



Public Transport Standard: Equipment Room

Engineering — Design

Asset Management

CE5-DOC-003514

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1. Introduction

The South Australian Public Transport Authority (SAPTA) is a Directorate within the Department for Infrastructure and Transport (DIT) responsible for the delivery of public transport services.

SAPTA on behalf of the department manages the Adelaide Metropolitan Public Transport Network. As part of the execution of responsibilities of this role, it must have a governance structure which includes the adoption of standards, policies and procedures.

2. Purpose

The purpose of this standard is to specify the requirements for the design of a Common Equipment Room (CER) at a public transport station, stop or bus interchange precinct.

3. Scope

This Standard applies to all the Department's projects and to contractor organisations designing, constructing, or maintaining an equipment room associated with rail passenger stations and tram or bus stops for the metropolitan transportation networks.

4. Related Documents

DOCUMENT NAME	DOCUMENT NUMBER
Design – Stations – Earthing and Bonding	TP1-DOC-003507
Guidelines for the Protective Provisions Relating to Electrical Earthing and Bonding for the Adelaide Metro Electrified Rail Network (commonly referred to as <i>the E&B Guidelines</i>)	AR-EL-STD-0102
Guideline for Low Voltage Electrical Earthing and Bonding for the Adelaide Metro Tram Network	TP2-DOC-002020
Design – Stations – Shelters	CS1-DOC-003509
Design – Electrical Infrastructure	CS5-DOC-003511
Design – Security System	PI5-DOC-003512
Design – Stations – Passenger Information Systems	PI1-DOC-003513
Communications Network Principles and Practices for Public Transport	PTS-AR-10-CN-SPE-00200400
Standard Drawing, Public Transport — System Electrical, Internal Main Distribution Board with DALI Control, Detail Drawing	CS5-DRG-365195

5. References

- *AS/CA S009 Installation Requirements for Customer Cabling (Wiring Rules)*
- *AS1324.1 Air filters for use in general ventilation and air conditioning – Application, performance and construction*
- *AS 1680 Interior and Workspace Lighting*
- *AS 2293.1 Emergency Escape Lighting and Exit Signs for Buildings – System Design, Installation and Operation*
- *AS 3000 Electrical Installations (Wiring Rules)*
- *AS 3084 Telecommunications installations – Telecommunications pathways and spaces for commercial buildings*
- *ACBC National Construction Code*

6. Application

Railways have 'Stations', while tramways and buses have 'Stops'. Throughout this document the term 'station' is used for convenience, but all requirements herein, unless specifically noted, apply equally to:

- Heavy-rail railway stations on the AMPRN;
- Tram stops on ballasted track sections of the AMPRN's tram network or other stops where space permits (for example, the Entertainment Centre and South Road stops);

- Bus infrastructure (interchanges, O-Bahn, car parks, etc.); and
- Other public transport infrastructure as required (for example, underpasses).

7. Design requirements

7.1. Design life

The structural elements of the Equipment Room must have a design life of 50 years.

7.2. General

The Station Precinct Equipment Room must provide a suitable climate-controlled environment to securely house the infrastructure required for the Station Precinct security system, electrical, and Passenger Information (PI) systems. The room must be sized by co-ordinating the requirements of CS5-DOC-003511 *Electrical Infrastructure*, PI5-DOC-0012 *Security Systems*, PI1-DOC-003513 *Passenger Information Systems* and future AMPRN Signalling or Communications upgrades.

The equipment in the room will develop fan noise as a result of the climate control system. The fan noise will result in an Occupational Health and Safety (OHS) issue if located in normally occupied rooms.

The room may be part of a larger building used to house other infrastructure or staff facilities.

7.3. Dimensions and Structure

The roof style must be consistent with the Roof Style for Railway Lines — refer CS1-DOC-003509 *Shelters*.

7.3.1. New Enhanced Amenity Stations

The Equipment Room must have a minimum floor area of 18 m² without partition to allow for electrical, PI and security system equipment and must be of masonry or concrete construction.

7.3.2. Basic Neighbourhood Stations

- The Equipment Room may have a minimum floor area of 10.0 m² without partition to allow for electrical, PI and security system equipment and must be of masonry or concrete construction.
- When existing stations are receiving a Security (CCTV) upgrade, the Equipment Room may be a precast concrete “hut” of a size complying with the above floor area. This area must be calculated after the fitting of internal insulation — refer to section 7.7.1 (□).
- Any room of 10 m² floor area is limited to the installation of two equipment rack cabinets. If three or more racks are required, the precast hut must be a minimum of 6 m × 3 m external, providing an internal floor area of at least 15.5 m² after fitting of insulation.

Note: All precast concrete huts must be supplied with an additional 100 mm of wall height (minimum 2350 mm above floor level) to accommodate ceiling insulation.

7.3.3. Passenger Information (PI) Cabinets

When a neighbourhood station is having an Equipment Room installed, the existing PI equipment must be relocated from a free-standing, outdoor PIC enclosure into the room.

7.4. Equipment Room Location

- The location of the Equipment Room must be determined by co-ordinating the cabling requirements of the Passenger Information System (PIS), Electrical Infrastructure and Security System Requirements for the particular site, taking into consideration system limitations.

- Where practicable, the Equipment Room must be in a shaded location to minimise the solar air conditioning load.
- Its location should take account of other infrastructure and CPTED principles.
- Entry to the Equipment Room must be via a ramp to allow heavy loads (tools and equipment) to be trolleyed in and out. Stairs are not permissible.
- A bitumen or concrete hard-stand area must be provided outside of the door. This should be extended to connect with any other path or car park area in the near vicinity.
- Fencing must be provided to isolate the room from the rail corridor and pedestrian areas. Entry to the room must be possible without having to enter the rail corridor. Where the room is exposed to vehicular traffic, bollards must be provided.
- The building's location and design must take into account Earthing and Bonding (E&B) requirements when on electrified rail or tram territory. The station's isolation transformer must not be installed inside the room.
- Where the station is associated with an underpass or overpass, the room may be at ground level.
- Where possible, the room should be positioned to provide ready access for maintenance personnel and parking for a maintenance vehicle(s) should be provided.

7.5. Departmental Security Consultation

If a partition is used to make a separate security enclosure within the Equipment Room, it must be reviewed and accepted by the Department before executing a final design.

7.6. AS 3084 Compliance

- a) The fit-out of the room must comply with AS 3084. Note that AS 3084 references the Australian National Construction Code (NCC).
- b) For the purposes of interpreting AS 3084, the term "Equipment Room" must incorporate the functions of both "Equipment Room" and "Entrance Room" (or "Entrance Facility").
- c) The Room must be planned and equipped to comply with all normative requirements of AS 3084 for Equipment Rooms, notably Clauses 6.4, ZA (including all referenced standards applicable in Australia), ZB2.3, ZB2.4 and ZB6.
- d) In summary, this must include:
 1. Consideration of factors listed in Clause ZC3 in choosing the location;
 2. Floor load capacity of 4.8 kPa;
 3. Minimum clear height of 2700 mm below any ceiling fittings or suspended items (precast huts are excepted);
 4. No suspended ceiling below the true ceiling or slab above;
 5. Minimum door size 900 mm x 2,000 mm;
 6. Cable tray clearance of 300 mm from any light fittings;
 7. Connections to site entrance pathways and backbone cable pathways around the site (penetrations as required to connect pit and pipe, wall/ceiling duct or cable tray infrastructure, sized to minimum requirements in Appendix ZB where no further data is provided in this document);
 8. Positive pressure differential with respect to surrounding areas;
 9. Air filtering to provide protection from contaminants. In particular, the capability of keeping out pantograph dust which will be produced in electrified traction territory;
 10. Climate control via thermostatically activated air conditioning at all times;
 11. Walls and ceiling painted in a light colour;
 12. Electrostatic Dissipative (ESD) vinyl floor covering with copper strips incorporated;
 13. Sealing of any floor entry conduits or penetrations;
 14. Protective cages over any sprinkler or fire suppression heads;
 15. Lighting level of average 500 lux at 1 m above finished floor level (AFFL) in front of, and behind, the equipment rack (after equipment installation);

16. A minimum of two general-purpose 10 A, 240 Vac double electrical outlets (in addition to various dedicated outlets);
17. All pathways penetrating fire rated barriers must be properly fire stopped using a re-openable cable feed-through;
18. CO2 type fire extinguisher suitable for Class E fires mounted inside the door at the room entry;
19. Security detection and alarming of access;
20. Provisions for earth bonding to meet AS/ACIF S009;
21. Provision of lightning protection and surge filtering on the incoming rack supplies (if not provided already on the main building distribution board);
22. Compliance with the standards referenced within AS 3084 (notably Clause ZA2) must be achieved;
23. Internal CCTV camera incorporating Infra-Red (IR) illumination to monitor equipment racks in case of smoke alarm activation; and
24. A small shelf adjacent to the entry door to support the wireless microphone and its receiver unit, complete with a dedicated electrical outlet underneath — refer to PI1-DOC-003513 *Passenger Information Systems*.

7.7. Wall, Floor and Ceiling finishes

7.7.1. Walls and ceiling

- Light colours must be selected to promote uniformity of lighting levels around the room in support of tasks involving the correct identification of small colour coded components.
- Fixed ceilings or suspended slabs above acting as a ceiling must be painted white.
- External walls should be painted in a light colour generally consistent with other finishes at the same site.
- The paint seal to ceiling and walls must be applied before mounting frames, equipment and surface fittings are installed, so that unpainted surfaces will not be exposed if equipment or fixtures are changed or moved in the future.
- For temperature control, security and fire rating purposes, the room must not have any windows or skylights. Precast rooms should have no large, preformed wall or door vents.
- Walls and ceiling on the outside of the building must be fully insulated to minimise the solar heat load during warm weather. Precast rooms must have rigid internal insulation affixed to the ceiling and walls.

7.7.2. Floor

- Hold-down bolts and plates must be avoided inside precast huts.
- Floors must be covered in an Electrostatic Dissipative (ESD) sheet 'vinyl' material. It must be installed to the manufacturer's instructions and the finished surface must be smooth and washable. Its colour must be 'Dark Grey' or 'Mid Grey'.
- The covering must be unbacked flexible PVC or linoleum sheet with carbon particles permanently heat and pressure fused throughout the thickness of the material with electrical resistance within the range of surface resistance specified in AS 2834 clause 2.1.2, when tested to AS 4155.6.
- Joints must be made by welding or epoxy jointing:
 1. *Heat welding*: After fixing, groove the seams using a grooving tool and weld the joints with matching filler rod and using a hot air welding gun. Trim off flush when the weld rod has cooled.
 2. *Cold welding*: Apply seaming compound 100 mm wide to the substrate centrally under the seam. Roll the seam until the

compound is forced up into the joint. Clean off flush using a damp cloth.

3. *Epoxy jointing*: Join seams with epoxy adhesive.
- A continuous skirting must be formed by coving the vinyl 100 mm (minimum) up the face of all vertical surfaces.
 - The vinyl sheeting must be installed on a copper grid comprising copper tape 80 µm thick x 10 mm wide, adhered with conductive adhesive. Lay the copper tape along the length of each sheet and connect it to earth with copper tape at 20–30 m² intervals.
 - The connection(s) to earth must be made via a junction box housing a series 1 MΩ safety resistor — refer to Figure 4.7 below. The junction box should be located as close to the electrical cabinet as practicable. A suitable safety resistor can be supplied by RS Components as stock code 214-3159 (1 MΩ, 3 W, flame-proof).

Note: The final connection of the copper conductive tape to earth and the installation of the junction box and resistor needs to be made by the electrical trade.

Figure 7.7 — Typical Antistatic Flooring Junction Box



7.8. Lighting

- Lighting must comprise LED batten fittings with diffusers selected to provide even illumination around equipment racks and walls, and inside racks when the doors are opened.
- Ceiling mounted light fittings must be provided both behind and in front of racks. Light fittings must not encroach upon the space above racks, which must be reserved for cable tray, power distribution and smoke detection sensors.
- Light fitting colour temperature and spectrum must be selected to facilitate unambiguous identification of colour coded conductors, fibres and components which will be installed in the Equipment Room.
- The lights must be automatically switched on by a movement detector targeted at the door and remain illuminated for a dwell time of 15 minutes after last movement was detected. A high-level (typically 2.1 m AFFL) parallel manual start switch must be provided inside the door to override the movement detector if necessary.

- An Emergency Exit light must be fitted above the door.
- The lighting level must meet the requirements of AS 3084 at equipment termination spaces (including on walls) and at the front and rear of cabinets.
- The lighting level must be designed on the basis that the room is unoccupied (and therefore the shadowing effect of occupants is accounted for by virtue of the relatively high lighting level specified).
- The lighting level in access and circulation spaces within the room (such as the aisle providing access between the front and rear of the rack) may be lower but must exceed 150 lux at the centre of the aisle.
- A 90% maintenance factor should be applied to the manufacturer's rated light output.
- The 500-lux requirement must be achieved on average. The spot illuminance may be up to 30% lower than the average at any point between the rack front or rear and the wall opposite.
- All lights (including the Exit light) must be DALI controlled for remote monitoring purposes.

7.9. Climate control

- a) Air conditioning must be based on cooling of the projected ultimate equipment load which is estimated at 1,300 W. The peak building thermal load (from sun exposure at high outdoor temperatures) based on the AIRAH code for Adelaide must be taken into account.
- b) The Equipment Room's pressurisation air supply must be rated for continuous 24x7 operation. It must be fitted with an inlet louvre rated to IP54 (minimum) and filters rated as 'F7' to AS1324.1 in order to ensure protection against the entry of pantograph dust. At least 2% of the total air moved must be fresh air. A positive internal air pressure must be maintained at 10 Pascals. Its location must be selected to avoid long lengths of duct.
- c) Large Equipment Rooms of 18 m² or 15.5 m² floor area must be fitted with two (2) independent air conditioning units. Small rooms (10 m² nominal area) must be fitted with one unit.
- d) The air conditioning must be provided to meet the following requirements:
 1. The room temperature must generally be maintained between 15°C and 25°C and around 50% humidity;
 2. At peak outdoor ambient conditions and maximum equipment rack load, the supply air to the front of all racks must not exceed 28°C;
 3. The total (maximum) equipment load cooling capacity must meet or exceed 200 W/m² of Equipment Room floor area;
 4. The units selected must be suitable for continuous 24x7 operation with an expected service life of 5 years;
 5. The indoor unit(s) must blow cold air into the aisle in front of the equipment rack whilst drawing return air from above and behind the rack;
 6. The indoor noise level created by the air conditioning system (as measured with other systems switched off) must not exceed 60 dBA;
 7. Outdoor unit noise levels must comply with local authority requirements;
 8. The outdoor unit(s) must be fitted with a vandal resistant steel guard fixed to the building or mounting concrete pad using anti-tamper fasteners and provided with a pad-locking facility;
 9. The outdoor unit(s) must not be placed in the rail corridor (unless suitable "safe zone" fencing is provided);
 10. In the event of power failure, the units must automatically restart when power is restored;
 11. Notwithstanding AS 4755.1, the air conditioner(s) must have any Demand Response Enabling Device (DRED) functionality disabled;

12. Air conditioners must be fitted with alarms wired via pairs in a Cat-5 cable to a rack's Environmental Monitoring System (EMS) to report the following conditions:
 - i) Air conditioner switched off manually or power fail; and
 - ii) Air conditioner fault.
13. Where two air conditioners are installed, they must be controlled by a PLC or similar control system. This must provide staged control utilising both 'Fan' and 'Cool' modes and also start-up sequencing so that both units are used at a similar rate. The system may also generate the alarms as per (12) above; a PLC fault must generate an Air Conditioner Fault alarm.

7.10. Conduit and Service Entry and Cable Trays

- In order to comply with section 7.7.2 □, all floor-entry conduits must enter via concrete upstands ("plinths"). Pits must not be installed inside the room.
- Sealing of the conduits must be by the use of sealed enclosures rated to a minimum of IP66. Conduit entry holes into the enclosures must be sealed and cable exit must be via individually glanded holes. The use of expanding foam to seal conduits must be avoided because of the difficulty in removing it to reuse a conduit.
- **Note:** Figure 7.10 below shows the degree of segregation expected between electrical and communications conduit systems.
- Some stations have their Equipment Room located at a lower level than services at normal ground level (for example, Bowden). This means that some conduits are laid downwards from ground level into the Room, which gives the possibility of flooding if, for example, a pit's drainage is inadequate or blocked. In addition, there is the possibility of condensation forming in the conduits and entering the Room. Great care is needed in this situation with the design of the pits and conduits in order to maintain the Room's integrity.
- Conduits sloping downwards to enter the Room typically should be fitted with an S-shaped arrangement of 45° conduit sweeps and an adjacent drain-pipe. In addition, it may be necessary to install water level alarms in some pits.
- All cable trays and ladders in the Equipment Room must be galvanised and powder coated in order to reduce any sharp edges. Alternately, wire mesh cable 'basket' with smooth edges may be used.
- The recommended installation for cable trays or ladders is one layer at the top of the walls in a vertical orientation and with segregation provided. Alternatively, one layer in a horizontal orientation may be provided, as shown in Figures 7.17.1 and 7.17.2. Due to the restricted height in precast rooms, two horizontal layers should be avoided.

Figure 7.10 — Typical Cable Entry Plinth & Sealing Enclosures (Note covered vinyl flooring, segregation and powder-coated cable trays)



7.11. Fire Detection

The Equipment Room must be fitted with a smoke detector wired to the security panel; refer PI1-DOC-003513 *Security System* for details. A CO₂ fire extinguisher must be installed.

7.12. Power Supply

(a) Power must be supplied to the Equipment Room as required by CS5-DOC-003511 *Electrical Infrastructure* and PI1-DOC-003513 *Passenger Information Systems*. Additionally, the room will require the following circuits for the operation of the Security System:

1. 15 A rack captive-type pendant outlet #1 (CCTV Rack main – non-RCD);
 2. 15 A rack captive-type pendant outlet #2 (CCTV Rack backup – non-RCD);
 3. 15 A rack captive-type pendant outlet #3 (PI Rack main – non-RCD);
 4. 15 A rack captive-type pendant outlet #4 (PI Rack backup – non-RCD);
- Note:** Pendant-type outlets are not usually practicable in precast rooms.
5. Security alarm panel general power outlet (non-RCD);
 6. 10A GPO located under the wireless microphone shelf;
 7. Air conditioner(s) on separate circuits (fixed wiring);
 8. Wall convenience general power outlets (minimum of two circuits, RCD protected); and
 9. Lighting (RCD protected).

(b) In accordance with AS 3000:2018, Clause 2.6.3.2.3.3, Exception 3(i): “... *the connected equipment ... is required by the owner or operator to perform a function that is essential to the performance of the installation and that function would be adversely affected by a loss of supply caused by the RCD operation*”. All the equipment in the Equipment Room’s racks has one of the functions of essential system security, patron safety, emergency management or direct operation of the rail signalling and control systems.

(c) The racks must have their own internal UPS units.

(d) The maximum CCTV + PI equipment demand (under full battery recharge conditions) will be in the range 2.8 kVA to 4 kVA at 0.85 pf. The average equipment demand under normal steady state power supply conditions is estimated at 1,500 VA.

Note: The above estimates exclude lighting and air conditioner loads.

(e) Three 6 mm² flexible (84/0.3) Green/Yellow earth cables must be provided from the earth bar at the room’s Distribution Board to each of the PI racks and CCTV

racks (as provisions for Communications Earth Terminals, rack earths and surge arrester earths).

- (f) The station's Main Distribution Board, together with the 'master' DALI lighting controller and its associated equipment, will be located in the Equipment Room — refer to CS5-DOC-003511 *Electrical Infrastructure* and drawing CS5-DRG-365195. However, if this is not practicable, a separate power distribution sub-board must be fitted within the room for the equipment (fed from essential power if available)

7.13. NBN Connectivity

- Provision must be made for an underground network connection to be provided to the Equipment Room from the nearest point of NBN service connection (co-ordinate with a Communications Provider or NBN).
- This connection will either be for future use or for immediate use, depending on whether or not a Departmental optical fibre cable is available at the station.

7.14. Wireless network

The following services will employ 4G / 5G network cards:

1. Emergency Phones on platforms;
2. Security alarm panel dialler;
3. Lift car #1 Emergency Help Phone (if applicable); and
4. Lift car #2 Emergency Help Phone (if applicable).

7.15. Security

7.15.1. Physical Security of Doors and Walls

- The Equipment Room's walls and doors must be of a construction capable of withstanding malicious vandal attack. Access must not be readily gained by removing panels or in-wall air conditioners. Walls must be of masonry or concrete construction.
- The door must be of solid timber construction, steel clad with four heavy-duty hinges.
- The roof must comprise concrete slab or continuous sheeting of suitable strength. The roof must not have any access manholes or skylights fitted. By design, the roof must not be readily reached by climbing a fixed ladder or the surrounding structure.
- The Equipment Room's external door must be fitted with weather and dust seals to prevent ingress of water or contaminants into the room. (However, some filtered ventilation near roof level must be provided if necessary to meet the minimum air change requirements of referenced battery accommodation standards and the 2% fresh air criterion of Section 7.9 *Climate Control*). The external door must be fitted with a lock(s) keyed to suit the Department's "K12" Security Key. The door must have a self-closing mechanism and must automatically lock from the outside but must still be able to be opened without the use of a key from the inside.

7.15.2. Alarm

Both the external access and the Security System rack(s) must be alarmed. A panel inside the external door will allow Operations Personnel to access and deactivate the alarm. The Security System alarm must only be deactivated by approved personnel. The Contractor must co-ordinate the alarm system accordingly.

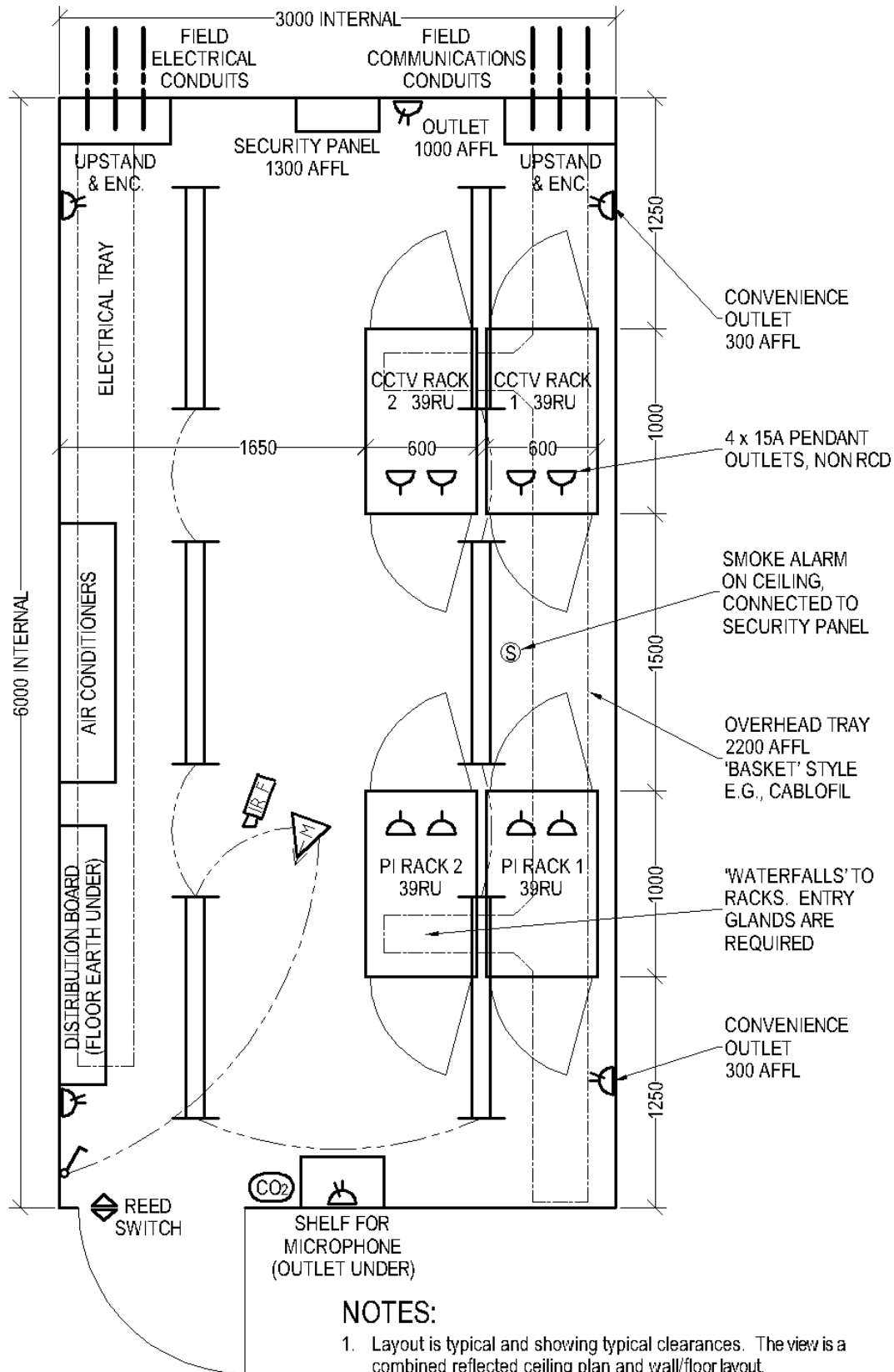
7.16. Fire Rating

The room must achieve a one-hour minimum fire rating. Refer to the National Construction Code of Australia (NCC) and Australian Standards.

7.17. Typical Two-Rack & Four-Rack Equipment Room Layouts

- Figures 7.17.1 and 7.17.2 below provide recommended layouts for a four-rack room and a two-rack room (hut). Entry conduits through the floor for power and communications must be planned as applicable and must be in the corners of a wall as shown.
- Note that these are recommended typical layouts but are not prescriptive or a complete specification. The actual size, orientation and layout of the room and the materials used must be adjusted to suit the requirements of the site and the position on the site, whilst maintaining clearances between items, cool air flow to the front of the racks and good illumination at the front and rear of racks. Where possible, it would be advisable to separate the racks entirely (for example, each rack butted up against opposite walls), allowing enough room between them for unrestricted access to the rear of the racks.

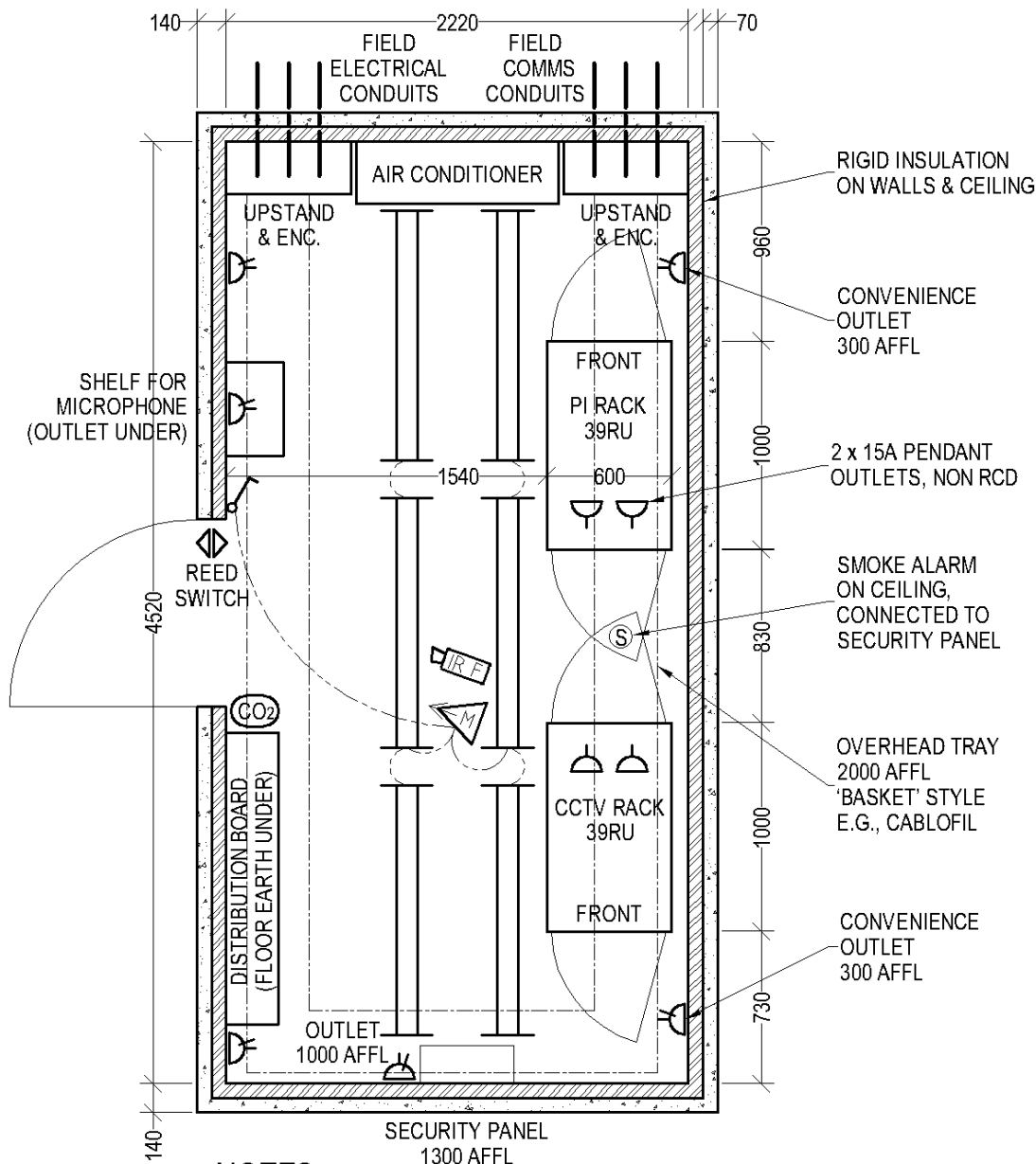
Figure 7.17.1 – Room Layout with Four Rack Enclosures for Enhanced Stations



NOTES:

1. Layout is typical and showing typical clearances. The view is a combined reflected ceiling plan and wall/floor layout.
2. The actual tray routes must be designed to connect to the respective facilities and pathways and wall-mounted facilities placed around the tray runs.
3. Lights shall be on movement detector control to ensure they are not left on unattended.
4. Room dimensions are internal clear space.

Figure 7.17.2 – Room Layout with Two Rack Enclosures for Neighbourhood Stations



NOTES:

1. Layout is typical and showing typical clearances. The view is a combined reflected ceiling plan and wall/floor layout.
2. The actual tray routes must be designed to connect to the respective facilities and pathways and wall-mounted facilities placed around the tray runs.
3. Lights shall be on movement detector control to ensure they are not left on unattended.