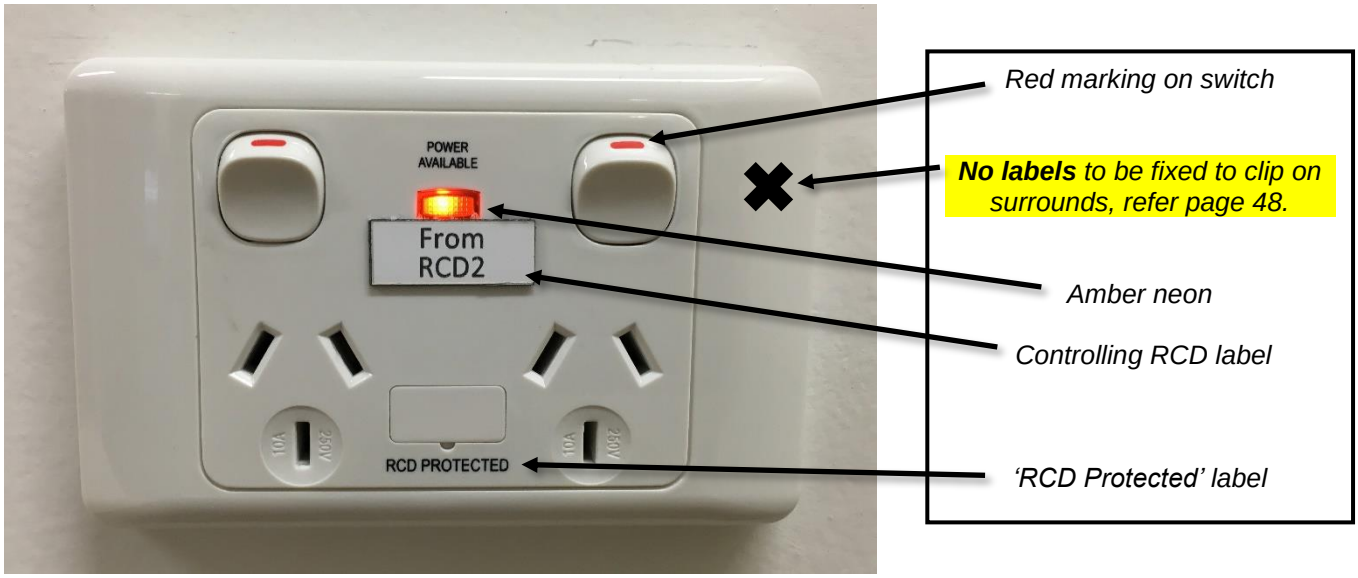
CL.2.4.3.2.2(c) – (socket-outlets) GPOs in ceiling spaces or imaging control rooms to be protected if supplying medical electrical equipment used within the patient area.
Where such socket-outlet is located in a room, this requirement applies to ***all other socket-outlets*** in that room. (RCD shall be 10mA double pole)

- ***Socket-outlets (cont.)***



CL.2.7.4.1 – (socket-outlets) socket-outlets on RCD protected supplies (including 5m rule) shall be:

- Fitted with one amber, yellow or orange indicator light to show when supply is available (CL. 2.7.4.4). (indicator light not required for ELV / USB charging-socket outlets)
- Marked 'RCD Protected'.
- Marked 'From RCD X'.
- The switch shall indicate when on, by a red marking or red indicator light (CL.2.7.4.2).
- Socket outlets ***shall not*** have DB/CB identification affixed.



CL.2.7.4.3.1 – (socket-outlets) Colour coding of socket-outlets as follows (for 10A, 15A and 20A and ELV):

- Normal supply shall be **white**
- Essential supply shall be **red**
- UPS supply shall be **dark blue**
- ELV socket plates and covers ***shall be colour coded as above*** (cl. 2.7.4.3.2)
- Cleaning Purposes Only shall be **beige**

CL.2.7.5 – (socket-outlets) Each socket-outlet shall be individually controlled by its own accessible manual switch.

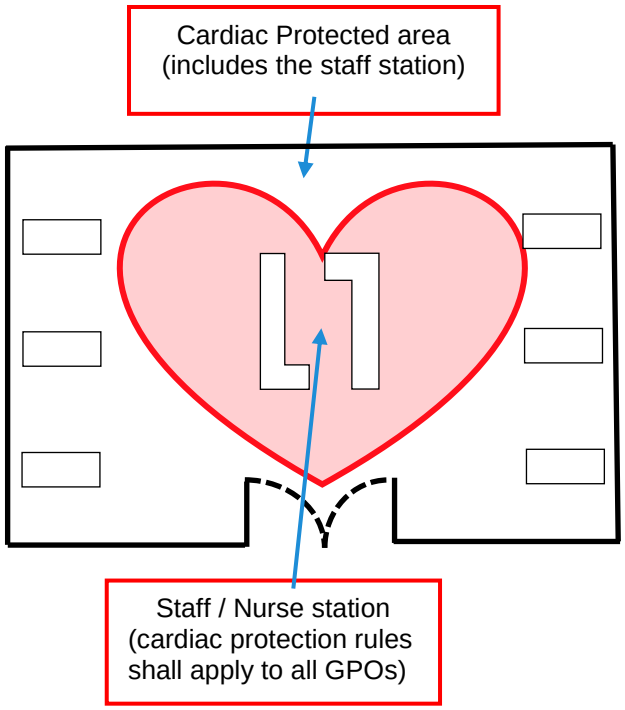
- ***Electrical Areas***

CL.2.2.2 – (electrical areas) Nurse stations and beverage bays if in the cardiac protected area form part of the area (***therefore cardiac protection rules apply***).

In general terms, ***Cardiac protected electrical areas are bound by full height walls and doors only.*** (This would normally account for the whole room)

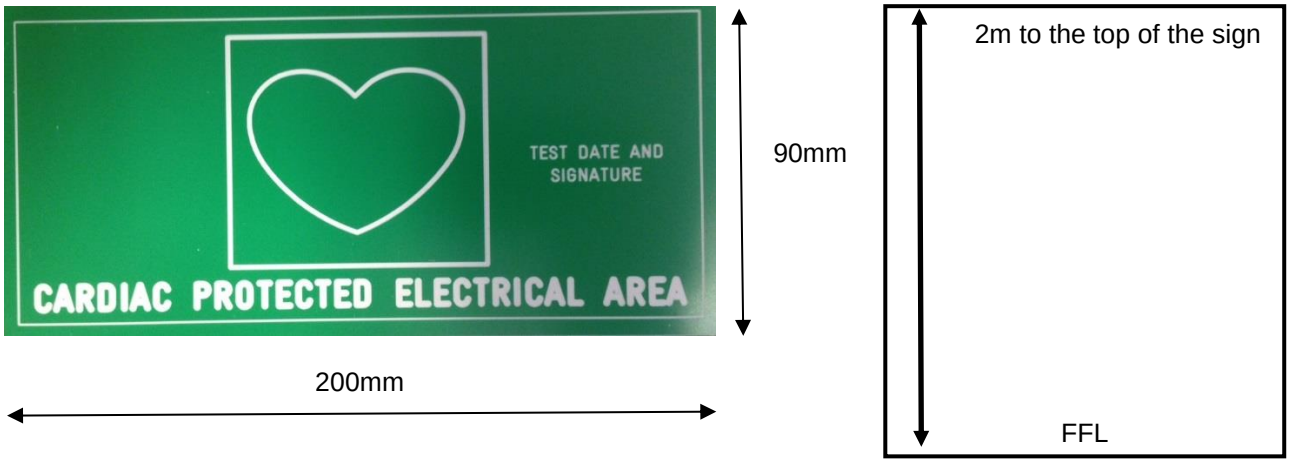
The following ***are not*** boundaries:

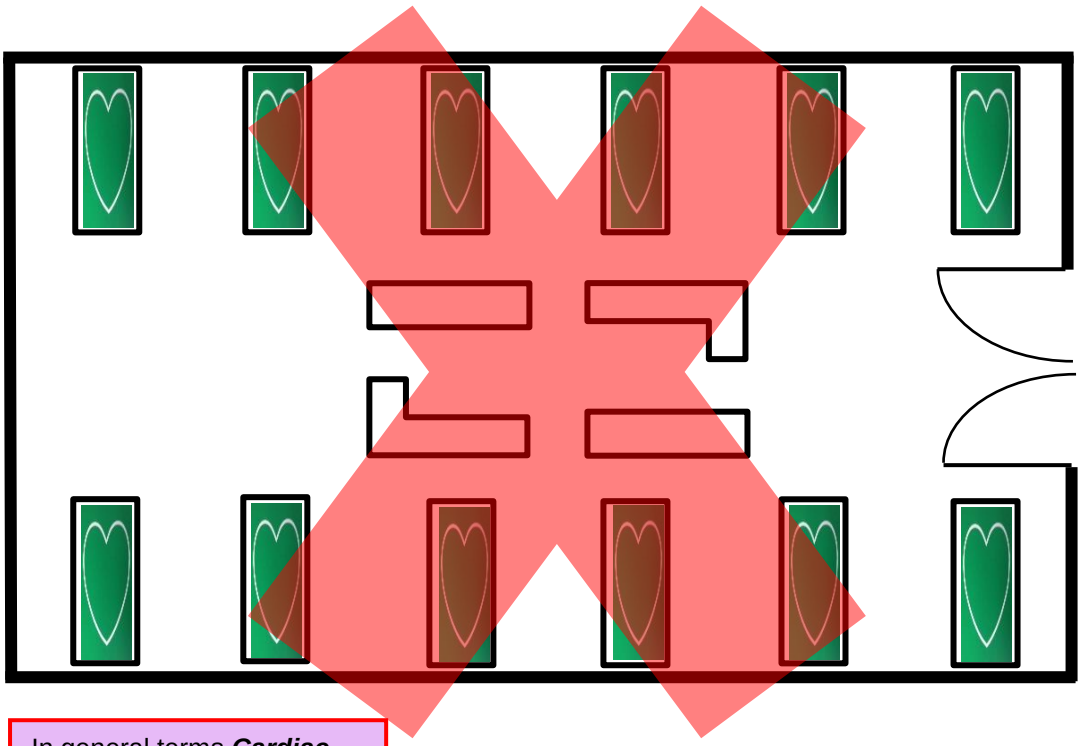
- Bed curtains
- Staff stations
- Partitions/dividers
- Benches/desks
- Moveable walls
- Screens
- Nib walls



CL.2.2.3 – (electrical areas) Refer this clause for a list of locations required to be wired as cardiac protected electrical areas if cardiac-type procedures are undertaken – ***Cardiac catheter labs, Cardiac ICU, CCU, Neo natal ICU, Operating theatres for cardiac surgery.***

CL.2.12.2 – (electrical areas) Green area sign to be installed on a wall and be readily visible in the area, and at a height of 2m to the top of the sign.





In general terms ***Cardiac protected electrical areas are bound by full height walls and doors only.***

(This would normally account for the whole room)

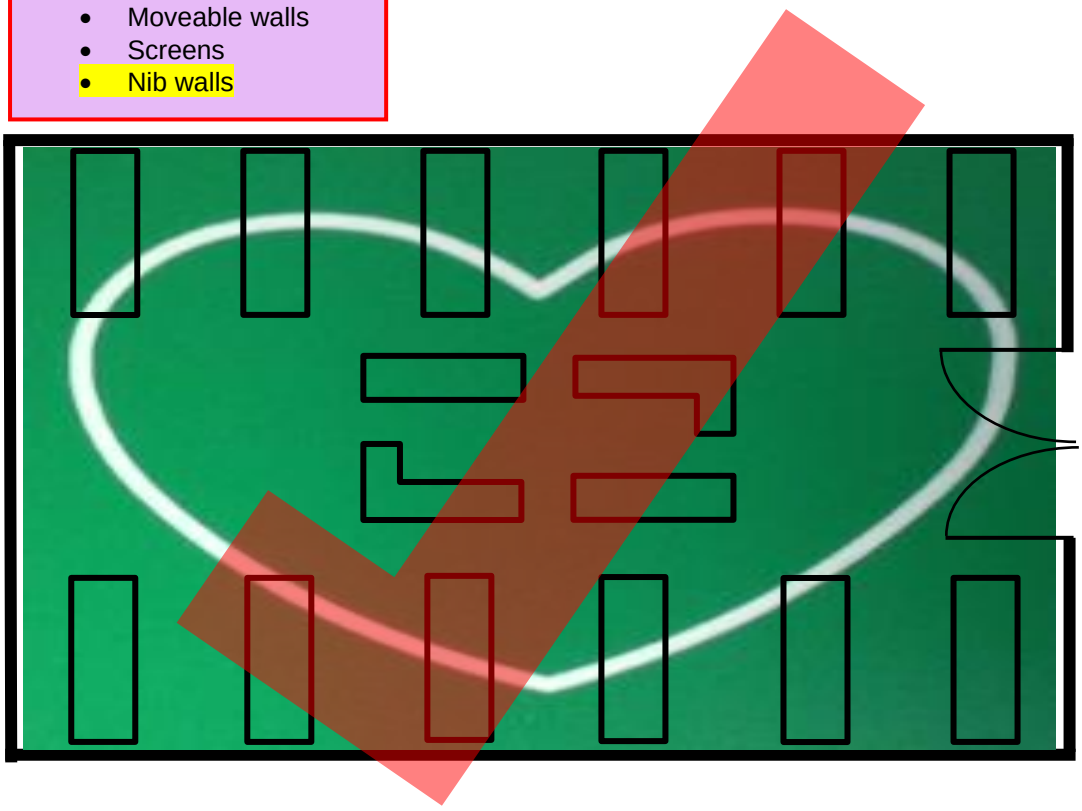
The following ***are not*** boundaries:

- Bed curtains
- Staff stations
- Partitions/dividers
- Benches/desks
- Moveable walls
- Screens
- Nib walls

CL.2.2.2 – (electrical areas) Nurse / staff stations and beverage bays etc. if in the cardiac protected area form part of the area (***therefore cardiac protection rules apply***).

Where walls are incomplete at the entry way(s) into a single clinical operational unit, those walls shall be extended to enclose the boundary (refer the full statement of clause 2.2.2).

Design engineers should indicate on drawings that the whole room / area is cardiac-protected, not individual bed spaces.

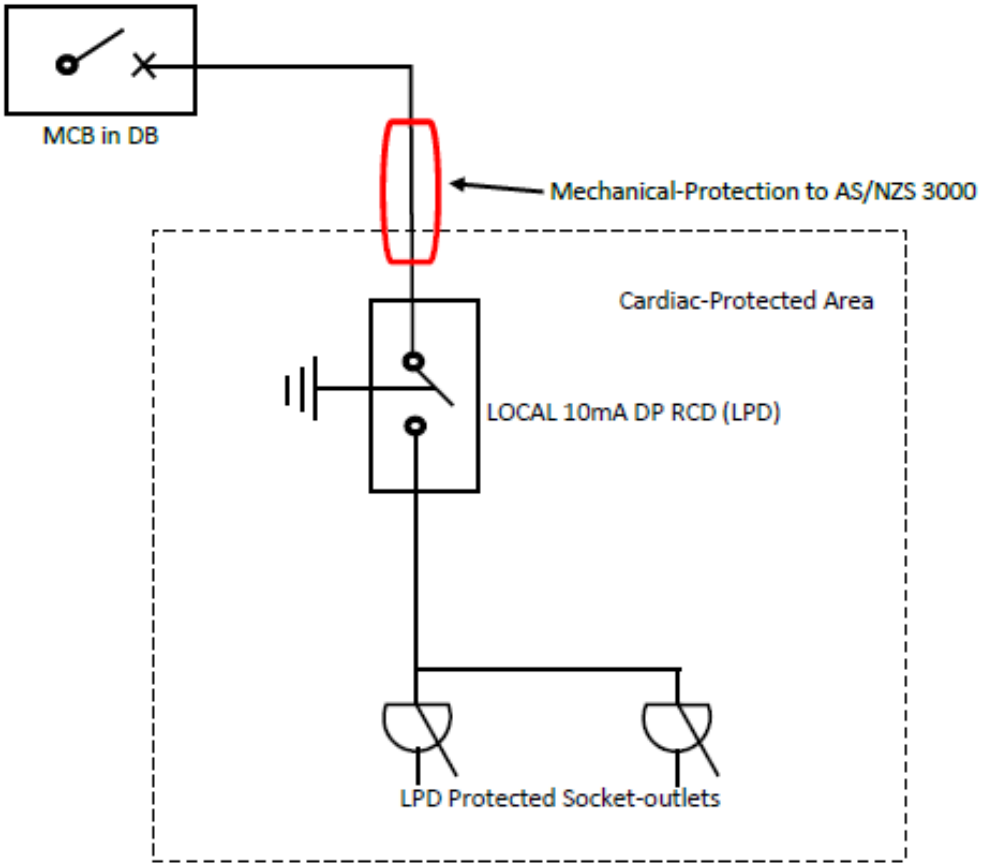


- ***Mechanical protection of wiring systems***

CL.2.4.2 – 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.

Ensure 30mA RCDs do not back up RCDs used in areas classified as Cardiac protected electrical areas.

Therefore, a 30mA RCD cannot be used in the switchboard in lieu of mechanical protection to enable compliance to section 3.9.4 of AS/NZS 3000.



Protection methods (clause 3.9.4.4 of AS/NZS 3000:2018)

- (a) provided with adequate mechanical protection at a minimum of WSX3 (appendix H, paragraph H5.4).

  OR

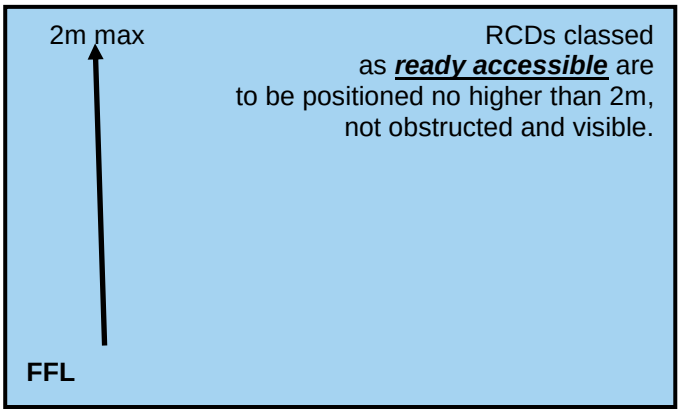
- (b) provided with an earthed metallic armouring, screen, covering or enclosure, to operate a short circuit protective device under fault conditions.

- ***RCDs***

CL.2.4.3.2.3 – (RCDs) Socket-outlets requiring RCD protection include single phase and multi-phase LV socket-outlets of type:

- 3 pin types, (including round pin earth)
- IEC industrial type with 3 to 5 round pins rated 10 to 100A.
  (RCD protection not required if the socket location is based on the 5m rule)
- IEC appliance type C13


CL.2.6 (a) – (RCDs) Readily accessible and no more than 2m above the floor.



CL.2.6 (b) – (RCDs) Be located in accordance with Table 2.1:

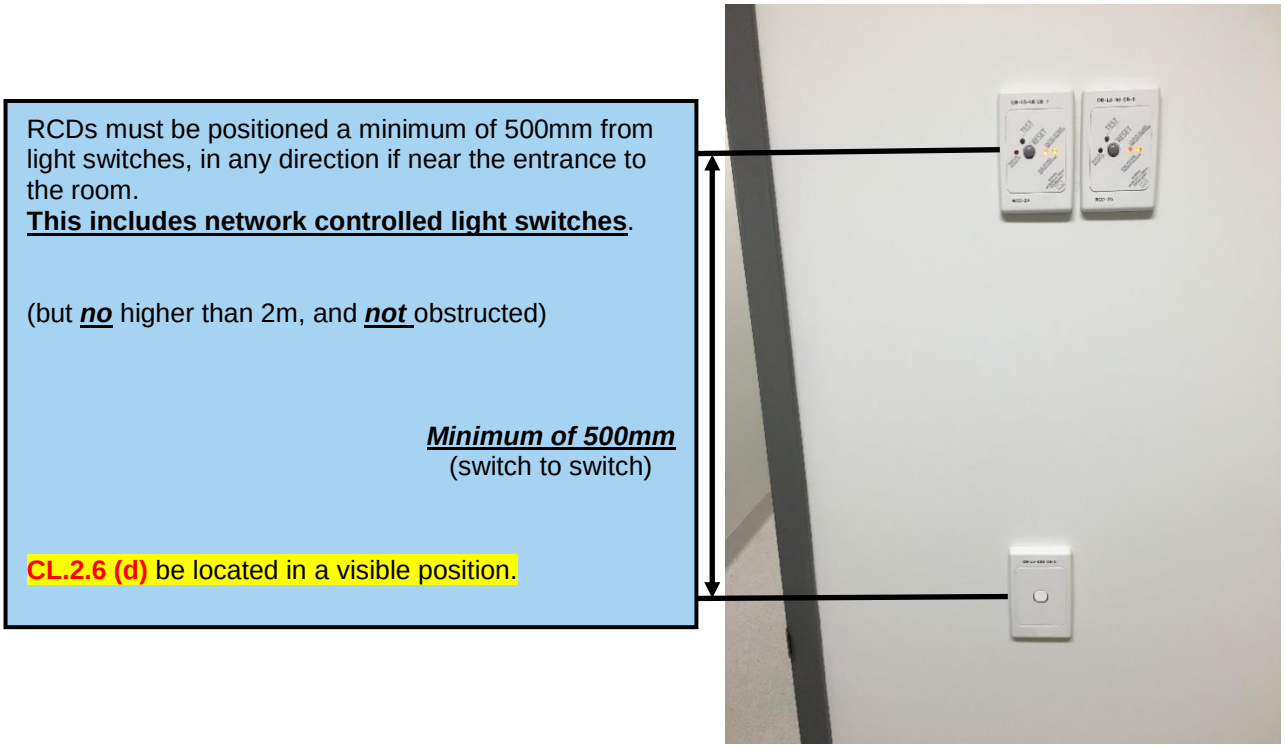
Location of protected socket or equipment	***Location of RCD***
Within patient area	Within patient area
Accessible outside a patient area	Located within the area of the socket-outlet
Inaccessible outside a patient area, RCD protected (if controlling medical electrical equipment used within the patient area)	Within patient area

- ***RCDs (cont.)***

CL.4.3 – RCDs ***shall not*** control the supply to socket-outlets to more than ***one*** patient location (cardiac). Refer diagrams on page 36.

CL.2.6 (c) – (RCDs) ***Not*** mounted under benches and,
RCDs ***must be above*** structures which are 1200mm or less from the ground and protrude more than 250mm out from a wall (such as a shelf).

CL.2.6(d) – (RCDs) Located 500mm from any wall mounted light switch, if near the entrance to the room.



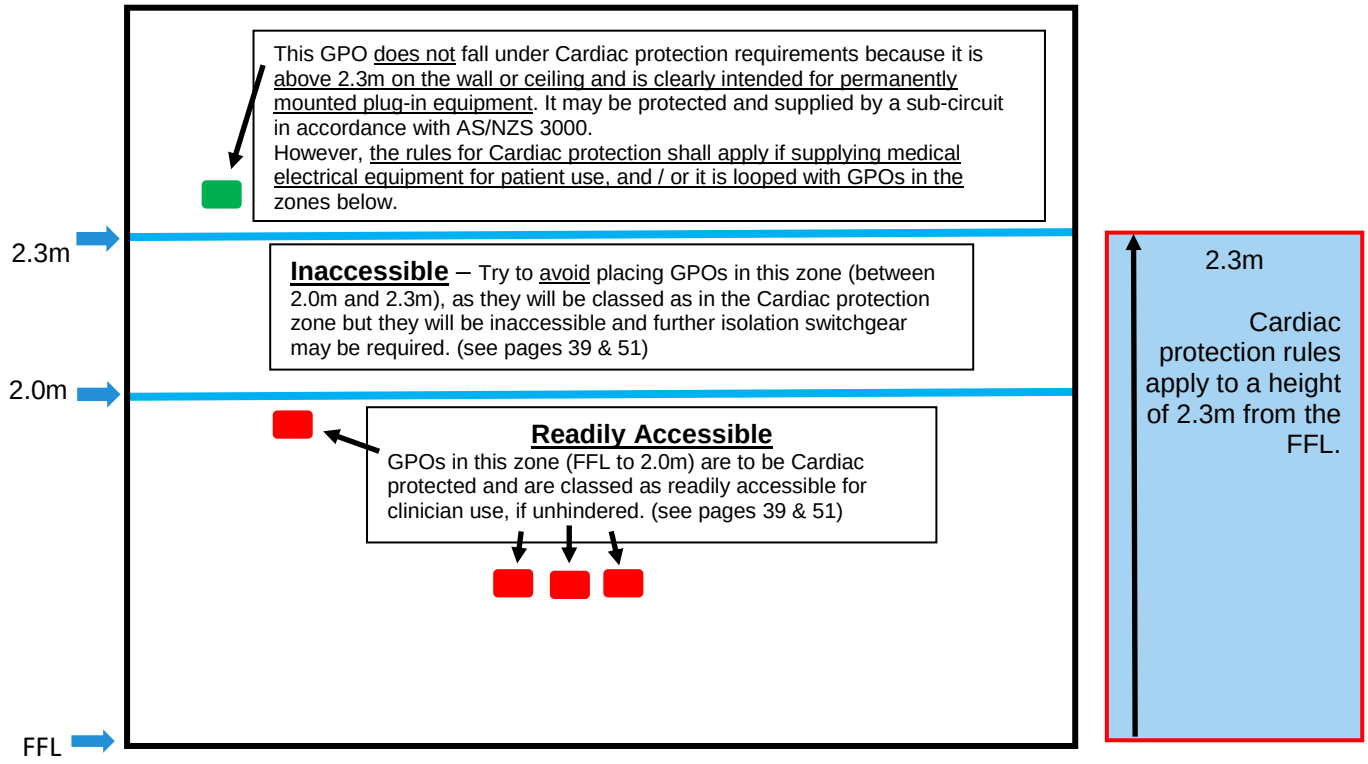
CL.2.6 – (RCDs) Cleaners RCDs are excluded from the above requirements.

- ***RCDs (cont.)***

CL.2.4.3.2.2 – (RCDs) ***Not*** required for GPOs mounted on a medical electrical system, for powering that system.

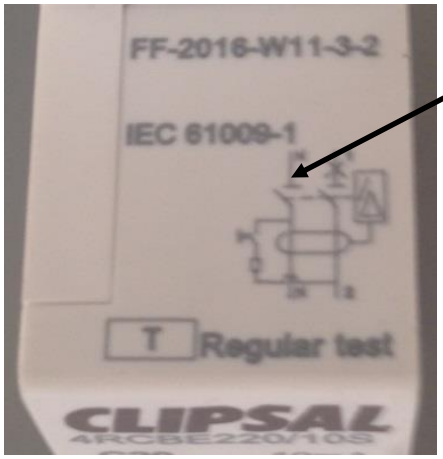
CL.2.4.3.2.2 – (RCDs) ***Not*** required for GPOs above 2.3m and clearly intended for permanently mounted plug-in equipment other than medical electrical equipment. (Do not use the patient circuits in this case).

Cardiac protected patient area typical wall elevation



(GPOs shown coloured red and green)

CL.2.8.1 – RCDs must be ***double pole*** (single pole switchboard busbar chassis RCDs do not comply). All active and neutral conductors are 'live' conductors.



*RCDs must isolate the **neutral** conductor as well as the active conductor.*

CL.2.8.1 – Each RCD shall be a Type 1 RCD, rated 10mA & max. trip time of 40ms. Complying with:
AS/NZS 3190
AS/NZS 61008.1
AS/NZS 61009.1

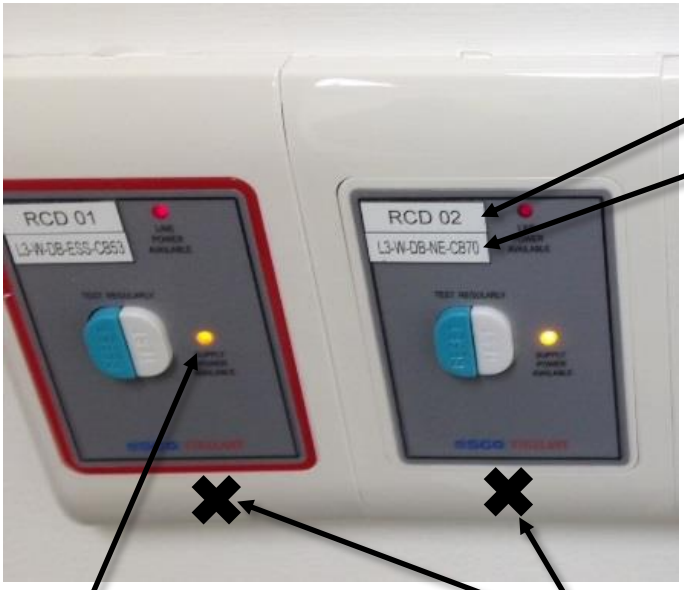
CL.2.8.3 (a) – (RCDs) Supply no more than 12 points (GPOs and hard-wired equipment).

CL.2.8.3 (b) – (RCDs) Shall not supply points in different rooms.
(**Cardiac area: *The RCD shall control GPOs in one patient location only***)

- ***RCDs (cont.)***

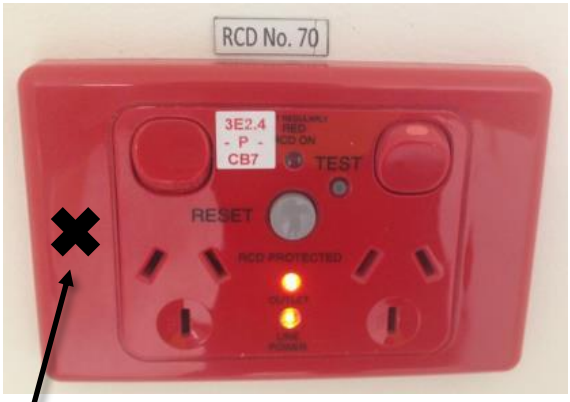
CL.2.8.4 – (RCDs) If the RCD is remote from the GPOs it controls, it shall be fitted with an amber, yellow or orange indicator light to show when ***supply is available to the socket outlets***.

CL.2.8.5 – (RCDs) Labelled with ***SW/BD*** and ***MCB*** reference (letter height, minimum 1.5mm high), and RCD number i.e. ***'RCD 1***' etc. (letter height, minimum 2.0mm high).
Note: The RCD reference / number shall be unique within the patient area.



RCD number label

SW/BD MCB label



Amber indicator light to show supply available to GPOs.

CL.2.12.1*- Labelling* ***shall not be fixed to removable surrounds*** *of RCDs or socket-outlets unless duplicate identification is permanently affixed to the body of the RCD or socket-outlet and visible when the surround is removed.*
The label maybe adjacent, e.g. on the wall.

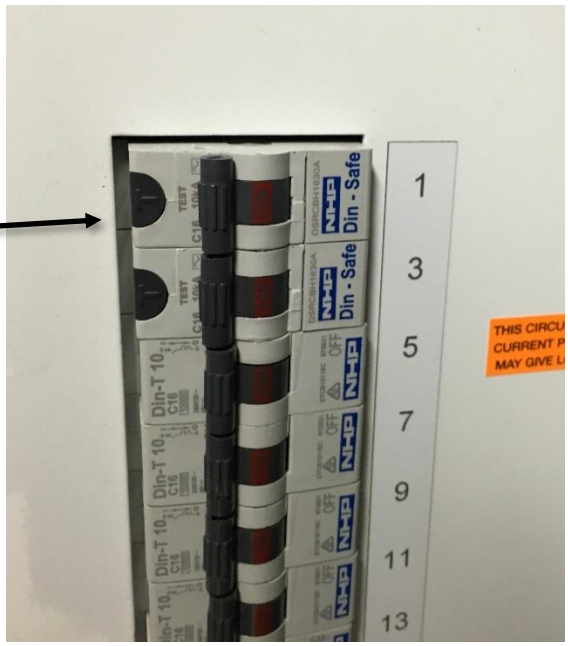
CL.2.8.2 – (RCDs) 10mA RCDs ***shall not be backed up*** by 30mA RCDs.

Ensure 30mA RCDs do not back up RCDs used in areas classified as Cardiac protected electrical areas.

Ensure your switchboard builder (if applicable) does not load the busbar chassis with 30mA RCDs for classified areas under this standard.

A 30mA RCD upstream of a 10mA RCD will not provide adequate discrimination.

Therefore, a 30mA RCD cannot be used in the switchboard in lieu of mechanical protection.
– refer section 3.9 of AS/NZS 3000, refer clause 3.9.4.3.2 and 3.9.4.4.



- ***Testing and Verification***

CL.2.13 – (Testing and verification) Prior to placing an electrical installation into service, it shall be inspected, tested and verified, that the installation is safe to energize and complies with the requirements of AS/NZS 3000 and AS/NZS 3003.

Verification is defined as being the confirmation, corroboration, proof, substantiation, authentication and certification of an electrical installation following construction, alteration, addition or repair.

The electrical installation shall be –

- ✓ Inspected as far as is practicable; and
- ✓ Tested and verified in accordance with Appendix B (Commissioning Inspection Checklist) of AS/NZS 3003

Normally carried out by an independent body with defined experience and certified, compliant and calibrated electrical testing equipment and regime.

Contact:

Electrical Testing Company Pty Ltd

Unit 15, 10 Victoria Ave

Castle Hill NSW 2154

T: 02 8850 1380

F: 02 8850 1384

E: david@electricaltestingcompany.com.au

; and

- ✓ Tested in accordance with AS/NZS 3000.

Verification documentation:

The electrical installation worker / contractor will provide a written statement of compliance.

See next page for statement template

This form needs to be completed and handed to the person responsible for final verification prior to inspection and electrical testing against the requirements of AS/NZS 3003.

Statement of Conformity with AS/NZS 3003:2018

☐ **Cardiac-protected electrical area**

☐ **Body-protected electrical area**

☐ **Repair to electrical installation**

☐ **New patient area**

☐ **Alteration or addition to electrical installation**

Institution: ……..

Address: ……

Location: ……..

Description of electrical work: ……

……

Date completed: …… Date of statement: ……..

I, the licensed electrical installation worker, who carried out the work described above, certify that:

• **The work has passed all the required tests and complies in all respects with the current edition of AS/NZS 3000.**	**O Yes**	**O No**	**O N/A**
• **The work has followed a formal specification prepared by or on behalf of the health care institution or practice.**	**O Yes**	**O No**	**O N/A**
• **I/ We have discussed the number of socket-outlets required with the medical or nursing personnel who will be responsible for work in each area and verified the likely loading on each circuit.**	**O Yes**	**O No**	**O N/A**
• **I/We have verified that the isolation transformer, line isolation monitor and overload monitor comply with AS/NZS 4510.**	**O Yes**	**O No**	**O N/A**
• **I/We are in possession of manufacturers' statement(s) of compliance or have otherwise verified that each ELV supply conforms with a suitable standard ensuring double insulation from the LV supplies.**	**O Yes**	**O No**	**O N/A**

Name: ……

Company: ……

Address: ……

……

Signed: …….. Electrical licence number: ……

- ***Definitions***

CL.1.5.2 – Applied part,

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

- **Type B**  (non-isolated, equipment has a protective earth terminal)

- **Type BF**  (floating, equipment is separated from earth)

- **Type CF**  (floating, equipment is separated from earth)

CL.1.5.16 - Medical electrical equipment (ME equipment)

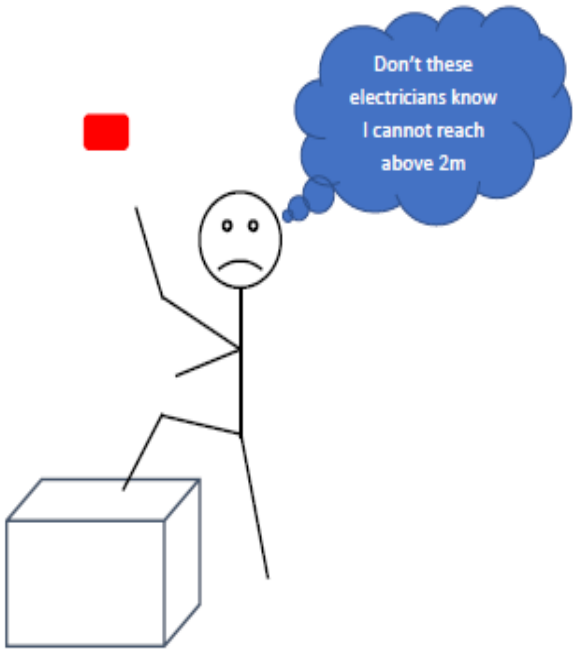
Electrical equipment having an 'applied part' for transferring energy to or from the patient or detecting such energy transfer to or from the patient and which is –

a) Provided with not more than one connection to a particular supply mains, and
b) Is intended by its manufacturer to be used – in diagnosis, treatment or monitoring of a patient, or
- For compensation or alleviation of disease, injury or disability.

CL.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 2m above the ground, floor or platform***.

This electrical standard is quite specific in that the cardiac-protected electrical areas medical electrical equipment ***must be in the control of the clinician within the area*:**

- The clinician must be able to access all the electrical controlling switchgear to enable isolation of socket-outlets and resetting of RCDs.
- The clinician is ***unable*** to reach above 2 metres.
- The clinician cannot by accident turn off RCDs when switching light circuits.
- The clinician is ***unable*** to reach below benches or desks or enter cupboards to reset RCDs.
- The clinician is ***unable*** to move bulky equipment to access GPOs and RCDs.
- The clinician may ***not*** use a ladder or chair for standing on to access GPOs.
- So therefore, RCDs must be positioned below 2 metres but above benches or desks, and at least 500mm from a light switch.
- So therefore, socket-outlets located behind bulky equipment must have an accessible ***double pole*** isolator.
- So therefore, socket-outlets behind or inhibited by flat screen monitors must have an accessible ***double pole*** isolator.
- So therefore, socket-outlets above 2 metres which are looped with other socket outlets in the area below 2 metres must have an accessible ***double pole*** isolator below 2 metres.
- A dedicated RCD for an inhibited or inaccessible socket-outlet requires a readily accessible test facility (round pin earth, white GPO).



- ***Cleaners socket-outlets***

CL.2.4.1.3 – (cleaner GPO) ***Shall not be*** supplied from any final sub-circuit supplying other sockets in the area.

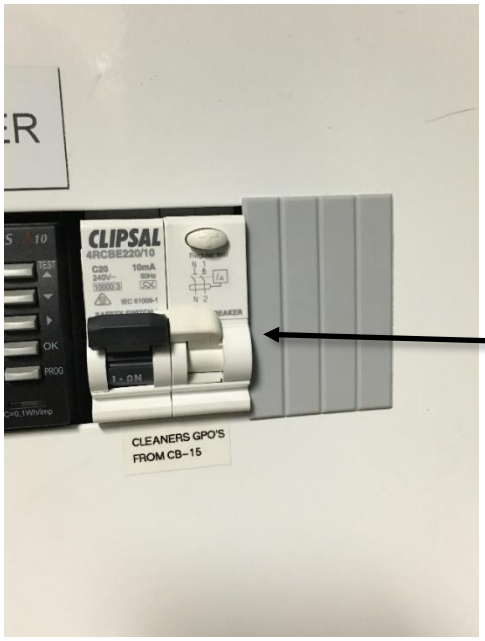
CL.2.7.4.3.1 (d) – (cleaner GPO) Colour beige, marked 'Cleaning Purposes Only' (letter height minimum 5.0mm high).

CL.2.7.3.1 (b) – (cleaner GPO) Cardiac area - one placed within the area (refer drawing page 40).

CL.2.7.3.2 – (cleaner GPO) Shall be RCD protected, this RCD shall only protect these sockets.

CL.2.8.1 – (cleaner RCD) Must be 10mA and double pole. (Good practise is to install these RCDs within the switchboard area/cupboard for easy reset by hospital staff),

(note - single pole switchboard busbar chassis RCDs do not comply)



All RCDs associated with this standard shall be ***double pole***, including cleaners RCDs, which shall also be 10mA.

Ensure your switchboard builder (if applicable) supplies you with double pole RCDs.

- ***Marking / Labelling***

CL.2.12.1 (ii) – (labels) DB/CB identification labels for RCDs shall be not less than 1.5mm for the lettering height.

CL.2.12.1 (iii) – (labels) RCD identification for RCDs shall not be less than 2.0mm for the lettering height.

CL.2.12.1 (A) – (labels) portable adhesive tape labels (Brother type) shall include a ***clear top laminate overlay*** in order to protect the printed lettering (tape labels without the laminate overlay are not acceptable).

RCD ID minimum 2mm letter height.

DB/CB ID minimum 1.5mm letter height.

Tape labels must have a ***clear top laminate overlay***.

Socket-outlets to be labelled with their controlling RCD: ***'From RCD X'***

RCD number label

SW/BD MCB label

CL.2.12.1 *- Labelling* ***shall not be fixed to removable surrounds*** *of RCDs or socket-outlets unless duplicate identification is permanently affixed to the body of the RCD or socket-outlet and visible when the surround is removed.*
The label maybe adjacent, e.g. on the wall.

- ***Permanently wired equipment***

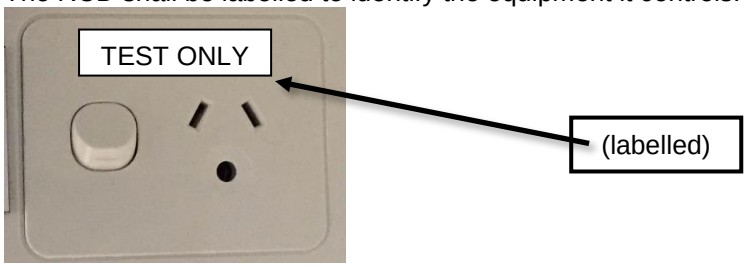
CL.2.4.3.3 – Permanently wired medical electrical equipment with any of the following Type B applied parts –

d. electrodes or transducers that contact patients;
e. that enter patients;
f. that contact liquid that enter patients

- shall be RCD protected (10mA double pole).

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

CL.2.8.6 - If an RCD is connected to permanently wired equipment only, ***a white round earth pin GPO shall be provided to enable testing of the RCD, and labelled 'Test Only'***.
The RCD shall be labelled to identify the equipment it controls.



(**information**)

The patient electrical area classifications of ASNZS 3003 (Electrical installations – Patient areas) is based on the application of medical electrical equipment as defined in ASNZS 3200 (Medical electrical equipment) and referenced in ASNZS 2500 (Guide to the safe use of electricity in patient care).

ASNZS 3200 defines medical electrical equipment with conductive 'applied parts' i.e. electrical connections to the patient, into the following classes:

- **Type B**  (non-isolated, equipment has a protective earth terminal)

- **Type BF**  (floating, equipment is separated from earth)

- **Type CF**  (floating, equipment is separated from earth)

ASNZS 3003 defines patient areas as locations where it is intended that low-voltage medical electrical equipment will be used in contact with patients while connected to the electrical supply mains.
ASNZS 3003 states that all patient areas shall be:

- Body-protected electrical areas

or

- Cardiac-protected electrical areas

Note: Standards may change, including the adoption of the IEC equivalent

(**information**)

There is a direct correlation between the patient area electrical classification (ASNZS 3003) and the type of medical procedure (ASNZS 2500) when using medical electrical equipment applied parts (ASNZS 3200) in contact with patients, categorized as follows:

AS/NZS 3200 Medical Equipment – Applied Part	***AS/NZS 2500 Medical Procedure Type***	***AS/NZS 3003 Patient Electrical Area***
Type B	Body	Body-protected
Type BF	Body	Body-protected
Type CF	Cardiac	Cardiac-protected

Body-type medical procedures as defined by ASNZS 2500:

- (summation) Applied parts not involving the heart, a patient is considered to be undergoing a body-type procedure when connected to a piece of medical electrical equipment in such a manner that the impedance of the skin is either reduced by electrode paste or gel, or by-passed by the entrance of conducting fluids, metal needles, saline-filled catheters and similar, through natural or artificial openings in the patient's body, but where direct contact with the heart is not possible.

Cardiac-type medical procedure as defined by ASNZS 2500:

- (summation) Applied parts involving the heart, a patient is considered to be undergoing a cardiac-type procedure when an in dwelling electrical conductor is accessible outside the patient's body and there is risk of microshock. In this context, an electrical conductor includes electrical wires, such as cardiac-pacing electrodes and intracardiac ECG electrodes, intracardiac catheters, or intracardiac insulated tubes filled with conducting fluids.

ASNZS 2500 defines the following protection levels against electric shock for electrical wiring in patient areas:

- (summation) Body-protected electrical area: where parts of medical electrical equipment are fastened to parts of a patient other than the heart, the use of a RCD or an isolation transformer with LIM monitor will ensure, that if any contact is made between a live conductor and earth (either directly or as a function of leakage currents), 'macroshock electrocution' is very unlikely.

- (summation) Cardiac-protected electrical area: where the procedure involves direct connection to the heart, RCD or isolation transformer protection, similar to that required for a body-protected electrical area, is supplemented with special earthing facilities to also provide protection against 'microshock electrocution'. Such a system not only protects against any fault or leakage currents posing a macroshock hazard, but also reduces the potential difference appearing between any conducting surfaces in the vicinity of the patient (electrically-operated equipment, plumbing, structural metal and similar) to a level well below that which would produce microshock electrocution.

(**information**)

This document has been produced to clear some confusion with respect to whether certain ceiling mounted electrical-operated equipment in Body and Cardiac protected electrical areas are required to have accessible 10mA RCD protection located in the protected electrical area, specifically supplies for electrical-operated equipment such as examination lights and monitor arms.
This type of equipment typically does not have conductive 'applied parts' electrical connections to the patient, so therefore it is not included in the definition for medical electrical equipment as described above under standards ASNZS3200, ASNZS 2500 and ASNZS 3003.

The supply power LV is normally located in the ceiling space and may be a power socket.

This power socket may be protected by an RCD located at the switchboard and be rated at 30mA.

The supply power is typically transformed from LV to ELV before entering the patient area.

This condition would be suitable for a body-protected electrical area without further protection.

However, if the equipment is to be located in a cardiac-protected electrical area the addition of supplementary bonding is required.

Such earthing is achieved by connecting the protective earth terminal to the EP junction (if protectively earthed equipment).

For non-protectively earthed parts, such earthing is achieved by connecting the mounting point of the equipment or the point in which it contacts structural metal to the EP junction.

The equipotential bonding (cardiac area) of the equipment would be tested and certified as part of the ASNZS 3003 commissioning process.

On the flip-side, contractors need to be aware of the type of electrical equipment, especially fixed electrical equipment they are terminating in body and cardiac protected electrical areas.

If the fixed electrical equipment is classified as medical electrical equipment with applied parts **Type B**  , all aspects of ASNZS 3003 are applicable, clause 2.4.3.3 specifically, and 10mA RCD protection is required including an RCD test point being a round earth pin white GPO.

ASNZS 3003 does not mention the same requirements for fixed medical electrical equipment with applied parts **Type BF**  **and Type CF**  .

Type BF  **and Type CF**  fixed medical electrical equipment would also fall under the installation requirements of ASNZS 3000, but supplementary bonding (ASNZS 3003) may be applicable in cardiac areas if the equipment contacts structural metal.

If the fixed electrical equipment is not medical electrical equipment with applied parts **Type B**  ,
ASNZS 3000 requirements are applicable, unless in a cardiac-protected electrical area then supplementary bonding (ASNZS 3003) may be required.

CL. 2.10 – where permanently wired electrical equipment is supplied from an RCD that also supplies socket-outlets or other equipment, the electrical equipment shall be provided with a separate, individual, readily accessible double pole isolation switch.
Not readily accessible GPOs shall be treated in the same manner.

- ***Earthing / EP bonding***

  (It should be noted that a full understanding of this section is only possible by consulting and reading the AS/NZS3003 2018 standard, section 4.4)

Definition of ***Equipotential Bonding*** from AS/NZS 3000:

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.

Exposed conductive part: a conductive part of electrical equipment that can be touched with the standard test finger, and is not a live part but can become live if basic insulation fails. (exceptions apply, including double insulation, refer AS/NZS 3000 for the complete definition)

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. Examples 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.

(There are further examples refer AS/NZS 3000 for the complete definition)

CL.4.4.1 – (cardiac bonding) The minimum size of any EP bonding conductor shall be $4mm^2$.

(**information**) (based on experience to achieve the 0.1 ohm or less requirement, ***the minimum size earthing conductor should be* no less than 6mm²** for a cable run up to 30m in length. Conductor size of ***4mm² should be avoided***).

CL.4.4.2.2 – (cardiac bonding) A cardiac protected electrical area shall only contain one EP earthing system but may serve more than one patient location in that area.
An EP earthing system may serve more than one cardiac-protected electrical area.

CL.4.4.2.2 – (cardiac bonding) ***If socket outlets are connected to multiple EP earthing systems due to the 5.0m rule, then the area shall be configured as a single EP earthing system.***

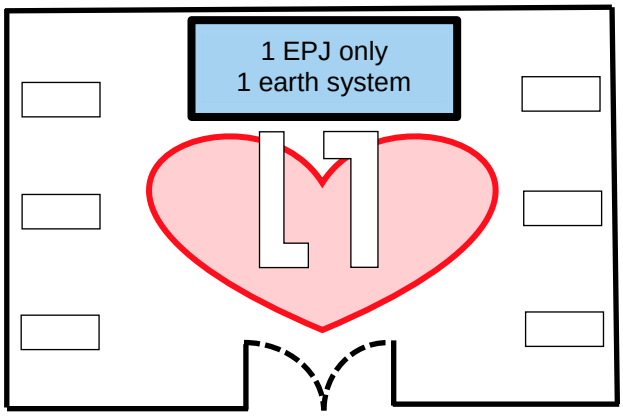
CL.4.4.2.3 – (cardiac bonding) An EP earthing system shall only be provided with one EP junction.

A cardiac protected electrical area shall only contain ***one EP earthing system.***

Shall only be provided with ***one EP junction*** (EPJ).

The EPJ may be positioned to facilitate cabling requirements.

Cardiac Protected electrical area (6 patient locations and includes the staff station)



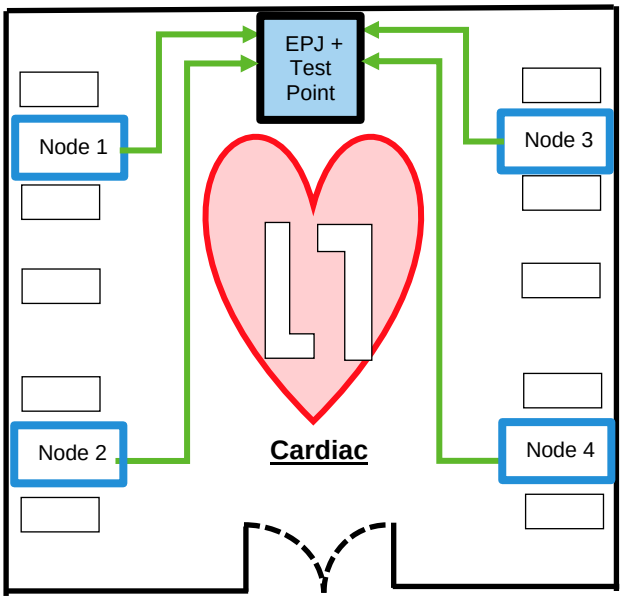
Earthing / EP bonding (cont.)

CL.4.4.2.3 – (cardiac bonding) A EP earthing system may have a number of separate nodes at strategic locations connected to the EP junction.

CL.4.4.2.3 (a) – (cardiac bonding) Each node is to be connected individually to the EPJ by insulated conductors with a maximum resistance of ***0.01 ohms***.

(based on experience to achieve the 0.01 ohm or less requirement, the minimum size earthing conductor ***should be no less than 70mm²*** for a cable run up to approximately 35m in length).

Cardiac Protected electrical area with many patient locations and a staff station.

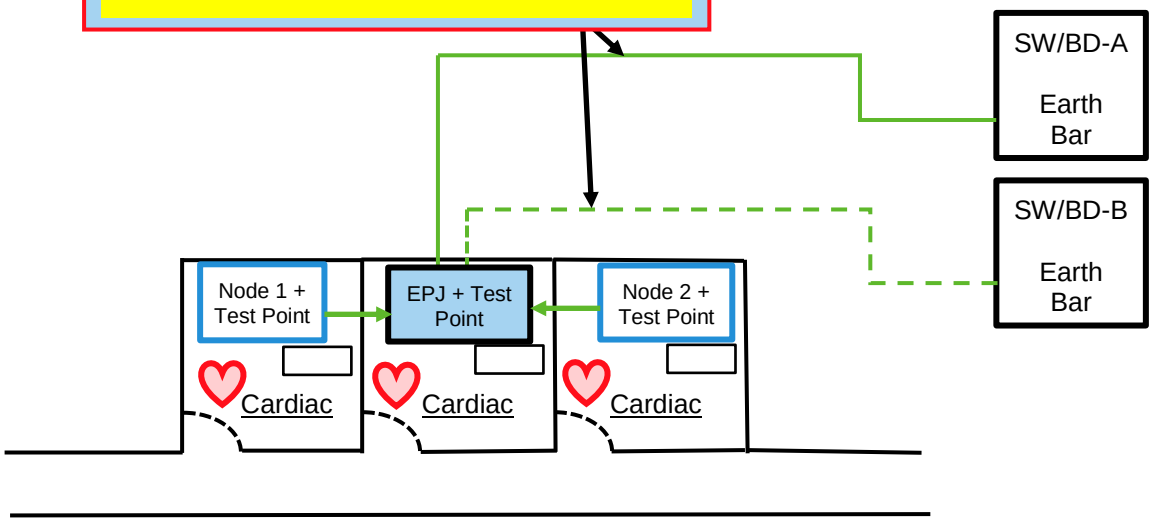


A cardiac protected electrical area shall only contain ***one EP earthing system.***

Shall only be provided with ***one EP junction*** (EPJ) but may incorporate a node system to facilitate cabling.

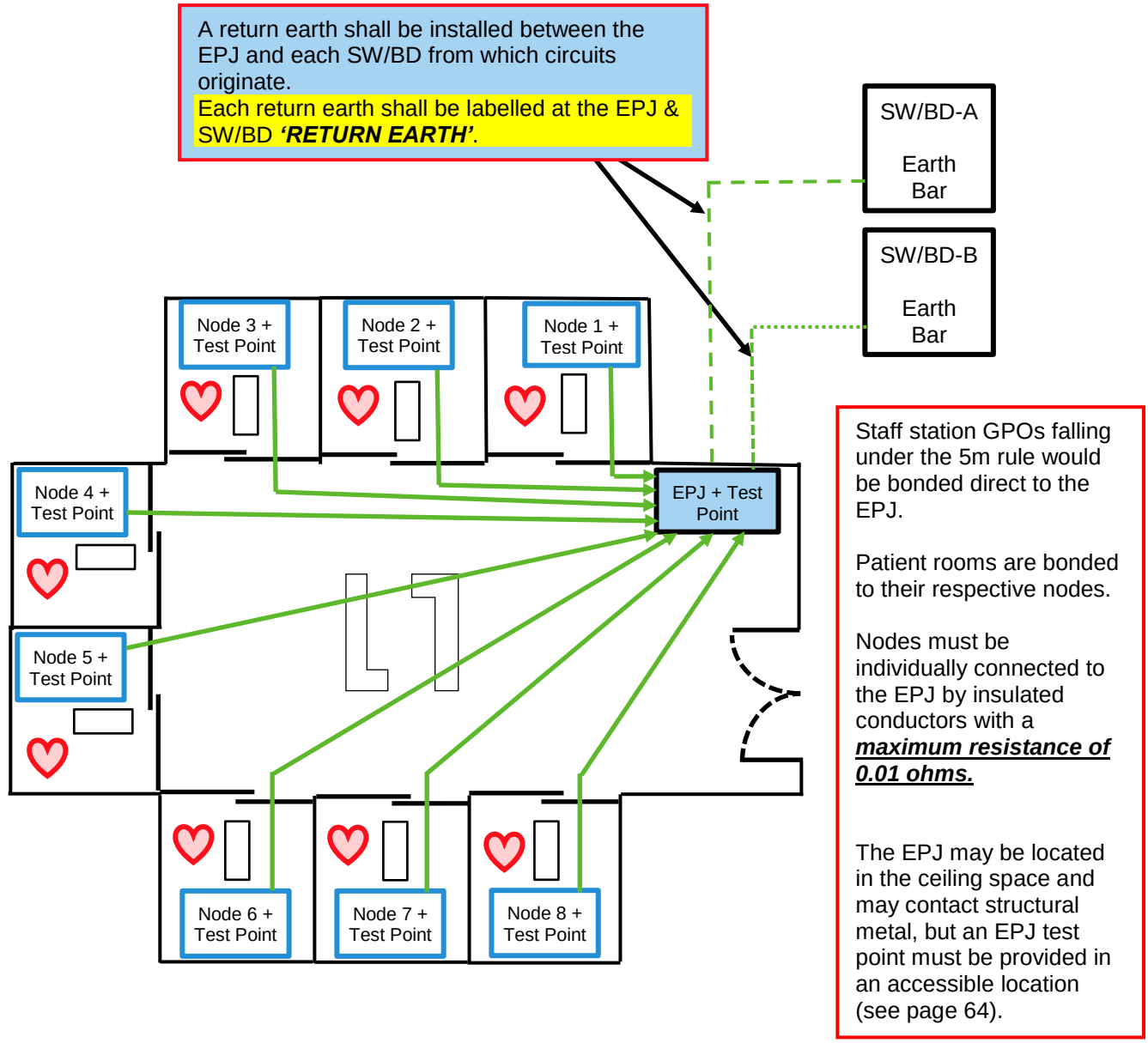
Each node shall be connected ***directly*** to the EP junction with a maximum resistance of ***0.01 ohms***.

A return earth shall be installed between the EPJ and each SW/BD from which circuits originate. Each return earth shall be labelled at the EPJ & SW/BD ***'RETURN EARTH'***.



Three separate cardiac areas with one EP earthing system comprising the EP junction and node facility.

Earthing / EP bonding (cont.)



CL.4.4.2.3 (b) – (cardiac bonding) Each node is accessible and its location identified by labelling.

CL.4.4.2.3 (c) – (cardiac bonding) Each node is fully insulated or isolated from contact with structural metal.

CL.4.4.2.3 (d) – (cardiac bonding) ***Each node is numbered and identifies the location of the EP junction.***

CL.4.4.2.3 (e) – (cardiac bonding) ***Each conductor installed between a node and the EP junction is numbered at the EP junction to identify the node.***

CL.4.4.2.3 (f) – (cardiac bonding) ***The EP junction identifies the number of nodes connected.***

Earthing / EP bonding (cont.)

CL.4.4.2.4.1 (a) – (cardiac bonding) Socket-outlets in the following locations shall be connected to the EP junction or node:

(i) ***Socket-outlets*** that are accessible anywhere in the cardiac protected electrical area without using a key or tool are required to be bonded to the EP junction or node. ***It is not limited to those that are defined as readily accessible (therefore those sockets above 2.3m still need to be bonded back to the EPJ or node).***

(ii)

5m RULE – socket-outlets that are located within 5m of the entrance to the cardiac area and are accessible without the use of a key or tool shall be connected to the EP junction or node.

(refer page 38 drawing)

The 5m rule GPO's could be located in rooms or corridors ***opening directly off*** the classified cardiac protected area.

(The process of accessing the 5m rule GPO through a second door other than a door associated with the classified cardiac protected area may ***exclude*** this GPO from the ruling).

(iii) (cardiac bonding) Socket-outlets installed outside the cardiac area but are used to supply –

(a) medical electrical equipment in the area shall be connected to the EP junction or node, e.g. imaging areas.

or

(b) any electrical equipment that is accessible in the patient environment of the cardiac area shall be connected to the EP junction or node.

Where the socket-outlet is accessible without the use of a key or tool in a room, this requirement applies to all socket-outlets within the room.

Where the socket-outlet is accessible without the use of a key or tool, but is not located in a defined room, this requirement applies to all socket outlets within 2m of the affected socket outlet.

Where the socket-outlet is inaccessible without the use of a key or tool (e.g. in ceiling space) this requirement only applies to the affected socket-outlet.

CL.4.4.2.4.1 (b) – (cardiac bonding) Socket-outlets include industrial style e.g. IP56 single and three phase outlets.

CL.4.4.2.4.1 exception – (cardiac bonding) Generally, socket-outlets for the connection of clocks are ***not*** required to be earthed back to the EP junction if they do not accept common 10A plugs.

CL.4.4.2.4.2 – (cardiac bonding) Socket-outlet protective earthing conductors shall be insulated from other conductive items except at the EP junction. ***The resistance between the socket earth pin and the EP test point or node shall not exceed 0.1 ohm.***

CL.4.4.2.5.1 – (cardiac bonding) The protective earth terminal of permanently installed Class I electrical equipment shall be earthed via the EPJ or node if any parts are accessible in the patient environment.

- Except accessible metal parts of Class I electrical equipment that is double insulated from live parts.
- Except accessible metal parts of Class II equipment.
- Except permanently installed electrical equipment that is inaccessible in the patient environment.

Earthing / EP bonding (cont.)

CL.4.4.2.5.2 – (cardiac bonding) Earthing of permanently installed electrical equipment shall be via the protective earth terminal for protectively earthed parts to the EPJ or node.
For non-protectively earthed parts, the earthing shall be achieved by connecting the mounting point of the equipment or the point at which it contacts structural metal to the EPJ or node.

CL.4.4.2.5.3 – (cardiac bonding) A separate earthing conductor shall be used to connect each item of permanently wired electrical equipment to the EP junction or node. Permanently wired electrical equipment includes such items as electrical wall boxes, medical service panels, pendants and pedestals, metal cable enclosures.

CL.4.4.2.5.5 – (cardiac bonding) The resistance of any earthing conductor installed between any socket outlet or any item of permanently wired electrical equipment and the EPJ or node shall not exceed 0.1Ω.
Note: Permanently installed electrical equipment that is inaccessible in the patient environment need not comply, this equipment may be earthed directly to the distribution board.

CL.4.4.2.6 – (cardiac bonding) ***Permanently installed non-electrical conductive equipment and fittings that contact structural metal*** shall be connected to the EPJ or node via ***individual*** earthing conductors having a resistance not exceeding 0.1 ohms. –

- Medical gas outlet reticulated pipelines may be earthed via pipe cable clamps or a braised copper strap with a cable lug connection.
- Water and drainage reticulated pipelines may be earthed via pipe cable clamps.
- Window frames may be earthed via the underlying fixed metal frame that contacts the structural metal.
- Air conditioning grills may be earthed via the underlying fixed metal frame that contacts the structural metal.
- Monitor brackets, hand and equipment rails etc. may be earthed via the underlying metal wall frame that contacts structural metal.

Non-electrical conductive fittings are regarded as contacting structural metal if the resistance to the EPJ or node is less than 1 MΩ when measured at 500V DC (megger test.)

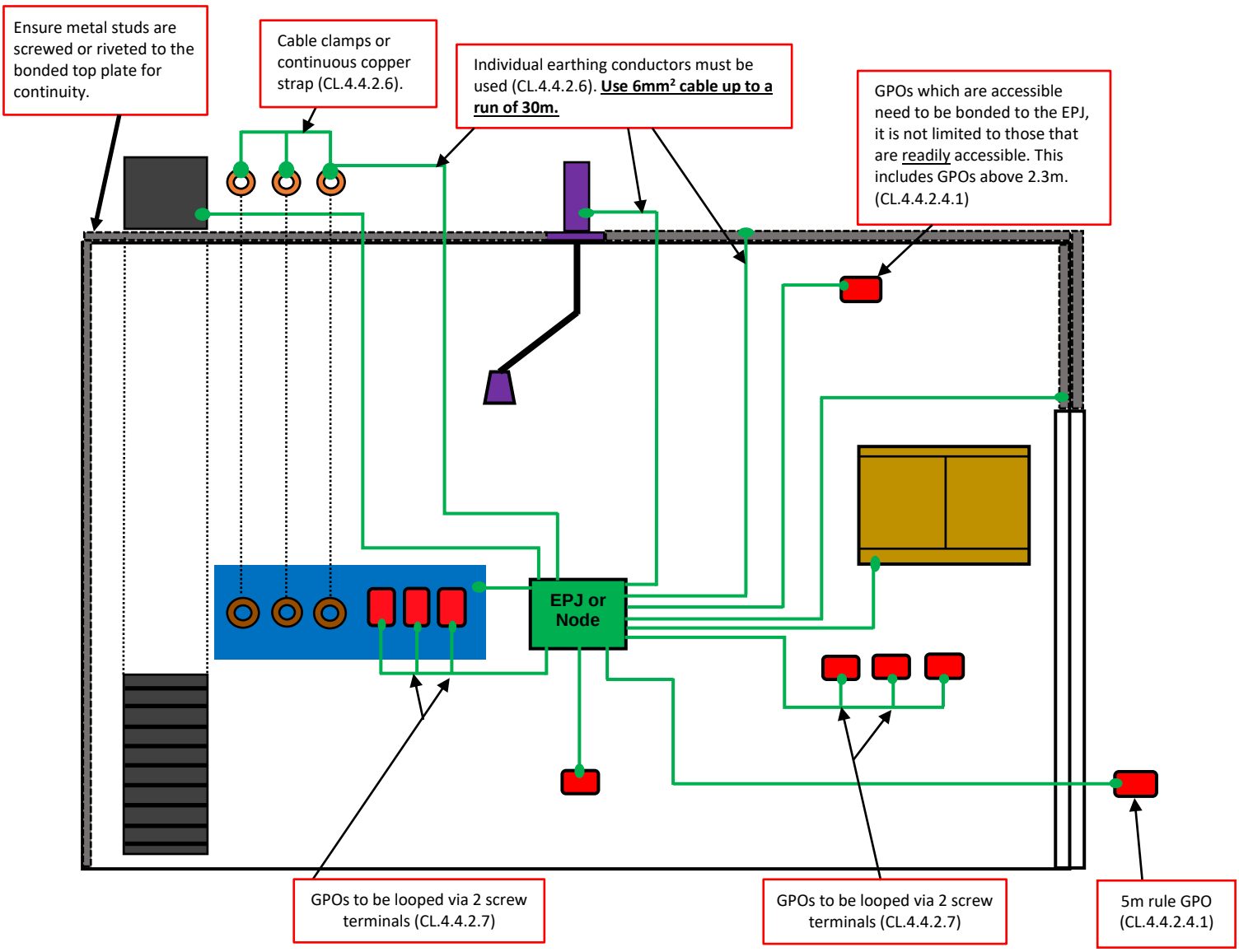
CL.4.4.2.7 – (cardiac bonding) All joints and connections to the EP earthing system ***shall be fully insulated or isolated from contact with structural metal*** (except at the EP junction, the EPJ may contact structural metal).

Recommended maximum cable length for bonding conductors (metres indicated are a conservative (safe) interpretation of Table D1 in AS/NZS 3003)**:**

Cable size mm²	*Maximum metres / for 0.1Ω*	*Maximum metres / for 0.01Ω*
6.0	28	2.8
10.0	48	4.8
16.0	78	7.8
25.0	125	12
35.0	172	17
50.0	230	23
70.0		

- 6mm² earth cable would be recommended for bonding socket-outlets to their respective nodes or EPJs in the patient area.
- 6mm² earth cable will provide a resistance below 0.1Ω up to a length of 28m, if there is concern with the length of the cable being marginally over the 28m the best solution would be to run two 6mm² cables to ensure compliance.
- The same GPO sub-circuit may have multiple earth connections to the EP junction or EP node. It is not a requirement to loop the sub-circuit earth to every GPO on the circuit (the length of the earth cable may end up being greater than the 28m recommended).
- Staff station island bench GPOs should be connected with 2 earth cables, one to the start and end of the GPO run (ring connection), in-order to avoid high resistance measurements and retrofitting extra cables after the installation is completed.
- 70mm² earth cable is recommended for cable links between EP nodes and EP junctions.
- Minimum size cable for imaging control-board earth connections to EP junctions should be 50mm².

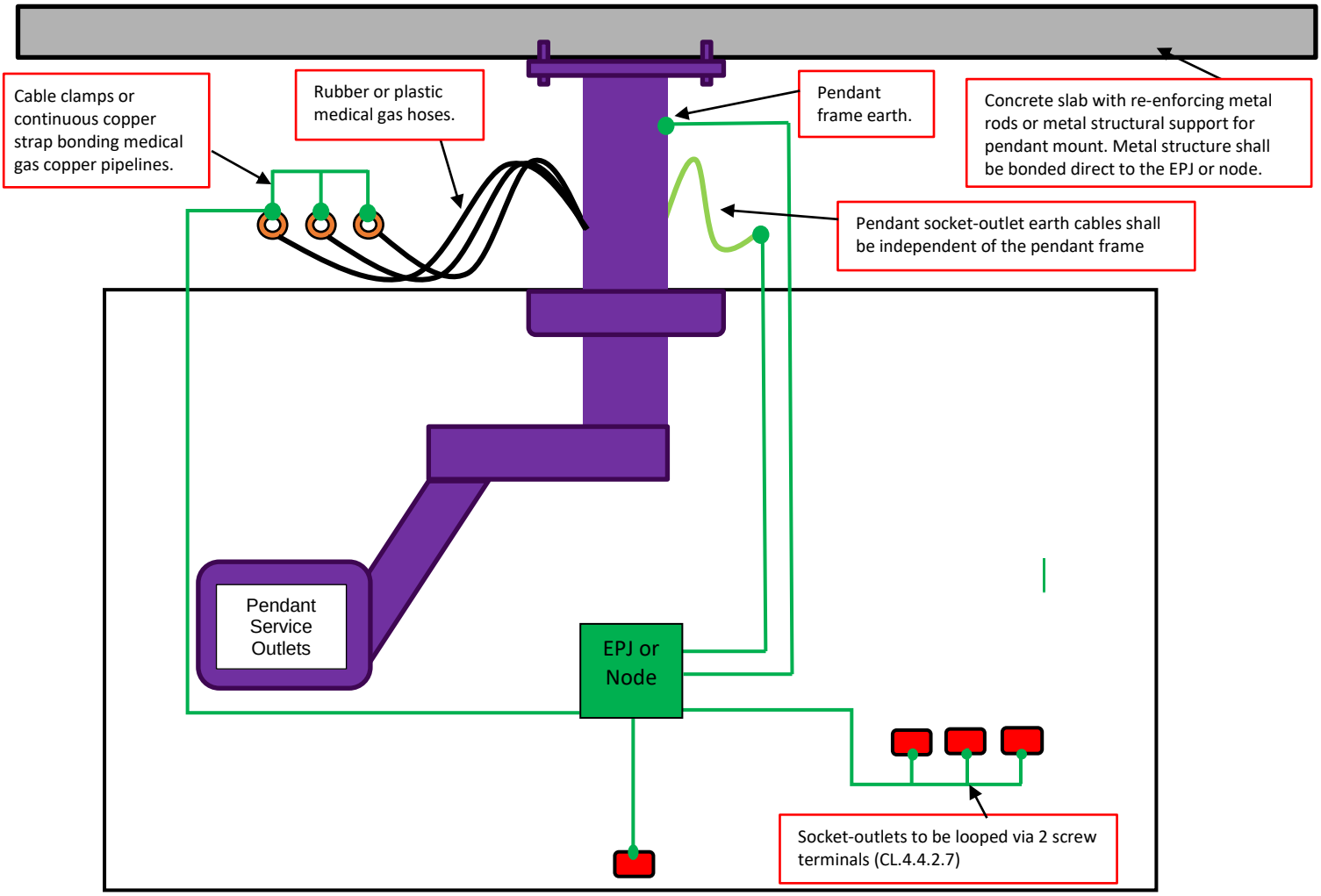
Typical Patient Bedhead Wall Elevation with Equipotential Bonding



KEY by colour code:

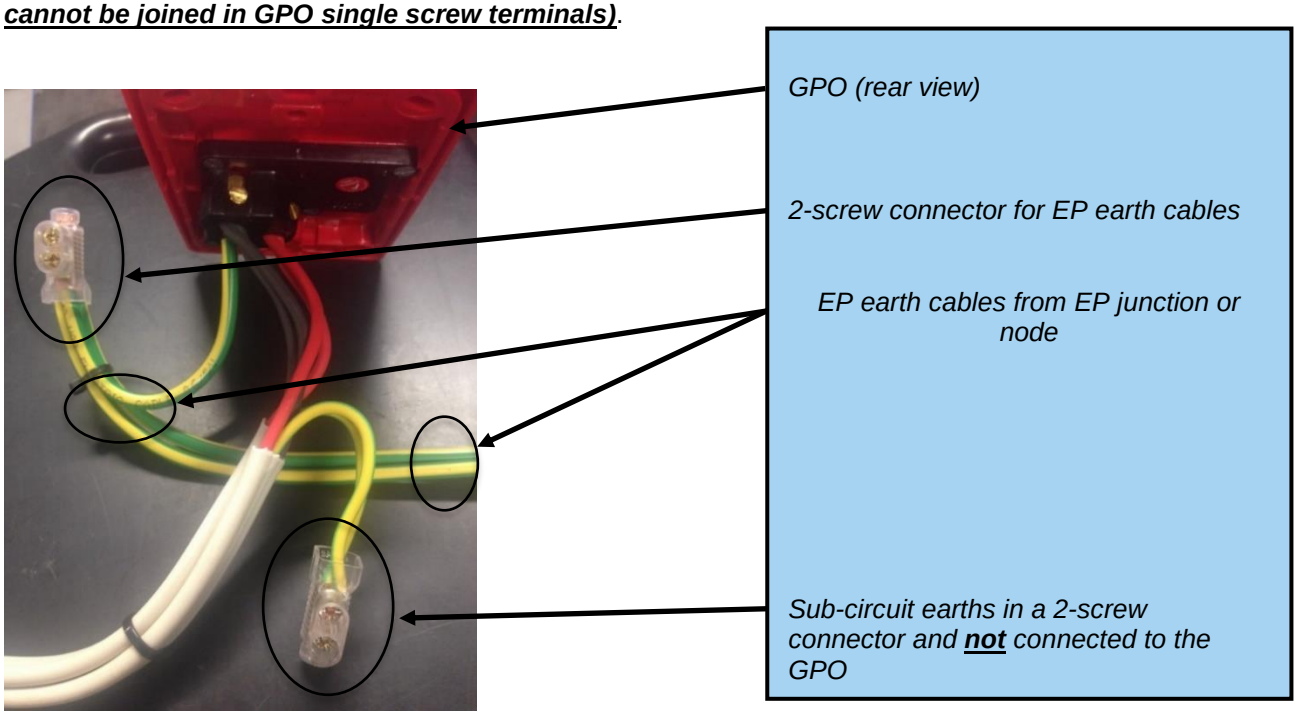
- ♥ **EP Junction or node, positioned to suit architectural layouts or to facilitate cabling requirements (an EPJ may contact structural metal, a node must be isolated from structural metal).**
- ♥ **Socket-outlets (plastic), which may be fed from different sub-boards (refer clause 4.4.2.4.1 and 4.4.2.7).**
- ♥ **Medical service panel (MSP) with metal wall-box and faceplate (exposed conductive part) (refer clause 4.4.2.5.3).**
- ♥ **Medical gas copper pipelines (extraneous conductive part) (refer clause 4.4.2.6).**
- ♥ **Examination light bonded at point of attachment to structural metal (refer clause 4.4.2.5.2).**
- ♥ **Metal structure top plate of wall studs/substrate (bond the underlying wall frame) (extraneous conductive part) (refer clause 4.4.2.6).**
- ♥ **Metal substrate of metal door frame or window frame (bond the underlying wall frame) (extraneous conductive part) (refer clause 4.4.2.6).**
- ♥ **Hard wired X-ray viewing screen (exposed conductive part) (refer clause 4.4.2.5.1).**
- ♥ **Air-con register dropper or internal metal duct to be bonded (extraneous conductive part) (refer clause 4.4.2.6).**

Typical Patient Pendant Elevation with Equipotential Bonding



Earthing / EP bonding (cont.)

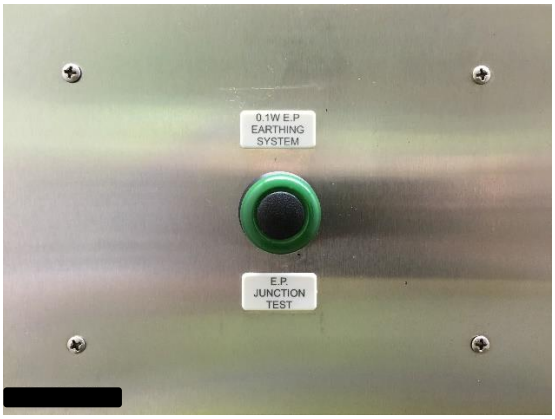
CL.4.4.2.7 – (cardiac bonding) Cables forming part of the EP earthing system shall be joined in ***2 screw*** tunnel terminals (this does not include single screw tunnels for socket outlets, however 2 or more conductors ***cannot be joined in GPO single screw terminals)***.



Earthing / EP bonding (cont.)

CL.4.4.2.8 – (cardiac bonding) Where the EPJ is readily accessible within the area it shall be identified –

- EP Test Point
- 0.1Ω EP Earthing System
- EP Junction



CL.4.4.2.9 – (cardiac bonding) If the EPJ is not readily accessible, a test facility shall be provided in the cardiac-protected electrical area.
It shall be a stud type test terminal of 6mm diameter as per CL. 4.4.2.10.
The EP test facility ***shall be isolated from structural metal***.
The earthing resistance measurement requirements shall apply from the EP test point.
The test point shall be identified as follows:

- EP Test Point
- 0.1Ω EP Earthing System
- (The location of the EP junction or node)

CL.4.4.2.10 – (cardiac bonding) The earth resistance between the EP test terminal and the EP junction or node shall have a ***maximum value of 0.01Ω***.

Earthing / EP bonding (cont.)

CL.4.4.3 – (cardiac bonding) The EPJ shall be connected by return earths to each switchboard associated with the cardiac area from which the circuits originate i.e. –

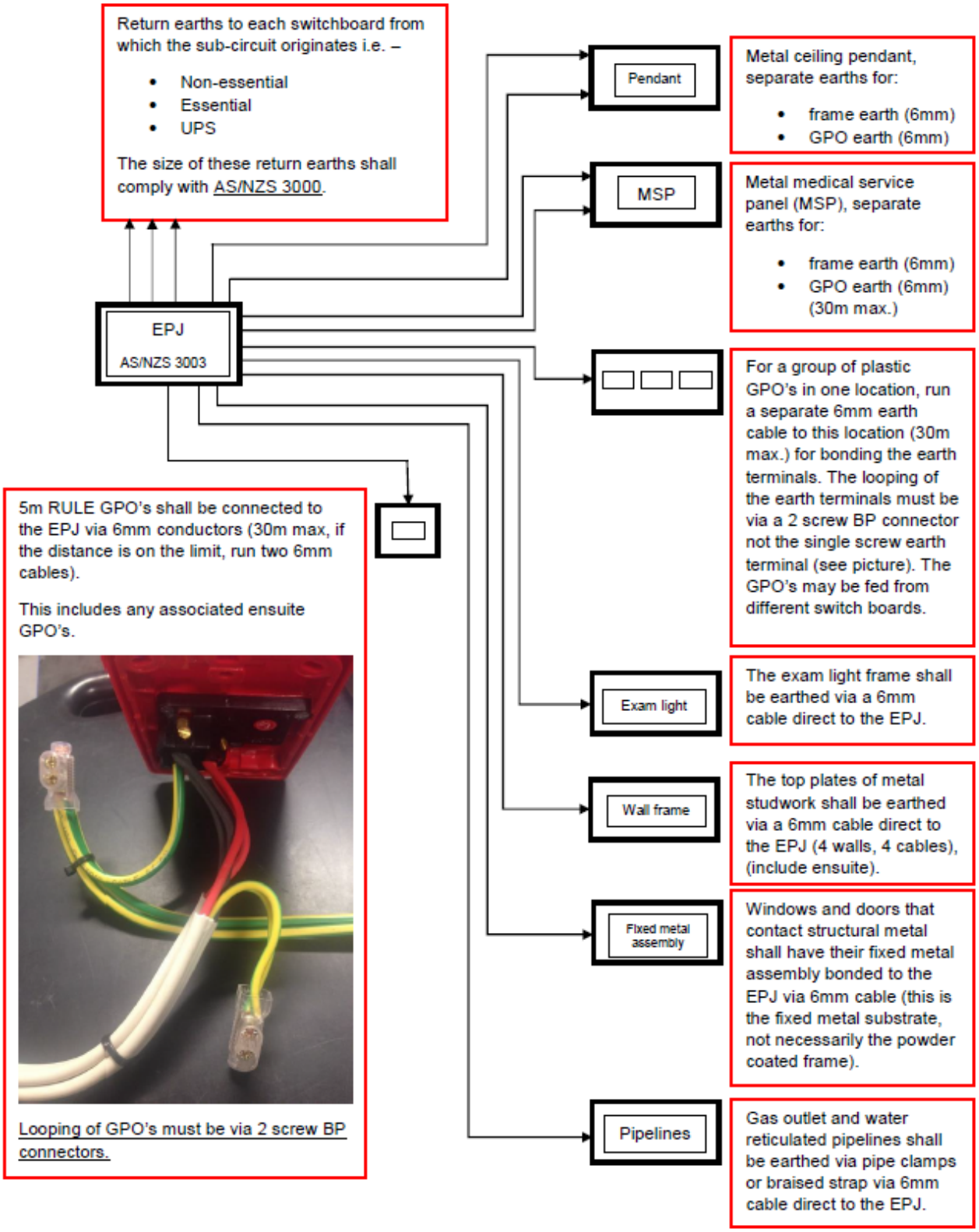
- One supply e.g. non-essential, 1 return earth.
- Two supplies e.g. non-essential and essential, 2 return earths (one to each switch board).
- Three supplies e.g. non-essential, essential and UPS, 3 return earths (one to each switchboard).
- The size of these return earths shall comply with ***AS/NZS 3000*** and shall not be less than 4mm^2.

Each return earth shall be labelled at the EP junction and at the distribution board:

'RETURN EARTH'

Multiple cardiac protected electrical areas and their associated EP junctions, ***individually connected*** back to their controlling switch boards via return earths.

AS/NZS 3003: 2011 Equipotential Bonding (typical but not limited to, refer standard)



- ***Alterations, additions and repairs*** (shall comply with Section 6 of the standard)

CL. 6.2.1 – (alterations and additions) Every alteration of, or addition to, the electrical installation in an existing patient area shall comply with the relevant provisions of AS/NZS 3003: 2018.
This requirement applies to all alterations and additions, ranging from the install of new socket-outlets to the installation or replacement of fixed electrical equipment such as dental chairs and CT scanners.

CL. 6.2.2 – (alterations and additions) Patient areas that are ***not already signposted as body-protected or cardiac protected electrical areas*** shall be upgraded to comply with AS/NZS 3003: 2018, prior to or during the alteration or addition to the electrical installation, or to permanently wired equipment.
Separate circuits to patient areas need not apply to alterations and additions to areas not wired as cardiac-protected or body-protected electrical areas.
Old signs indicating CLASS A or CLASS B areas are not body or cardiac protected areas.

CL. 6.2.3 – (alterations and additions) Alterations or additions to electrical installations in patient areas shall not proceed unless the patient area has been subjected to routine testing within the previous 12 months.
The green area sign shall have a current in-date sticker attached, if not the area needs to be retested prior to the works.

CL. 6.2.4 – (alterations and additions) If the installation of new socket-outlets in a patient area increases the overall number by more than 10%, all socket outlets shall comply with the colour coding requirements of AS/NZS 3003: 2017, clause 2.7.4.3.

d) White – normal supply
e) Red – essential supply
f) Blue – UPS

CL. 6.2.5.1 – (alterations and additions) ***IN CARDIAC Protected electrical areas*** the following requirements shall be applied prior to the alteration or addition:

5. Where the EP junction cannot be identified, or is inaccessible for new connections, the entire EP earthing system shall be upgraded to comply with AS/NZS 3003: 2018.

6. Where the EP junction or EP test point is not marked ‘EP TEST POINT’ an EP test facility shall be installed to comply with clause 4.4.2.9.

7. If the EP test point is remote from the EP junction the linking cable shall be sized to ensure the resistance measurements comply with the standard.

8. New EP earthing connections shall comply with this standard when installing new electrical accessories, fixed equipment rated below 2.0kW, and non-electrical structural metal connected fittings.

CL.6.2.5.2 – Where fixed electrical equipment rated at or above 2.0kW is to be installed in a body-protected or cardiac-protected electrical area, the entire patient area shall comply with AS/NZS 3003: 2018 prior to or during alteration or addition to the electrical installation.

CL.6.2.5.3 – If cardiac-protected areas are to be reclassified as body-protected areas, they shall comply with sections 2 and 3.
Have all EP studs or receptacles removed and be tested and verified.

CL. 6.3.1 – (repairs) Patient areas that ***are not*** wired as cardiac or body-protected electrical areas should be upgraded to comply with AS/NZS 3003, prior to or immediately after repairs of RCDs and socket-outlets or permanently wired electrical equipment. (The requirement for separate circuits need not apply to repairs CL.2.4.1)

Alterations, additions and repairs (cont.)

CL. 6.3.2 – (repairs) Patient areas wired as cardiac or body-protected shall have a current test sticker attached to the area sign before repairs proceed.

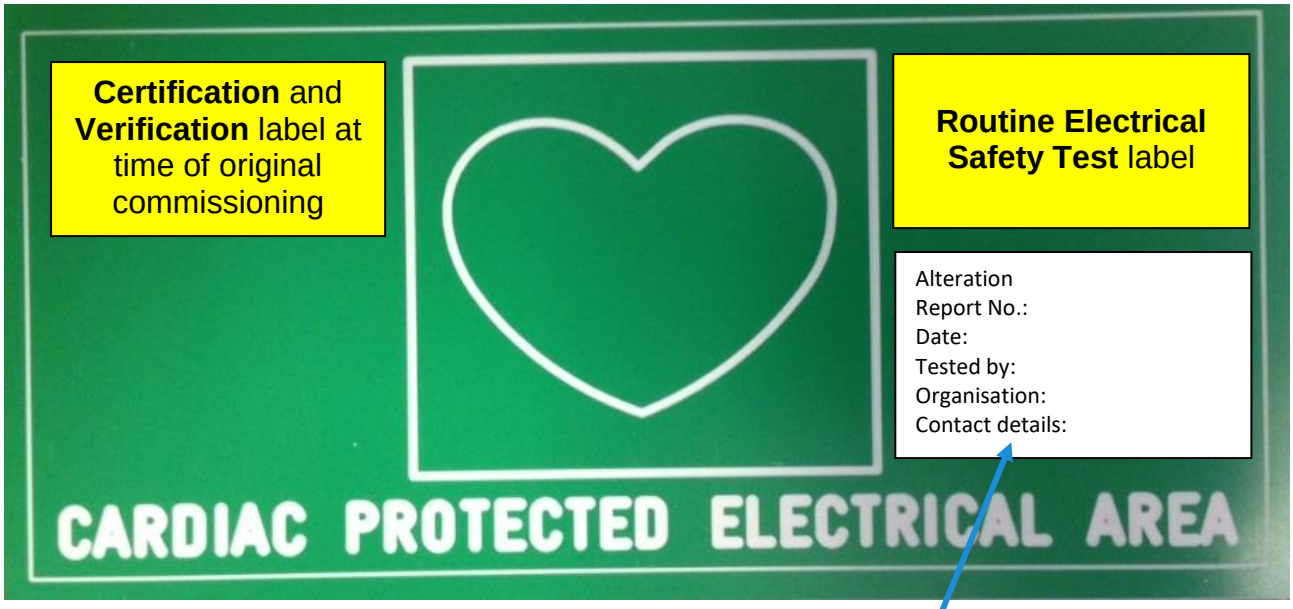
If the methods satisfy the fundamental safety principles of Part 1 AS/NZS 3000 the following work may be carried out to electrical installations with the original install method:

- Repairs to or replacement of accessories (as defined in AS/NZS 3000) forming part of the existing electrical installation or replacement of such accessories with equivalent fittings.
- Replacement of component parts of fixed equipment with equivalent components.

Replacement of a complete item of fixed electrical equipment in a patient area constitutes an alteration to the electrical installation and shall comply with clause 6.2.

The replaced item shall be tested against the applicable compliance requirements of this standard.

CL.6.4 – Where alterations occur, a label shall be added below the routine test label stating that alterations have occurred and indicating the report number, date, name of test person, organization responsible and contact details. The label shall not cover any existing labels and shall be removed at the time of the next routine inspection.



Label to be installed at time of alteration, addition or repair to the cardiac-protected electrical area.

Isolated Supplies – LV

LV isolated supplies may be used as LPDs in both body and cardiac-protected electrical areas.
Refer to the separate guides for specific information about these areas.

CL. 2.9.1 – (isolated supplies) Where a LV isolation transformer is used as an LPD, the supply shall include a line isolation monitor and an overload monitor (LIM or LIOM).
The manufacturer shall provide a certificate of suitability with the isolation transformer and LIM or LIOM stating compliance to AS/NZS 4510.

CL. 2.9.2 – (isolated supplies) Isolation transformers shall be installed in accordance with AS/NZS 3000 and the manufacturer's instructions to ensure the temperature of the enclosure does not exceed the maximum ambient temperature identified on the isolation transformer.
Isolation transformers shall be accessible for servicing.
CARDIAC – Isolation transformers in a cardiac protected electrical area **shall not** supply more than one patient location.
BODY – Isolation transformers in a body protected electrical area **may** supply more than one patient location.

CL. 2.9.3 – (isolated supplies) The primary side of the isolation transformer shall be protected by a miniature overcurrent circuit breaker (MCB) (may be located in the switchboard).
The rating of the MCB shall not exceed the primary current rating of the transformer (typically 16A 3.6kVA, 20A 4.8kVA).

Isolating transformer complying with AS/NZS 4510.

Current rating.

Maximum ambient temperature rating.

Isolated Supplies – LV (cont.)

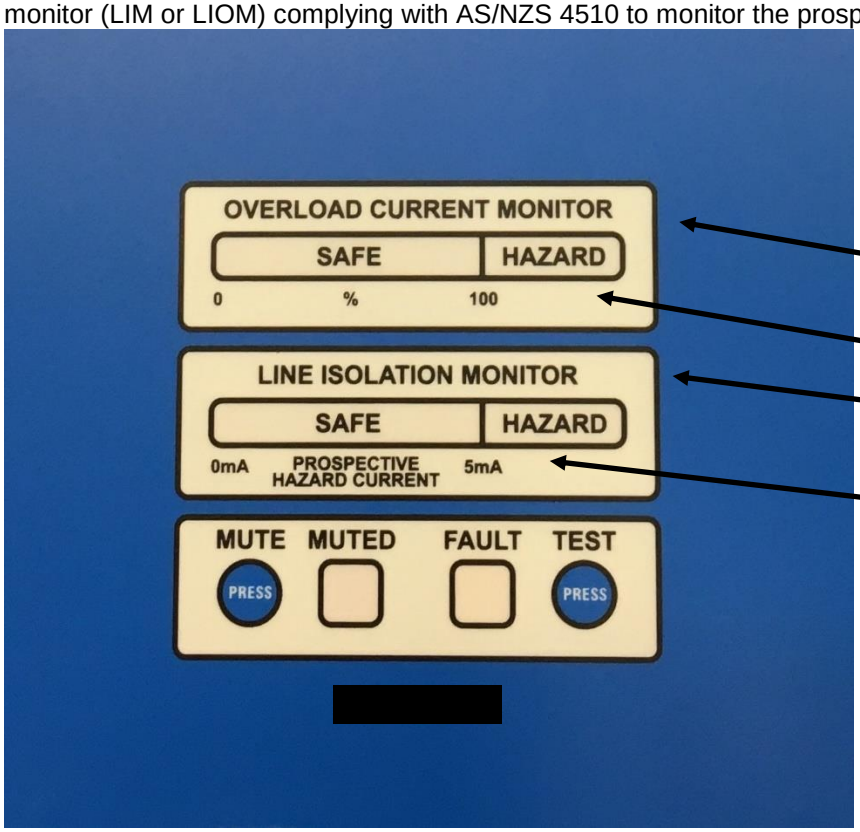
Ventilated isolation transformer cabinet.

Ensure adequate area ventilation to limit ambient temperature rise.

Transformers shall be positioned to allow service, maintenance and repair.

CL. 2.9.4 – (isolated supplies) Each LV transformer isolated supply that is connected to any socket-outlet shall be provided with an overload monitor (AS/NZS 4510) to monitor the load current.
The alarm current setting shall be identified on the monitor to facilitate testing.

CL. 2.9.5.1 – (isolated supplies) Each transformer isolated supply shall be provided with a line isolation monitor (LIM or LIOM) complying with AS/NZS 4510 to monitor the prospective hazard current (PHC).



Combined line isolation & and overload monitor complying with AS/NZS 4510.

Load current monitor bar-graph display.

Load current percentage bar.

Line isolation monitor bar-graph display.

Prospective hazard current (PHC) display.
Alarm fixed to operate at a PHC of 5.0mA.

Isolated Supplies – LV (cont.)

CL. 2.9.5.2 – (isolated supplies) Each LIM or LIOM shall be identified:

- To indicate the associated distribution board and its circuit breaker
- With an additional identifier unique to the patient area, e.g. 'LIM X'

CL. 2.9.7 – (isolated supplies) The maximum number of points protected by a single transformer-isolated supply shall be:

In a CARDIAC-protected electrical area – 12

In a BODY-protected electrical area – 12

(a point includes hard wired fixed equipment, and a DGPO is two points not one)

CL. 2.9.8 – (isolated supplies) A dedicated transformer-isolated supply for permanently wired equipment, shall have a test facility included in the load side of the circuit to enable testing of the LIOM.

CL. 2.9.9 – (isolated supplies) The test facility shall be ***a white round earth pin GPO, provided in an accessible position to enable testing of the LIOM, and labelled 'Test Only'.***
The test facility shall also be labelled to identify the LIOM unit associated – **'LIM X'**.

CL.2.6 (a) – (LIM or LIOM) Controls and indicators of monitors are to be readily accessible and no more than 2m above floor.

CL.2.6 (b) – (LIM or LIOM) Controls and indicators of monitors are to be located in accordance with Table 2.1:

Location of protected socket or equipment	***Location of LIM or LIOM***
Within patient area	Within patient area
Accessible outside a patient area	Located within the area of the socket-outlet
Inaccessible outside a patient area, LPD protected (if controlling medical electrical equipment used within the patient area)	Within patient area

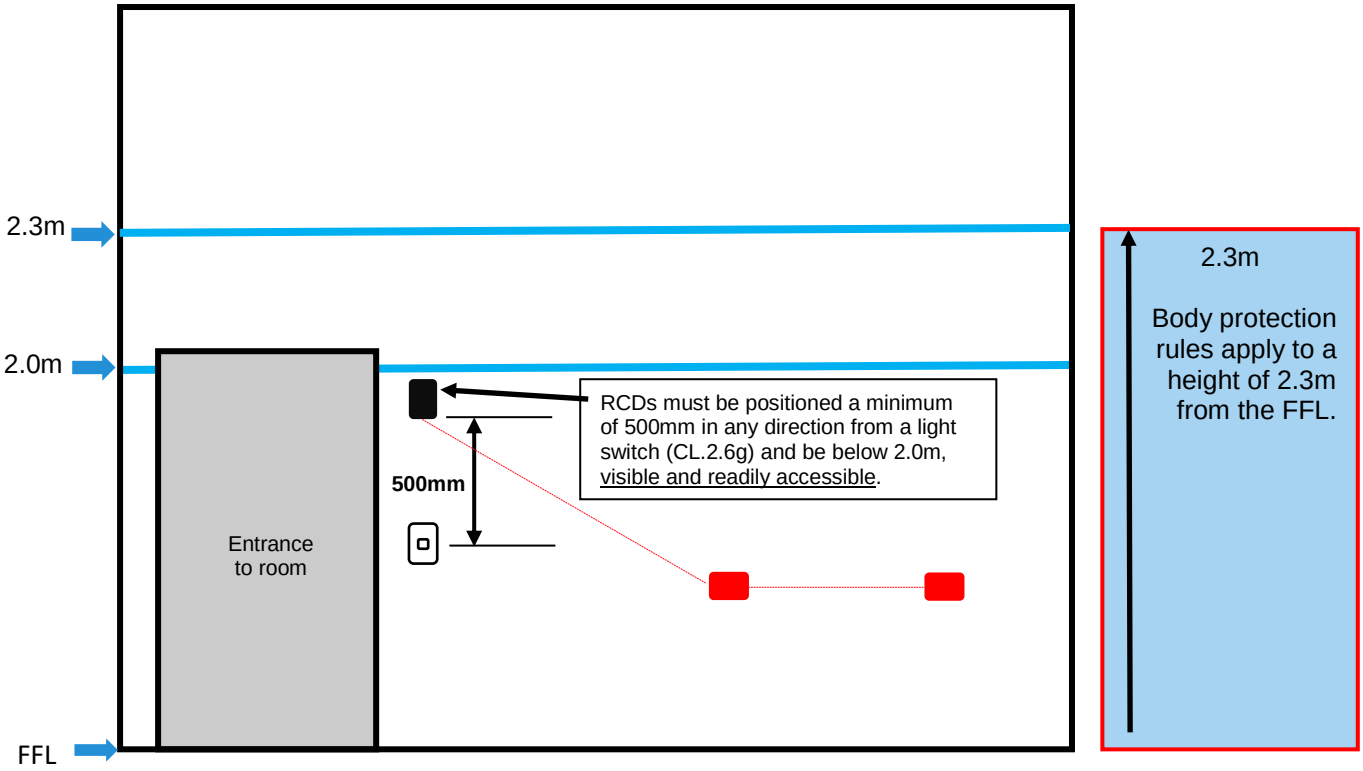
CL.2.6 (c) – (LIM or LIOM) Controls and indicators of monitors are ***not*** to be mounted under benches, in cupboards or behind bulky equipment.

CL.2.7.4.1 – (isolated supplies) socket-outlets on isolated protected supplies shall be:

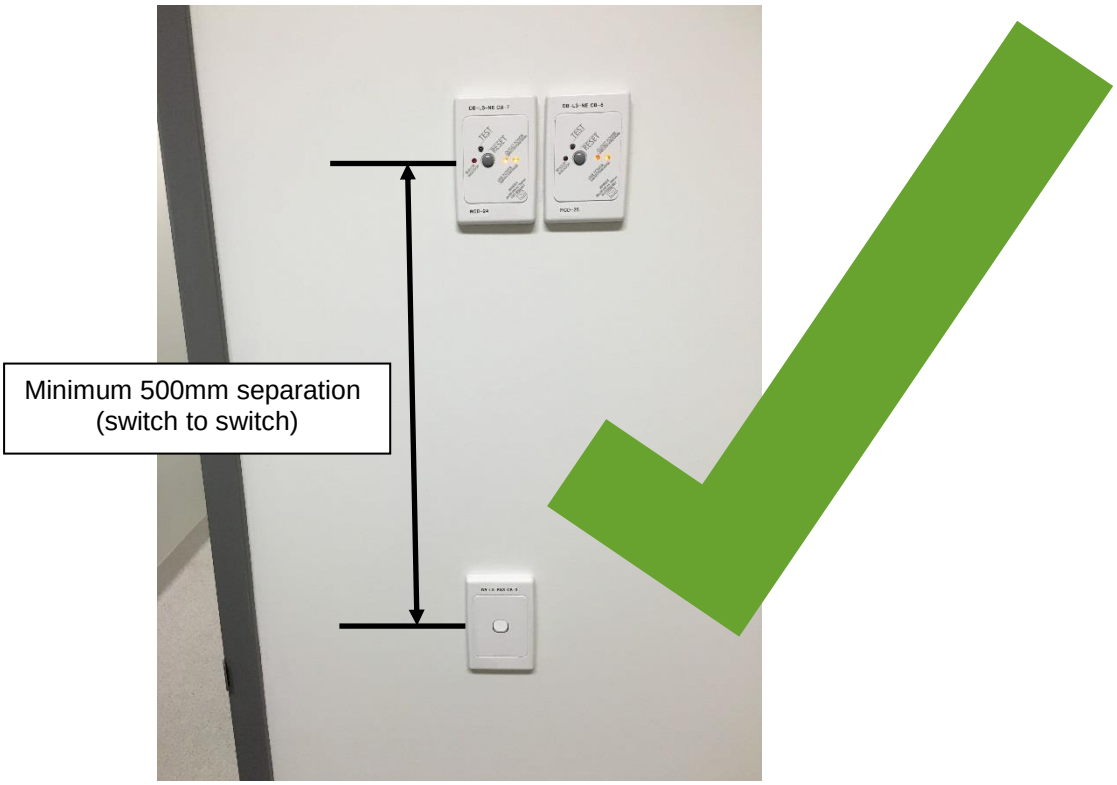
- Marked 'Isolation Transformer Protected'.
- Marked 'From LIM X'.
- The switch shall indicate when on, by a red marking or red indicator light (CL.2.7.4.2).
- Socket outlets ***shall not*** have DB/CB identification affixed.

CL.2.7.5 – (isolated supplies) Socket-outlets shall be switched in all active conductors. Each socket-outlet shall be individually controlled by its own accessible manual switch.
All supply conductors in transformer-isolated supplies are active conductors, socket-outlets protected by isolation transformers shall be provided with a switch that operates in all active conductors (double pole).

Body-protected patient area – typical wall elevation 'A'

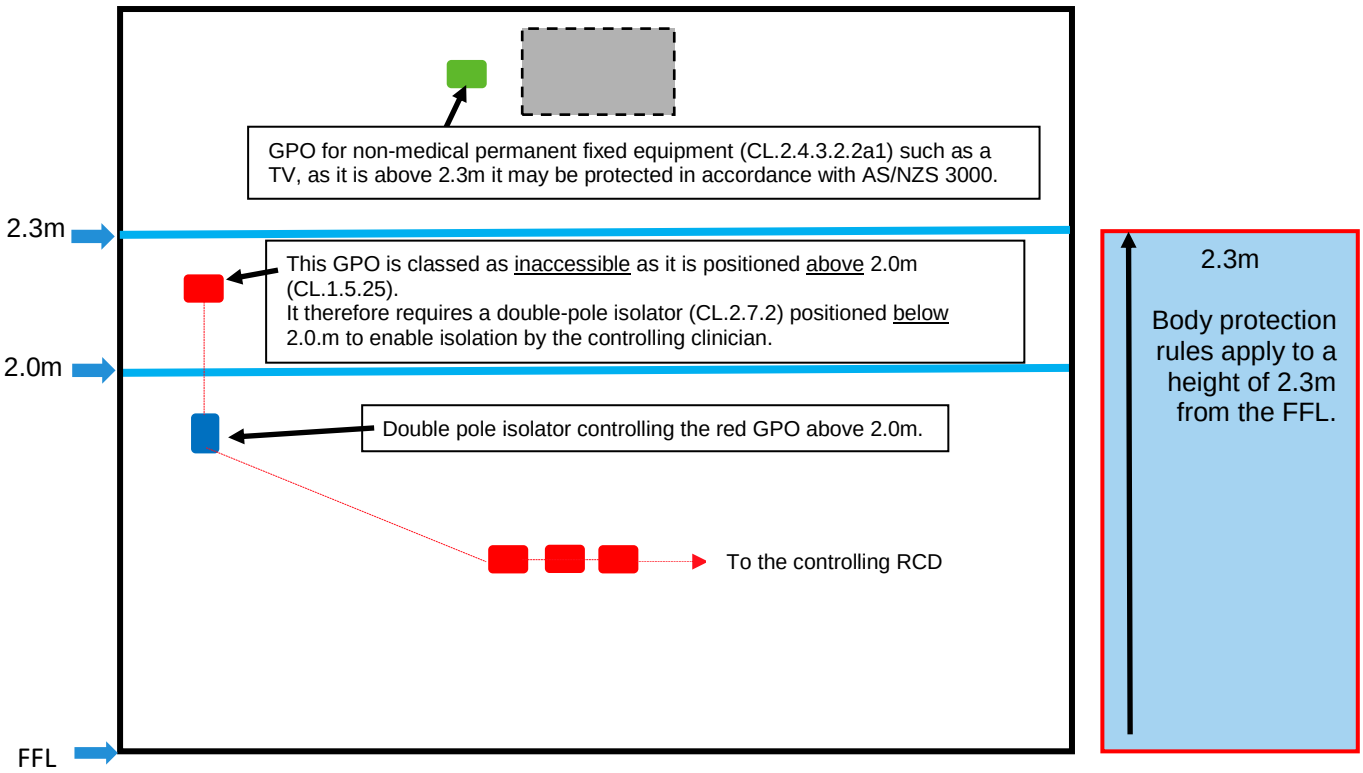


Body-protected GPOs shown coloured red
RCD shown coloured black



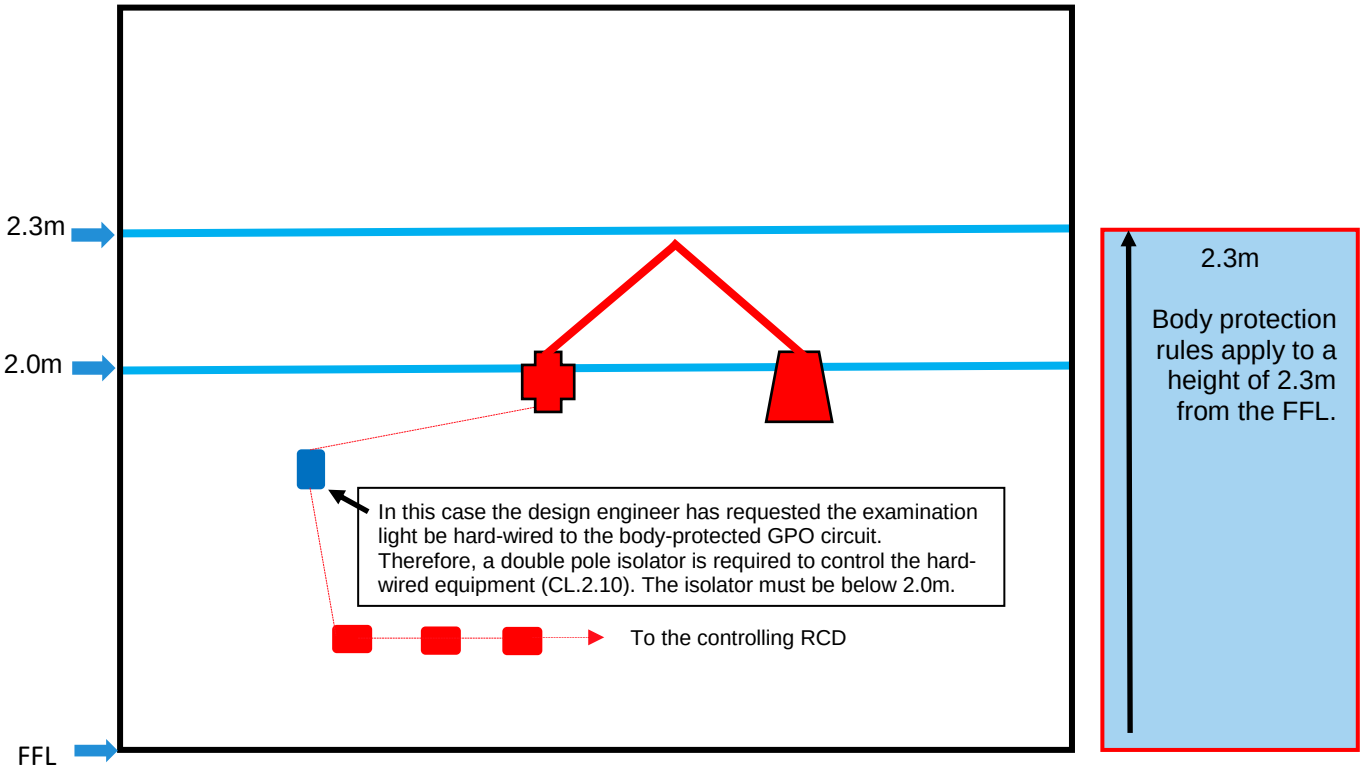
The 500mm separation also applies to network controlled light switches.

Body-protected patient area – typical wall elevation 'B'



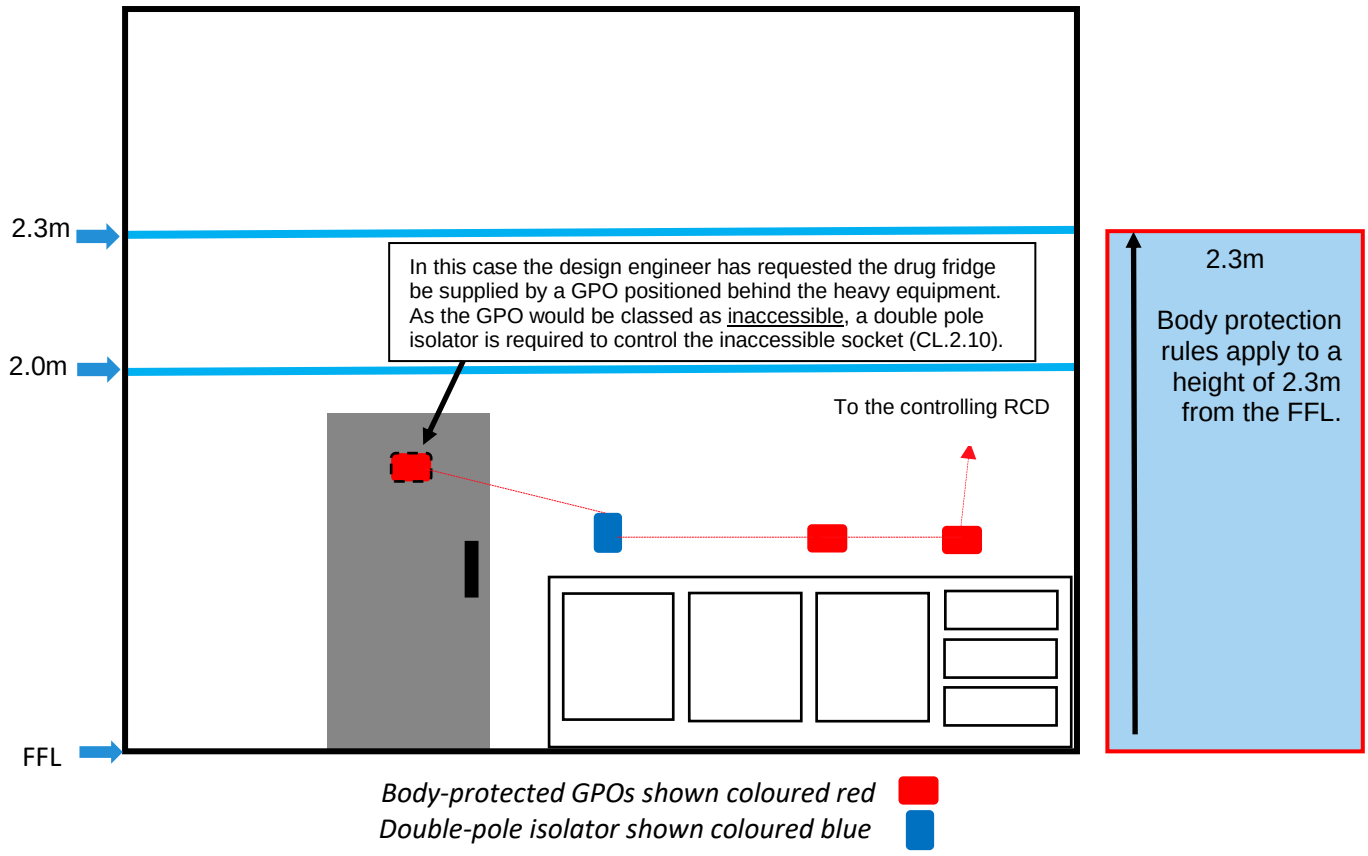
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue
AS/NZS 3000 protected GPO shown coloured green

Body-protected patient area – typical wall elevation 'C'



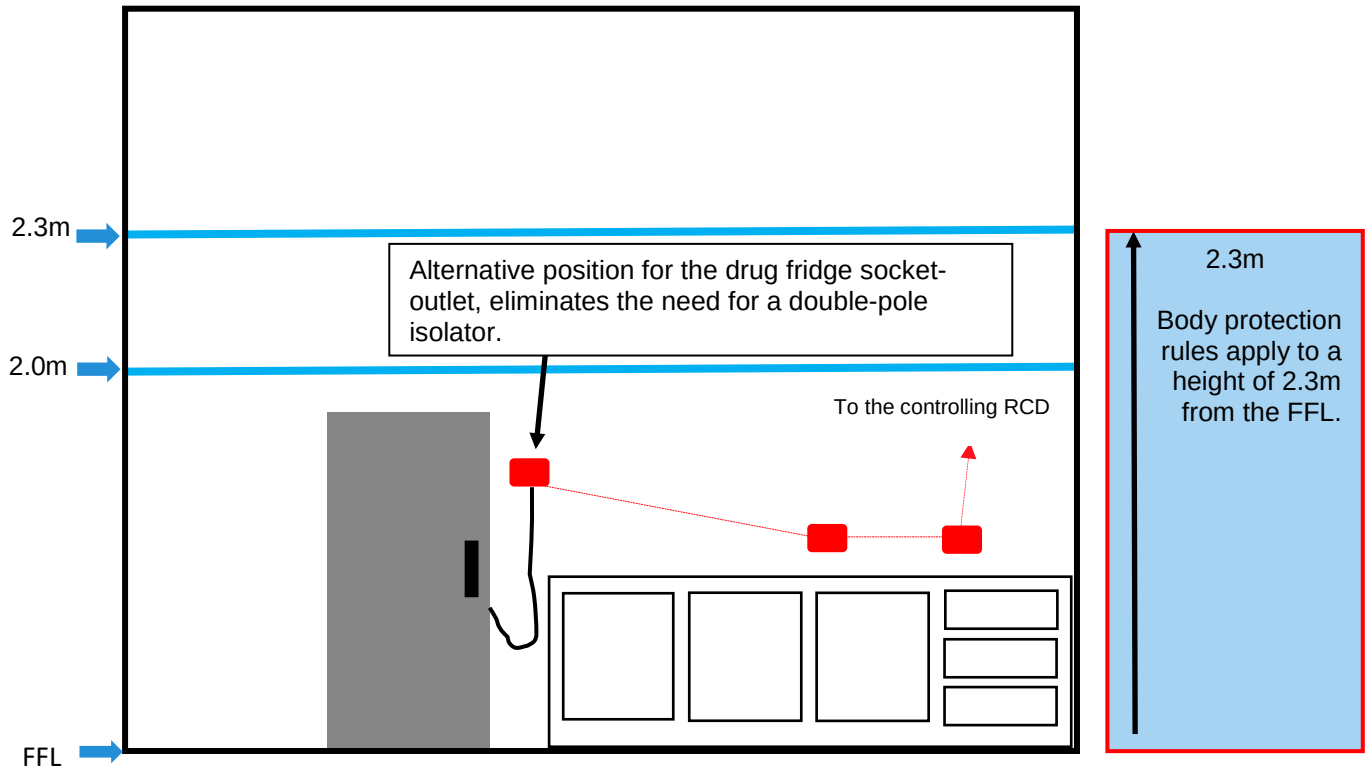
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'D'



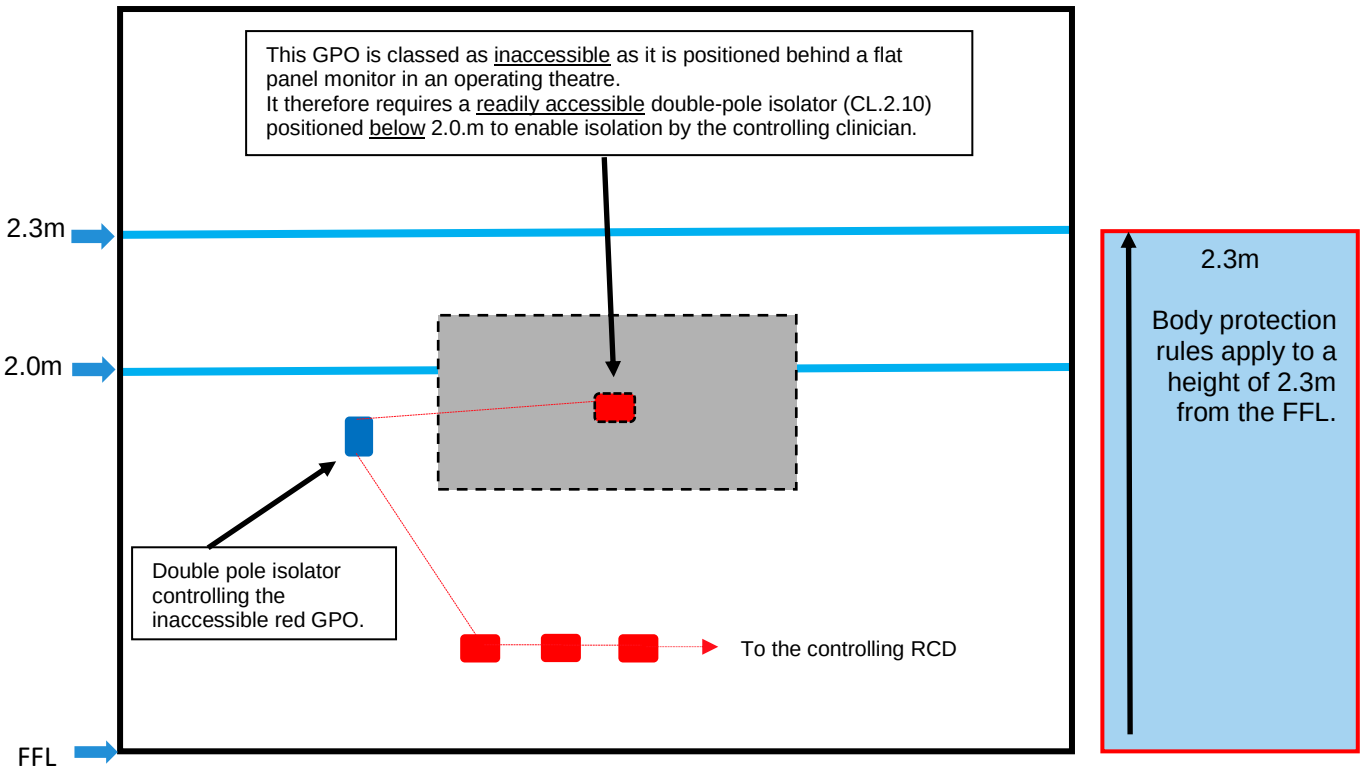
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'D1'



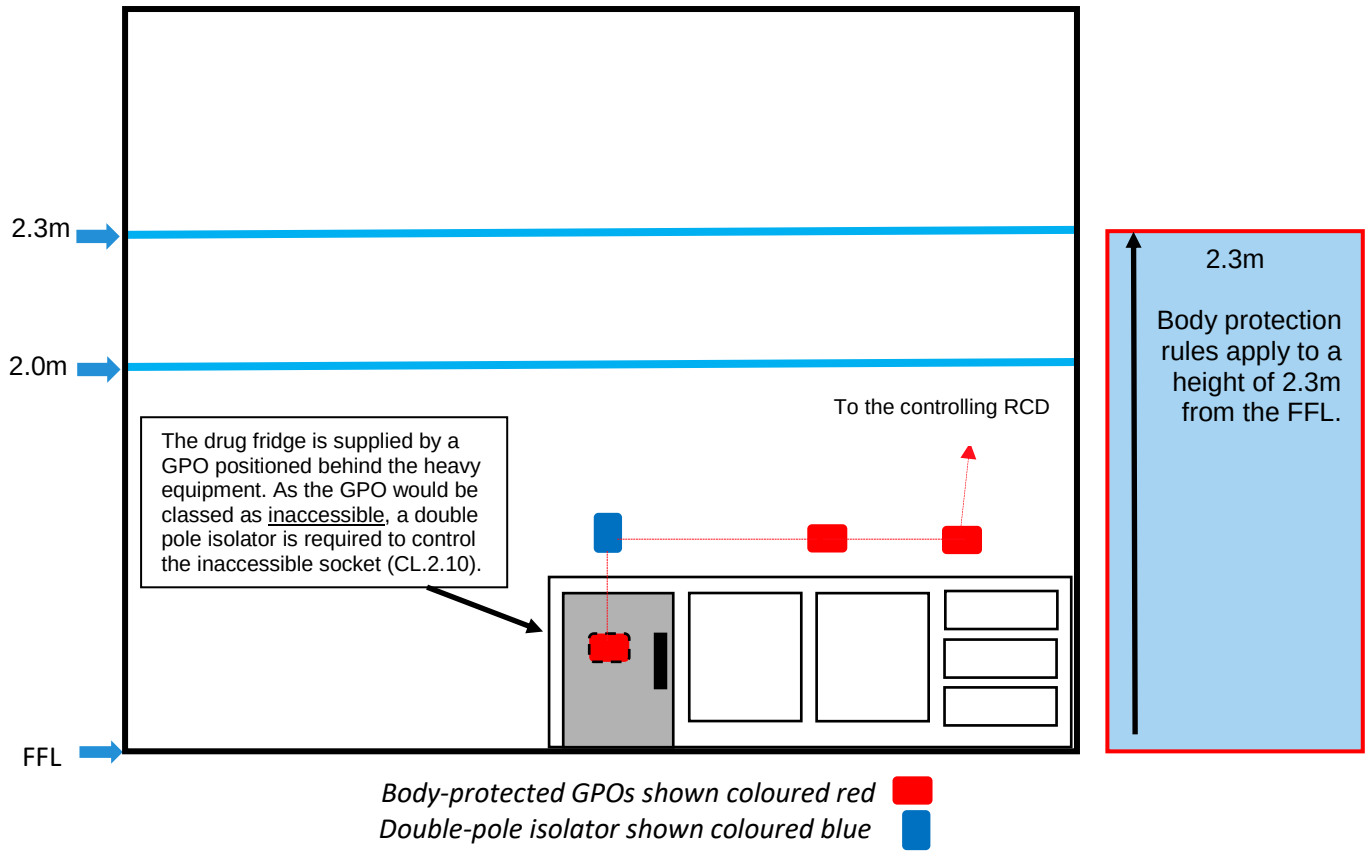
Body-protected GPOs shown coloured red

Body-protected patient area – typical wall elevation 'E'



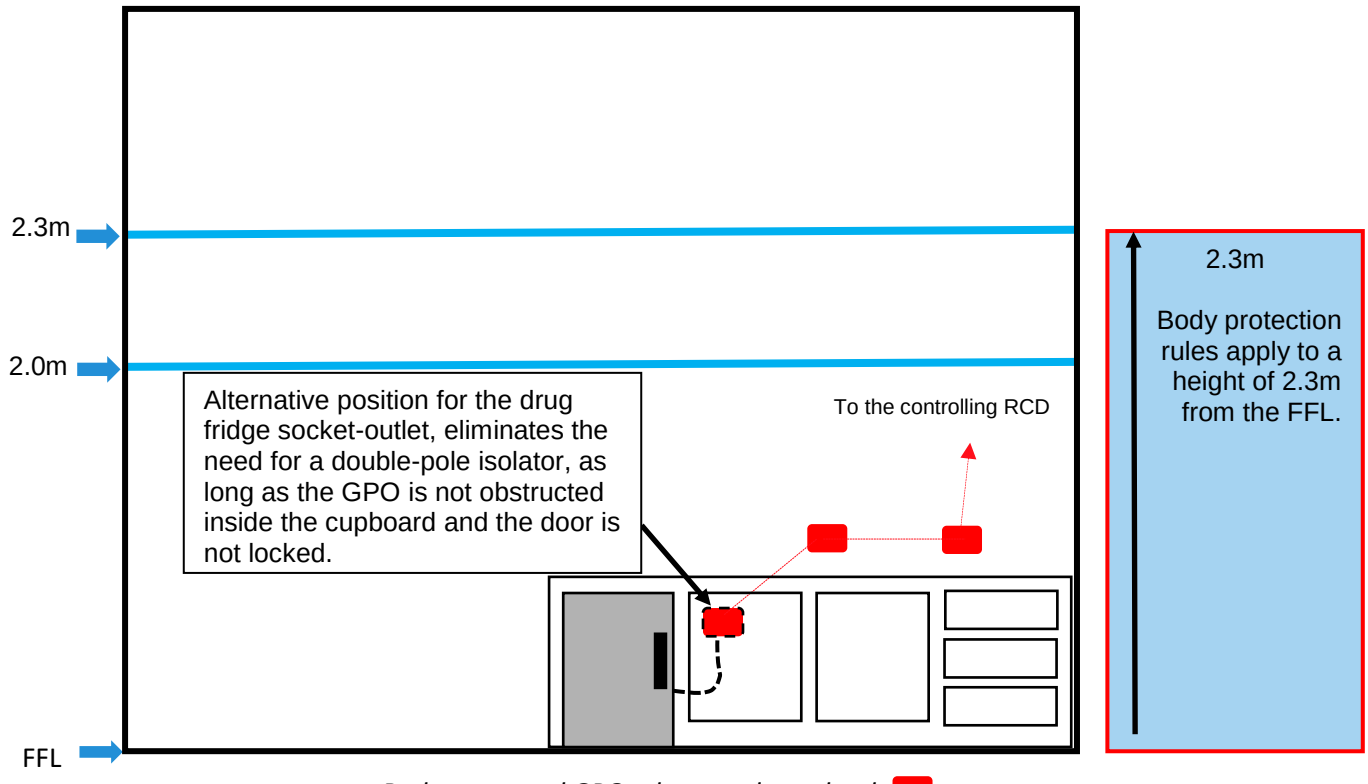
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'F'



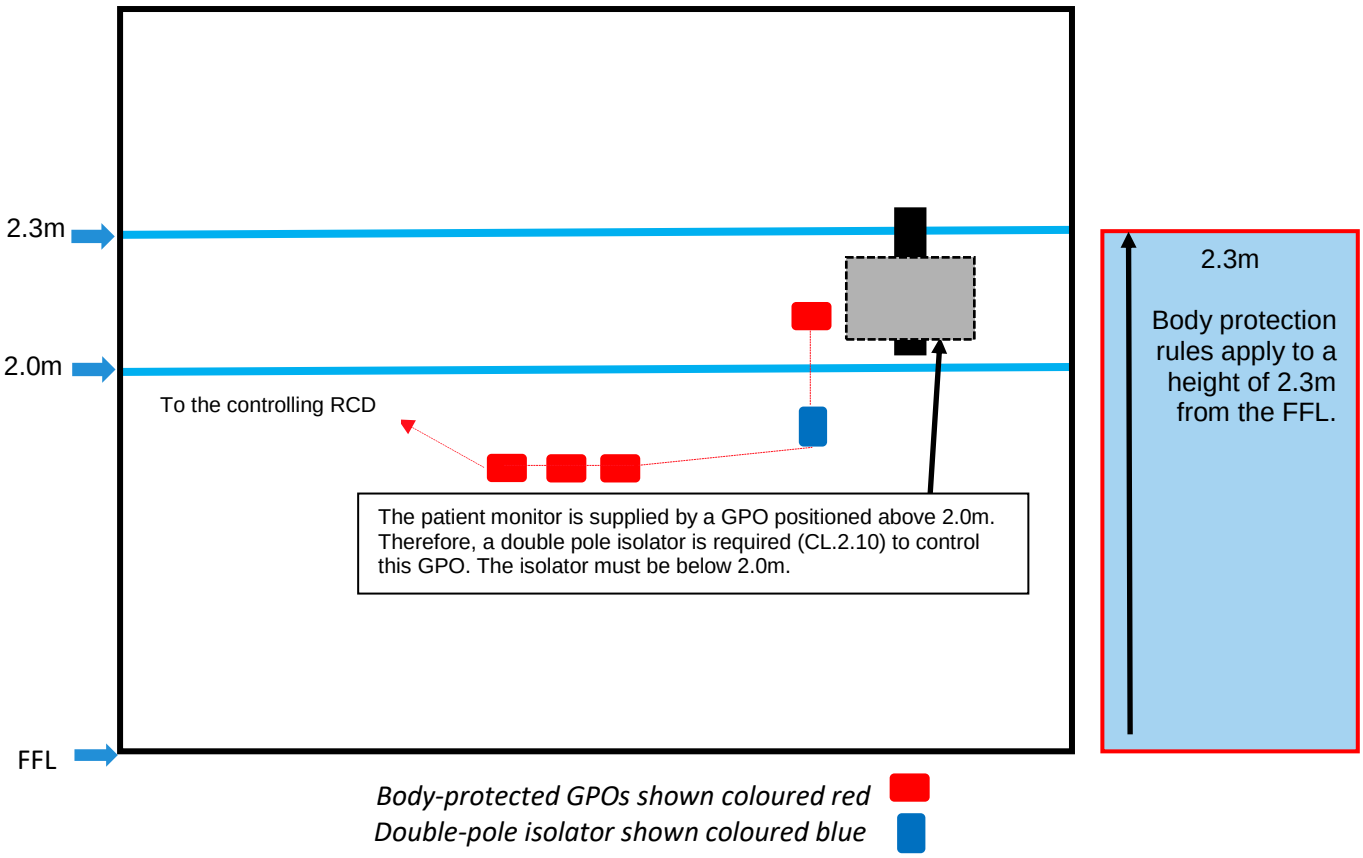
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'F1'



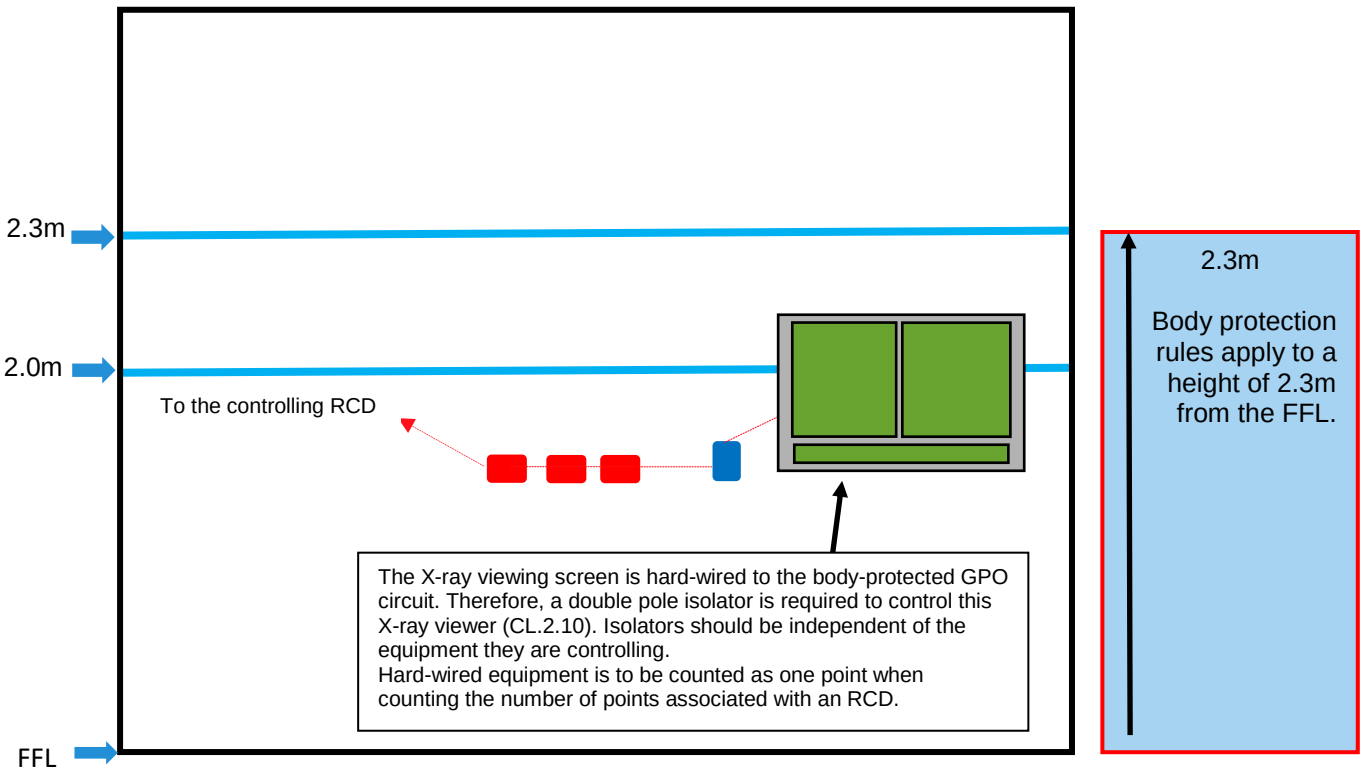
Body-protected GPOs shown coloured red

Body-protected patient area – typical wall elevation 'G'



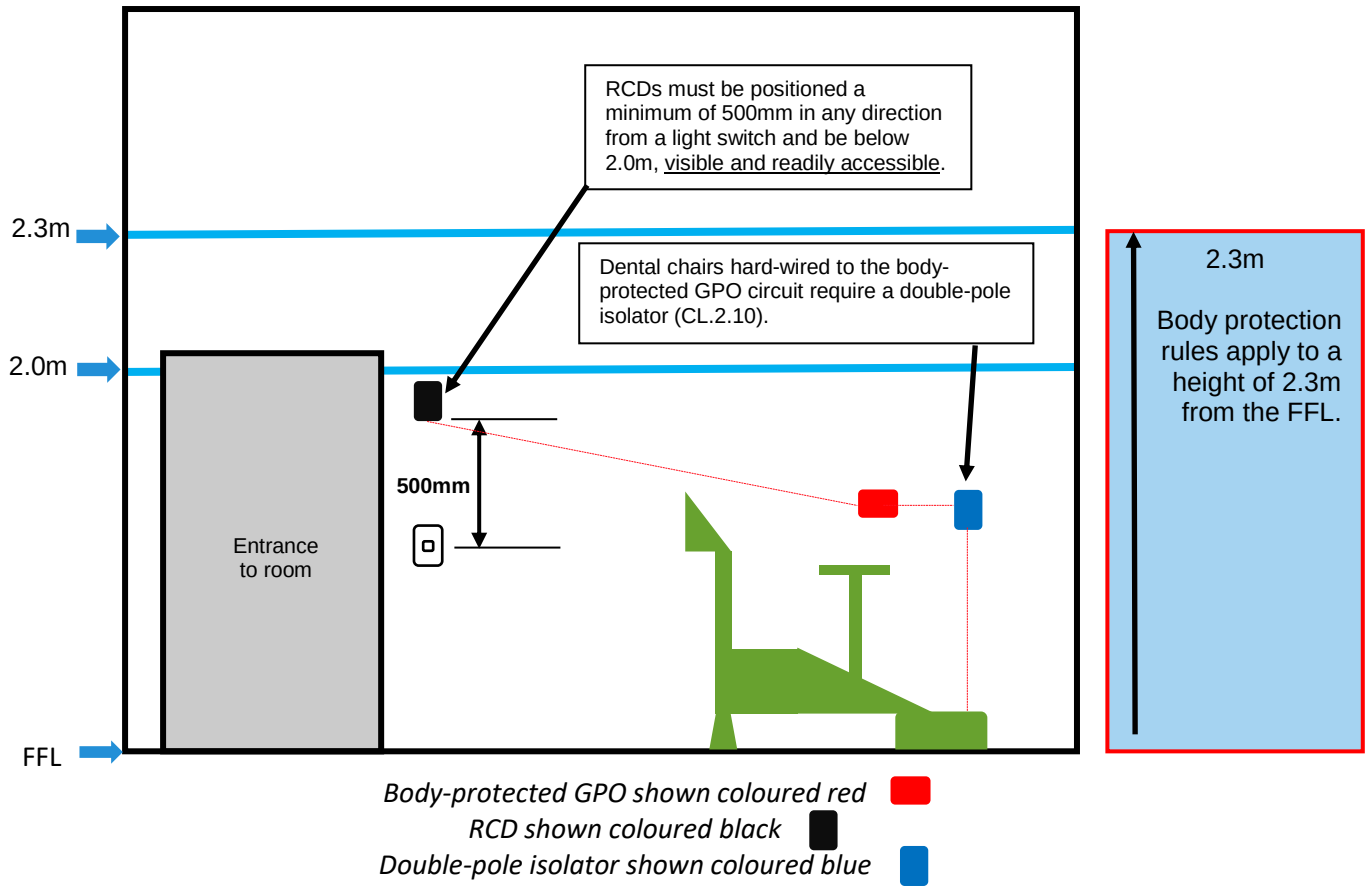
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'H'



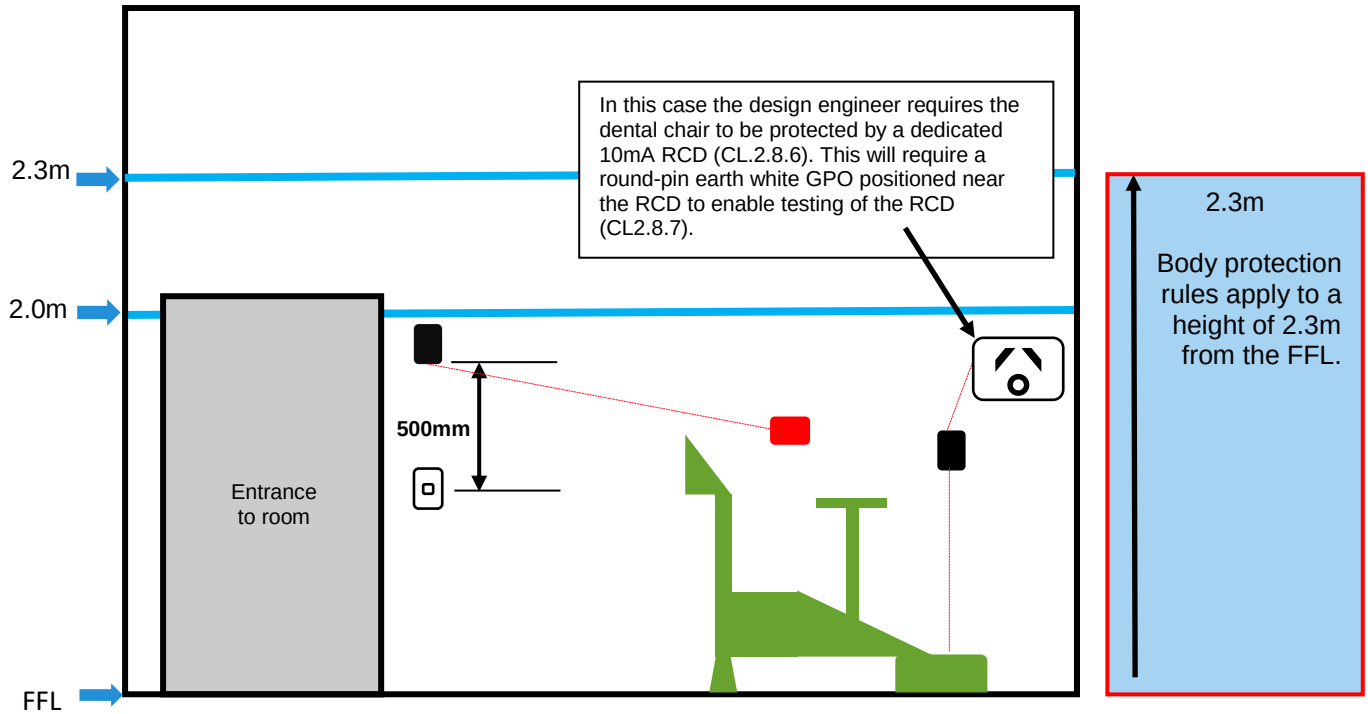
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'I'



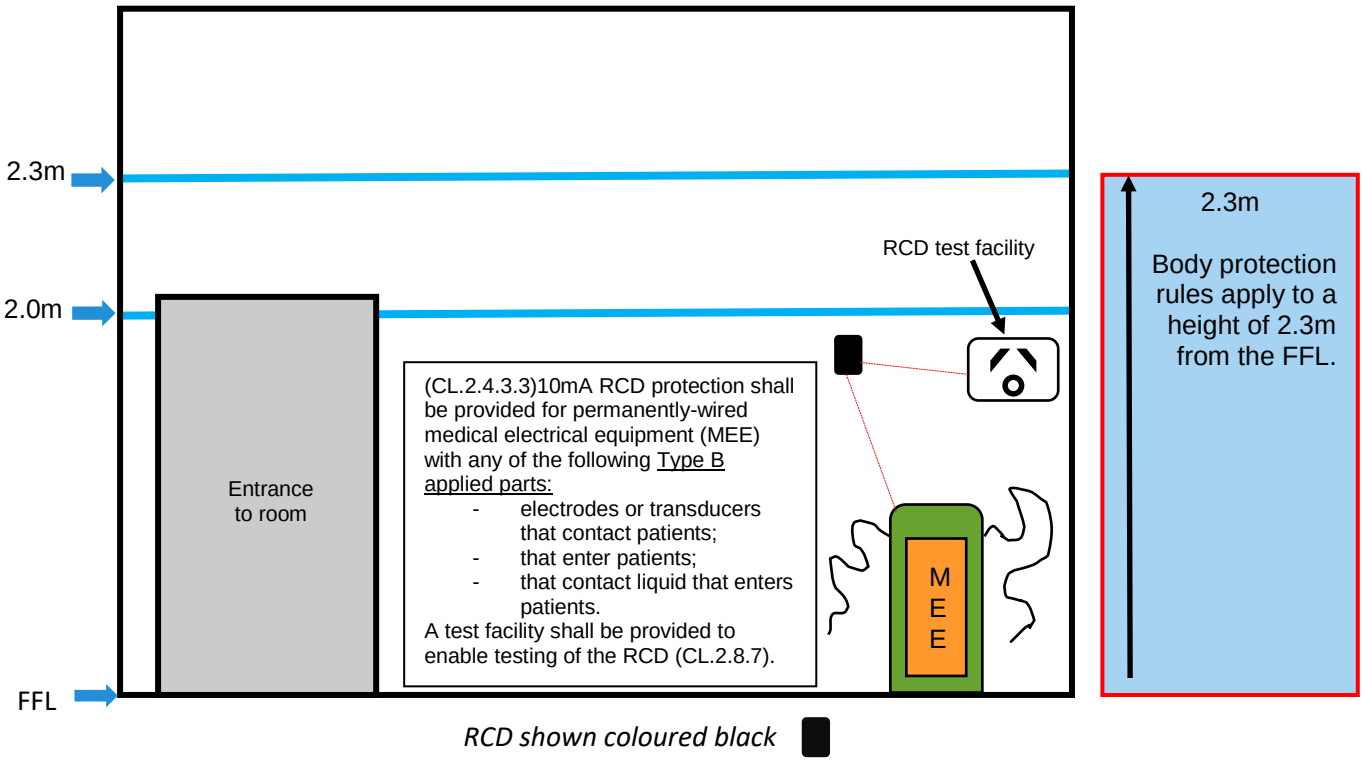
Body-protected GPO shown coloured red
RCD shown coloured black
Double-pole isolator shown coloured blue

Body-protected patient area – typical wall elevation 'J'



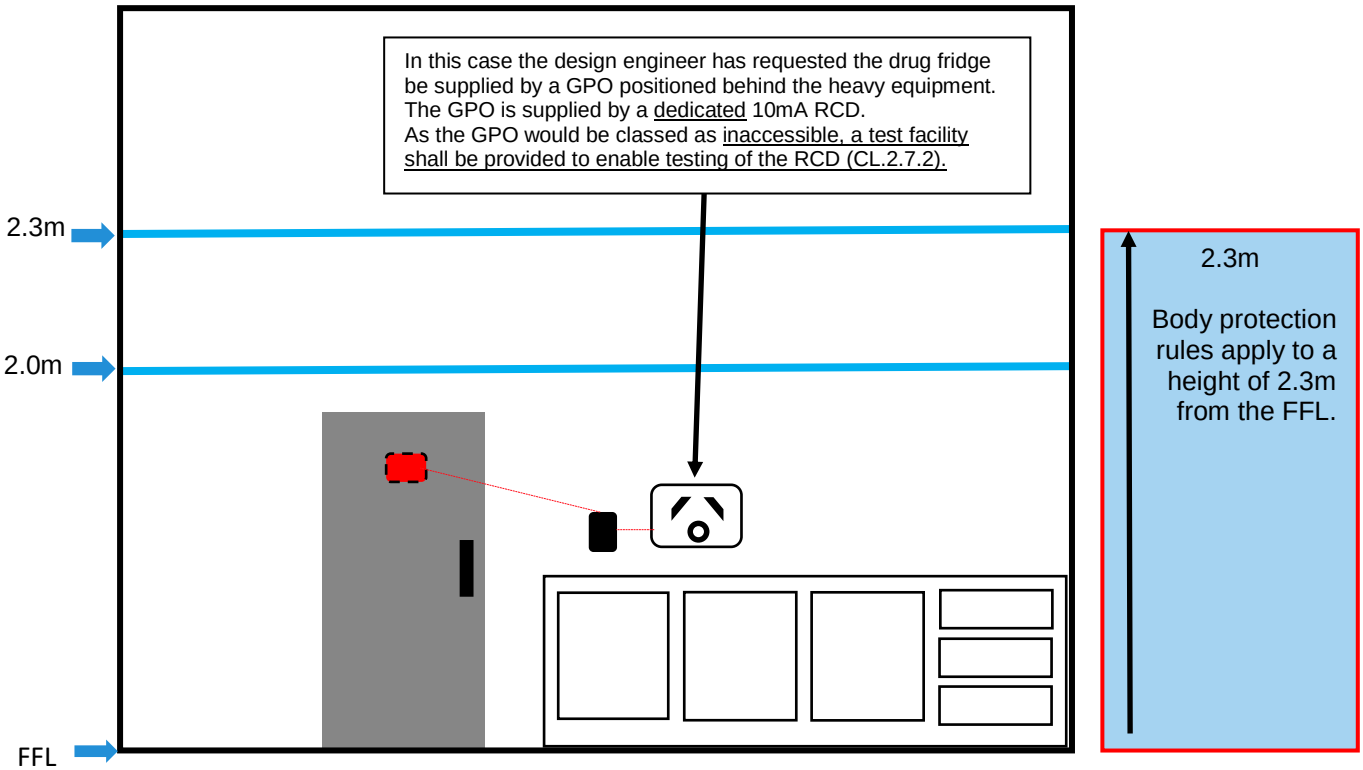
Body-protected GPO shown coloured red
RCDs shown coloured black

Body-protected patient area – typical wall elevation 'K'



RCD shown coloured black

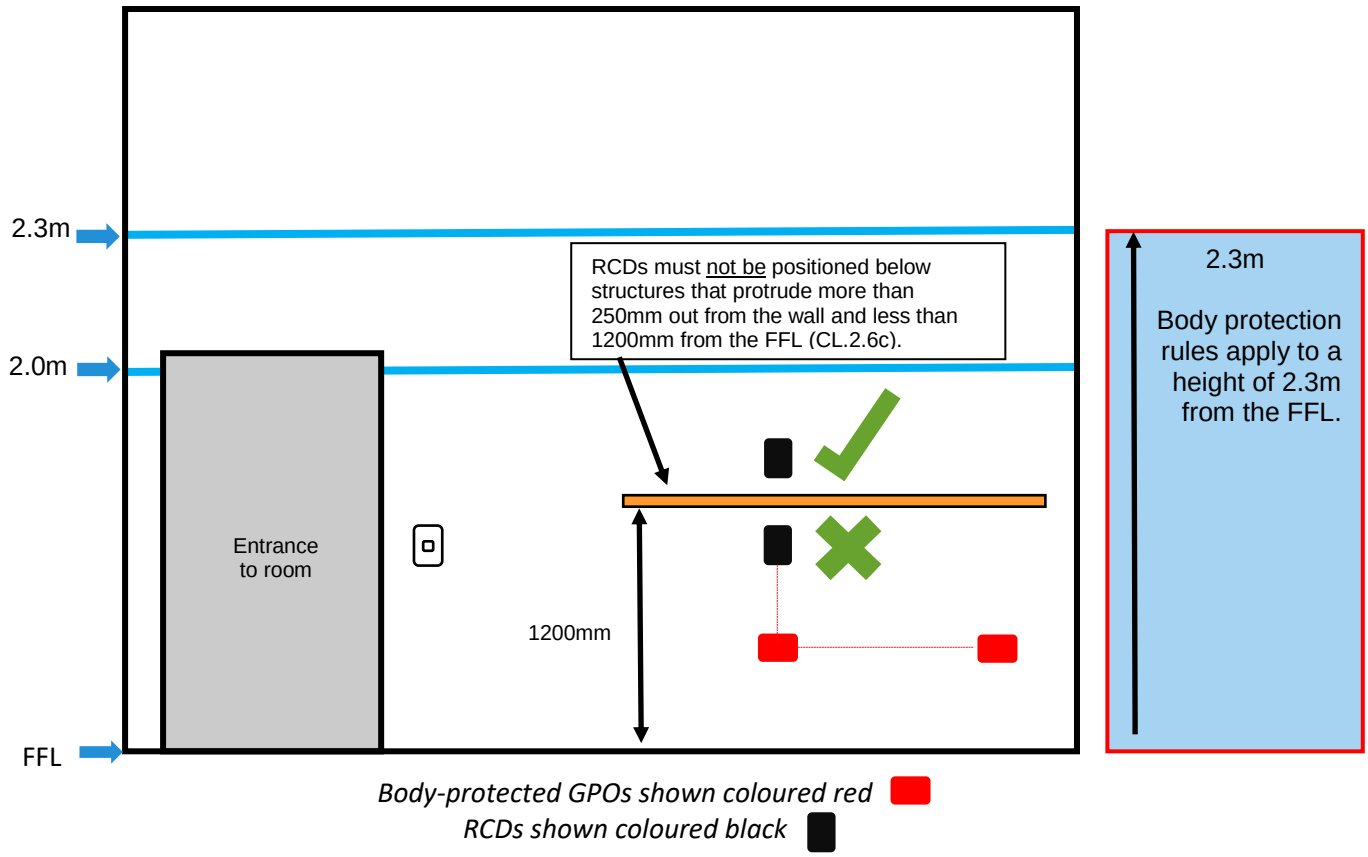
Body-protected patient area – typical wall elevation 'L'



RCD shown coloured black

Body-protected GPO shown coloured red

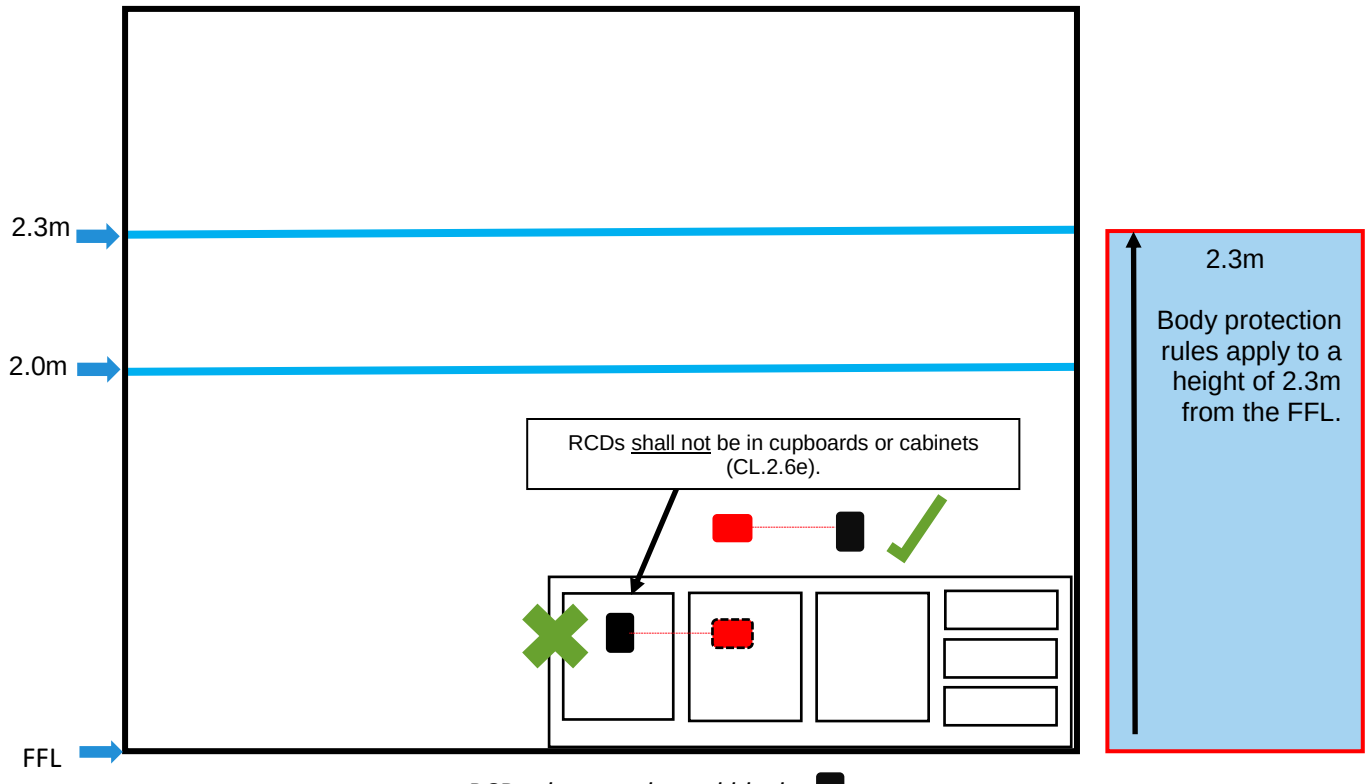
Body-protected patient area – typical wall elevation 'M'



Body-protected GPOs shown coloured red

RCDs shown coloured black

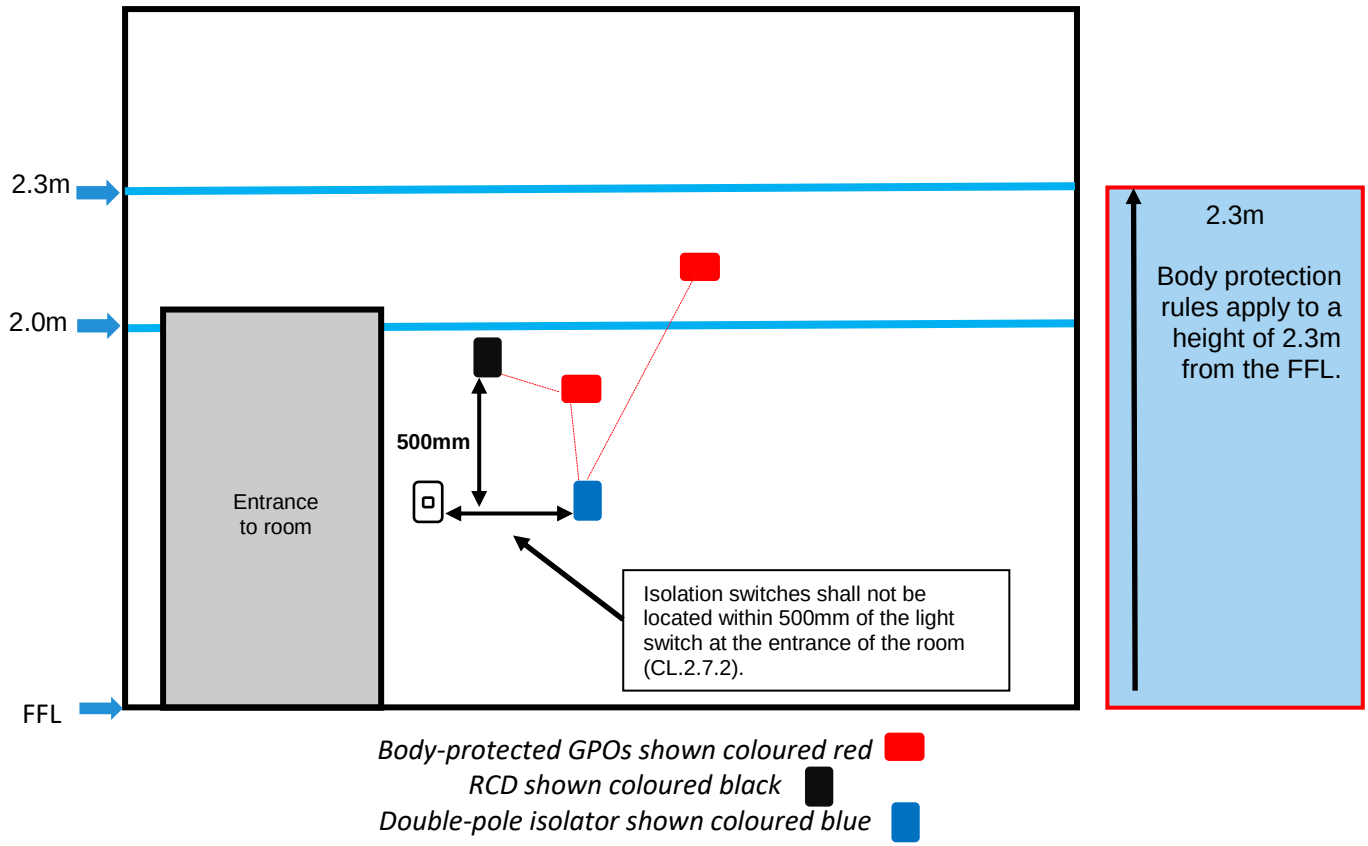
Body-protected patient area – typical wall elevation 'N'



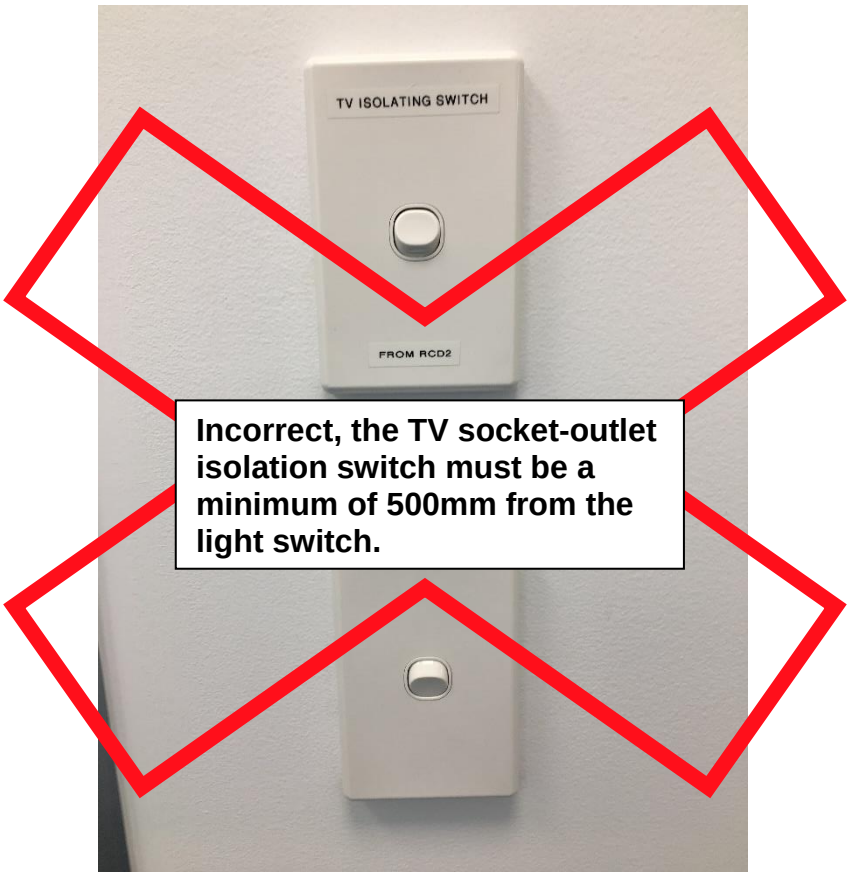
RCDs shown coloured black

Body-protected GPOs shown coloured red

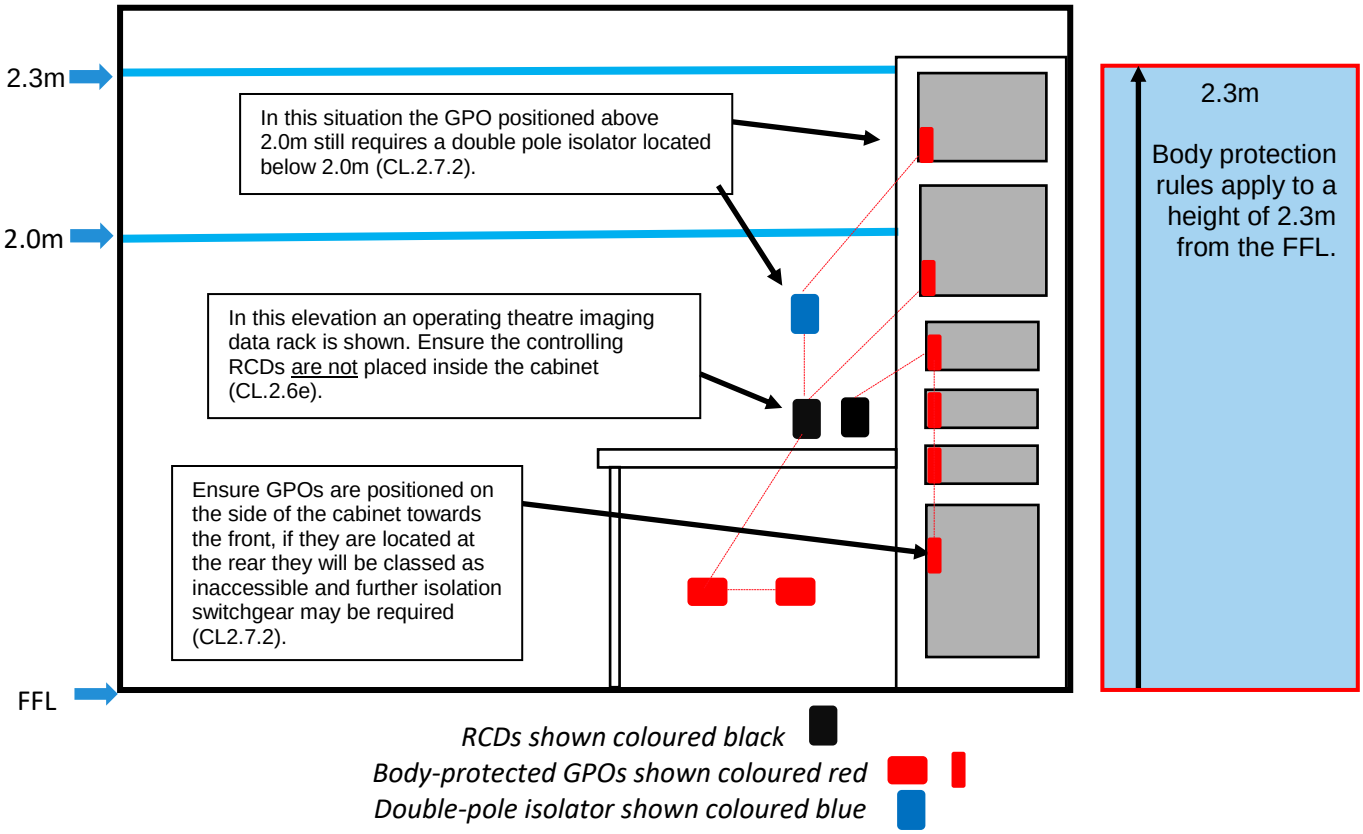
Body-protected patient area – typical wall elevation 'O'



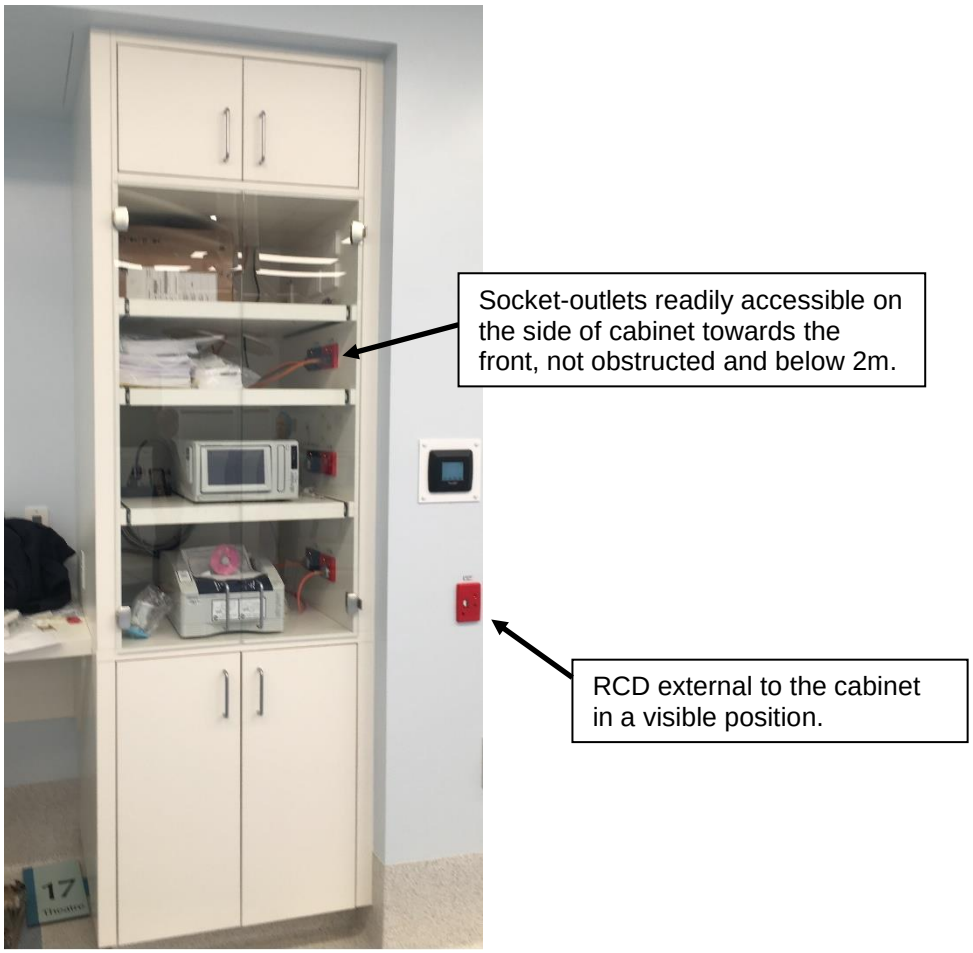
Body-protected GPOs shown coloured red
RCD shown coloured black
Double-pole isolator shown coloured blue



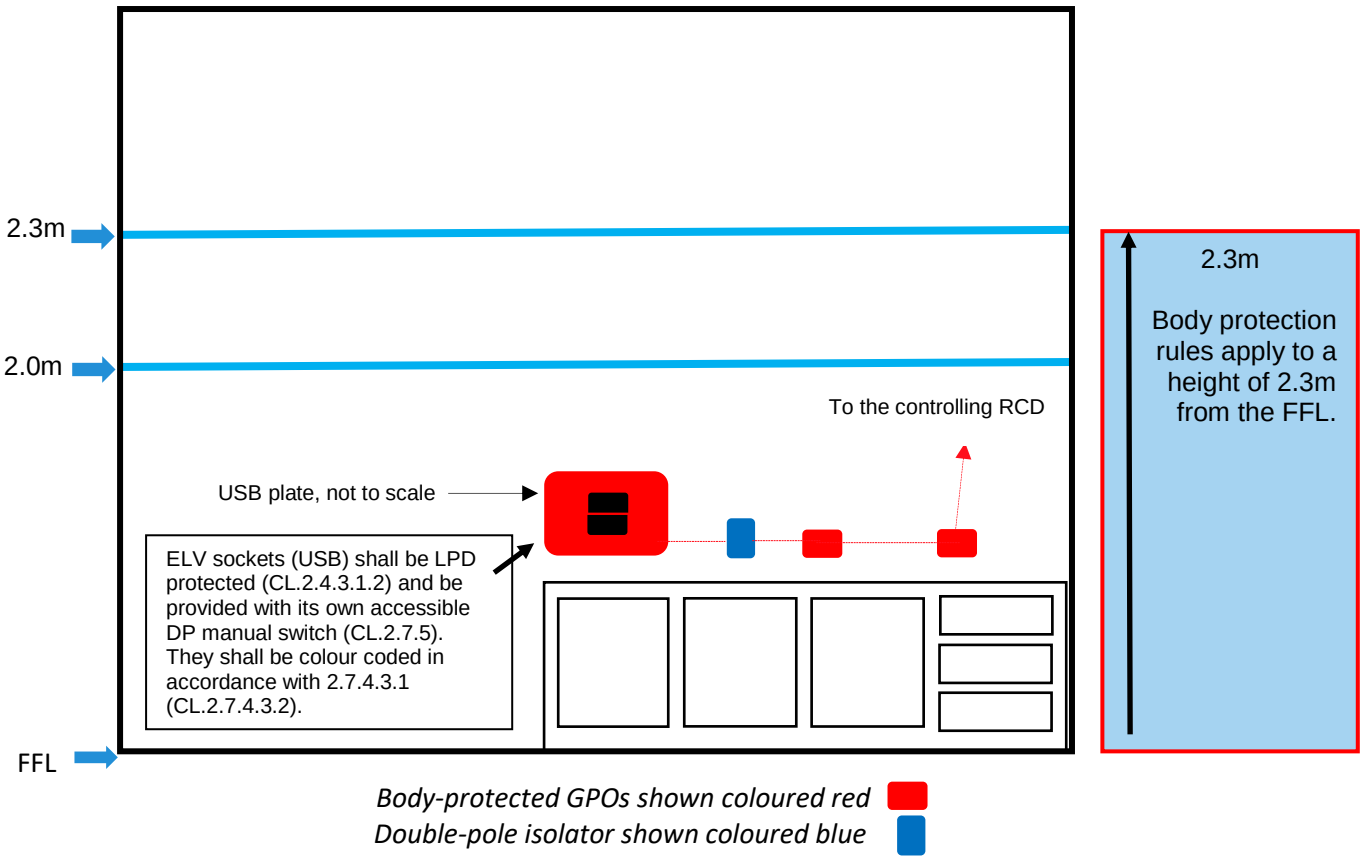
Body-protected patient area – typical wall elevation 'P'



RCDs shown coloured black
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue



Body-protected patient area – typical wall elevation 'Q'

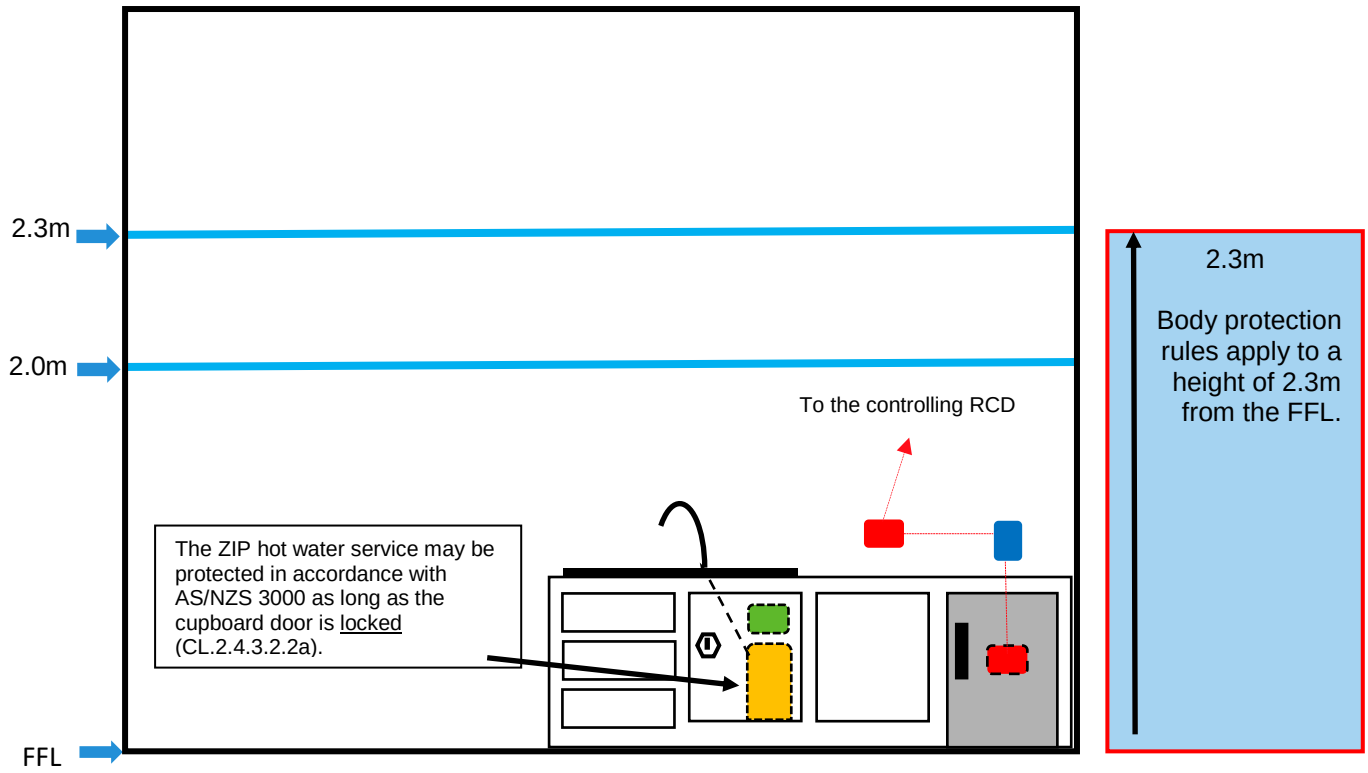


Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue

Incorrect, the USB sockets shall have a DP isolator on the 240V side of the power supplies.

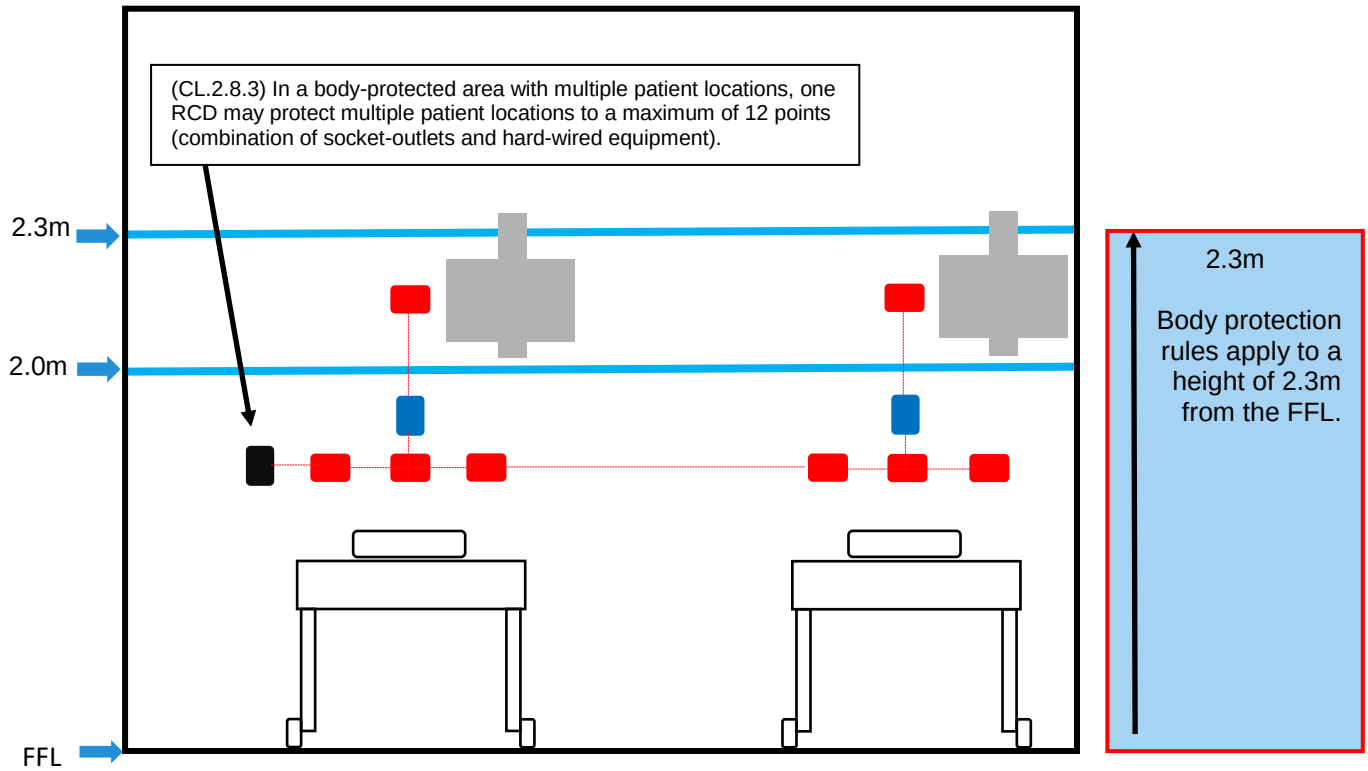
Correct, a DP isolator is incorporated into the plate to enable isolation of the USB power supply.

Body-protected patient area – typical wall elevation 'R'



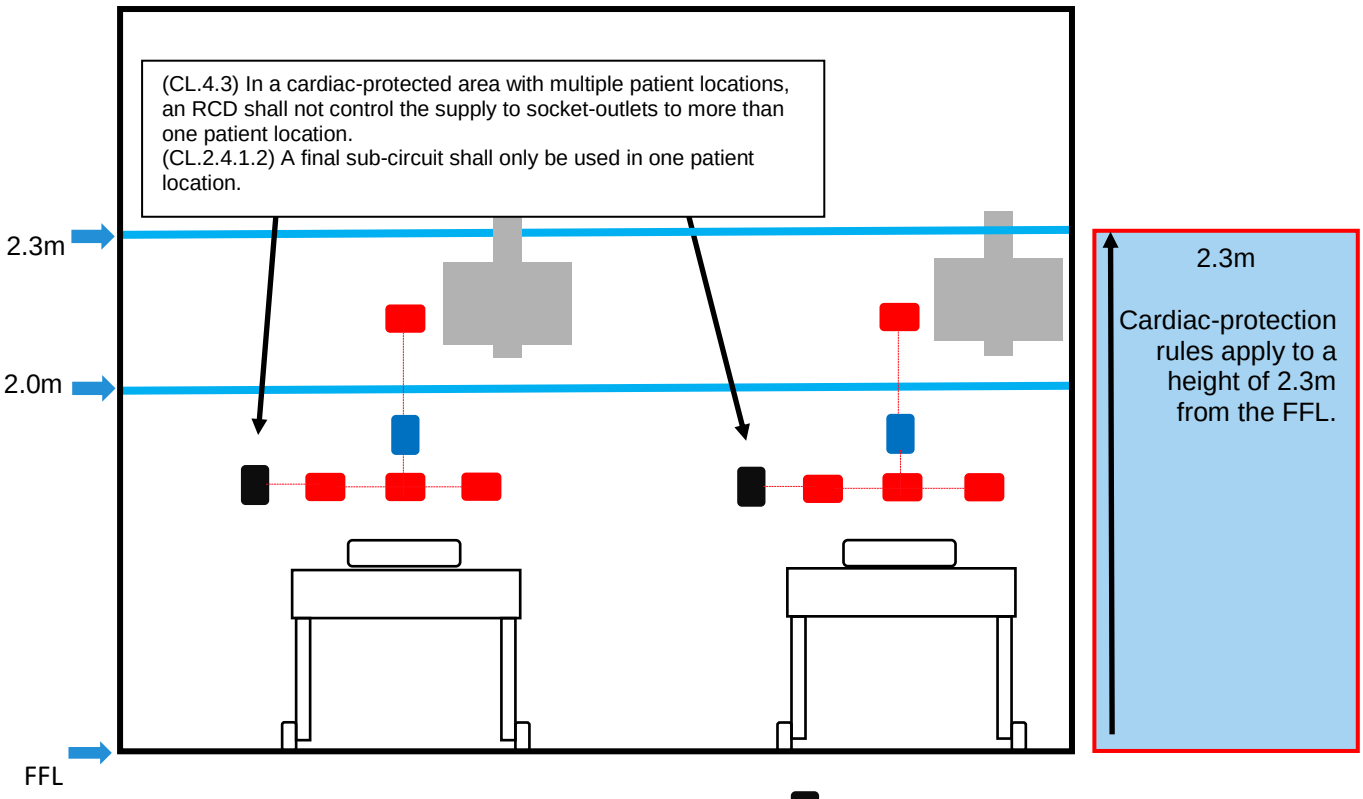
Body-protected GPOs shown coloured red
Double-pole isolator shown coloured blue
AS/NZS 3000 protected GPO shown coloured green

Body-protected patient area – typical wall elevation 'S'



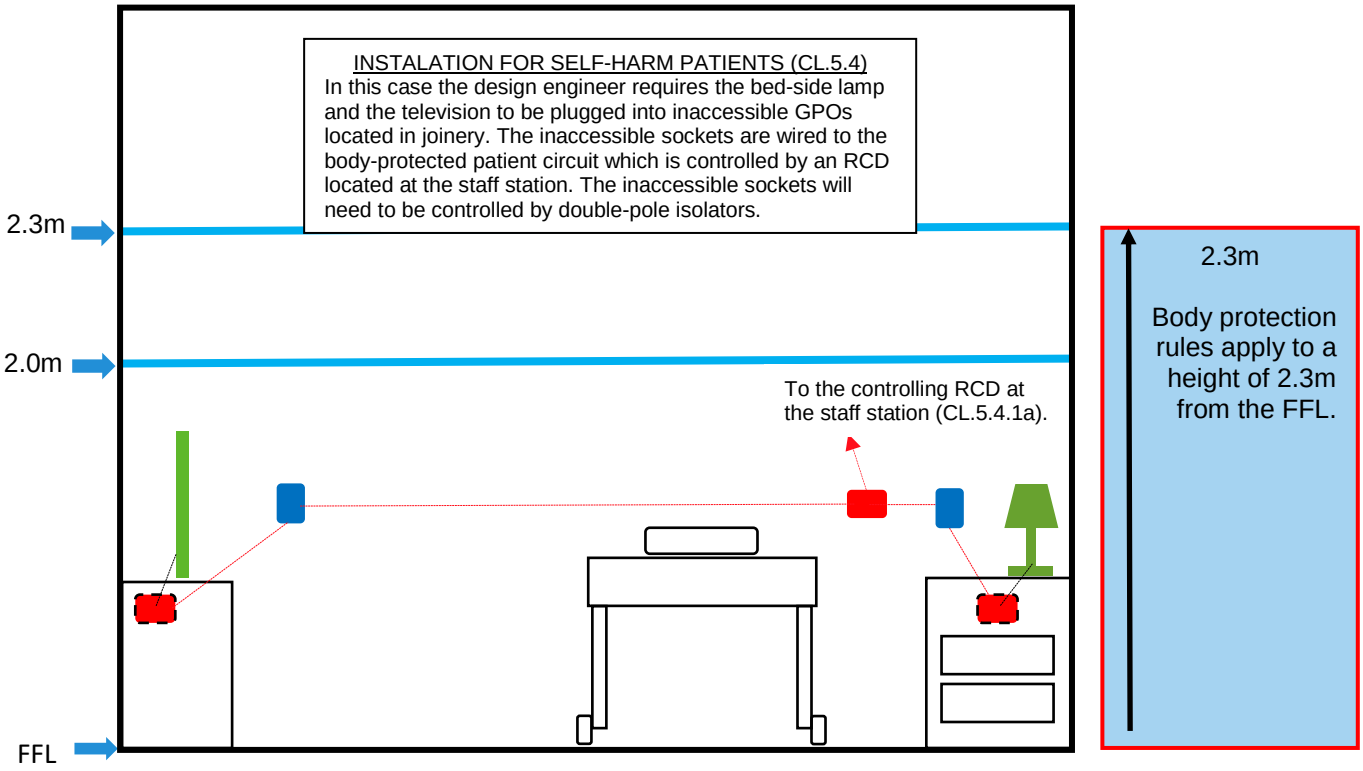
RCD shown coloured black
Body-protected GPOs shown coloured red
Double-pole isolators shown coloured blue

Cardiac-protected patient area – typical wall elevation 'T'



RCDs shown coloured black
Cardiac-protected GPOs shown coloured red
Double-pole isolators shown coloured blue

Body-protected patient area – typical wall elevation 'U'



Body-protected GPOs shown coloured red
Double-pole isolators shown coloured blue

Electrical Testing Company Pty Ltd

Est: 1969

Unit 15, 10 Victoria Ave
Castle Hill NSW 2154

T: 1300 TEST IT
1300 8378 48

electricaltestingcompany.com.au