



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Signalling)

Category: Specification

Small Buildings, Location Cases, Terminal Cases and General Purpose Cases

ESC-07-03

Applicability

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1 General

1.1 Scope

This specification defines the requirements for the design and construction of equipment housings for railway Signaling and control equipment, power supplies and communications equipment. The equipment housings will be buildings and cubicles including:

- major buildings with a single room or multi-rooms of brick or concrete block construction.
- smaller pre-cast concrete buildings.
- prefabricated buildings, and
- trackside equipment location cases.
- General purpose cases.

The Contractor shall supply all labour, material and equipment and any other requirements for the design and construction of the equipment housings.

Unless specified otherwise in the Particular Specification, the Contractor shall also carry out all investigative work necessary (including geotechnical investigations, survey etc) to enable the competent design of the equipment housings.

All work shall be carried out in compliance with:

- the Particular Specification, if issued;
- this specification;
- relevant Australian Standards;
- Building Code of Australia;
- all State and local government statutory requirements within whose jurisdiction the site falls; and
- industry best practice for work of this type.

1.2 Safety

The Contractor shall at all times and to the satisfaction of ARTC, arrange for the work to be carried out in a manner which:

- will ensure the safety of employees,
- not cause danger, delay, obstruction or stoppage to railway traffic, and
- not interfere with the business of ARTC or its Operators.

The Contractor shall ensure that all staff working on the Contract including sub-contractor's staff is appropriately accredited for work on or about rail corridors in accordance with ARTC network safeworking requirements.

1.3 Occupational Health and Safety

The Contractor, his employees and any sub-contractors engaged on the Works must comply at all times with the relevant Occupational Health and Safety legislation applicable in the jurisdiction that relates to the site.

1.4 Drawings

The documentation and drawings to be used in the execution of the works shall be:

- those of the Particular Specification,
- any drawings nominated in this Specification, and

- the Contractor's drawings prepared and approved under the contract.

The Contractor may be required to provide Certificate of Approval from a registered Engineer/Architect and documentation (i.e. drawings and specifications for the construction of this building) to the Principal prior to commencing.

1.5 Definitions

In this document, the following definitions of terms shall apply:

ARTC – Australian Rail Track Corporation

Contractor – A person, company or authority nominated by ARTC or ARTC's primary contractor to perform the works required under this specification.

ARTC's Representative – A person, company or authority nominated by ARTC to make engineering determinations on ARTC's behalf.

Works – The design and construction of Equipment housings in accordance with this standard specification.

Particular Specification – a specification issued as part of the contract documentation for a specific project that nominates amended, additional and/or special requirements specific to the project.

1.6 Quality

The standard of materials and workmanship shall ensure that the installed equipment housings are fit for their purpose over the lifetime of the asset in its physical and operational environment with respect to safety and reliability.

All equipment housings shall be manufactured and assembled to provide a minimum service life of 20 years when maintained at the manufacturer's recommended intervals.

Quality of materials and workmanship used in the works shall be such that life cycle routine maintenance of the asset is minimised.

All materials supplied to this specification shall be warranted free of defect in manufacture or assembly for a period of twenty four (24) months from installation. All of the materials, including consumables, shall be warranted as complying with this or any referenced specification and as being fit for purpose.

The Contractor is not exempt from statutory obligations and shall conform to all of the appropriate Local Government and State building regulations and requirements with particular attention drawn to the prevailing Environment Protection acts and subordinate regulations applicable within the site's jurisdiction.

1.7 Submissions for Approval

Where alternatives or new equipment types are proposed, the matter shall be submitted by the Contractor with documented justification in writing, in accordance with ARTC's PP122 acceptance process for "New Equipment and Systems" approval.

1.8 Referenced Documents

The following documents are referenced in this specification:

1.8.1 Australian Standards

AS 1650	Hot Dipped Galvanised Coatings
AS 3000	Wiring Rules
AS 1657	Fixed Platforms, Walkways, Stairways and Ladders
AS 1449	Wrought Alloy Steels (Stainless Steel)

AS 1734	Aluminum and Aluminium Alloys
AS 1665	Welding of aluminum structures
AS 1554.1	Structural steel welding
AS 1289	Methods of Testing Soils for engineering purposes
AS 3700	Masonry in Buildings
AS 1225	Clay Building Bricks
AS 4455	Masonry Units and Segmental Pavers
AS 1725	Galvanised Chainwire Security Fences & Gates
AS 2676	Installation and Maintenance of Batteries in Buildings
AS 4548	Guide for long life coatings for Concrete and Masonry
AS 1562.1	Design and Installation of Sheet roofing and wall Cladding
AS 3735	Concrete Structures for Retaining Liquids
AS 4678	Earth Retaining Structures
AS 2870	Residential Slabs and Footings
AS 4671	Reinforcing Materials
BCA	Building Code of Australia

1.8.2 ARTC Specifications

ESC-07-04	Install of Equipment Racks & Termination of Cables & Wiring
ESC-03-01	Level Crossing Equipment
ESC-09-02	Lightning and Surge Protection
ESC-07-01	Installation Trackside Equipment
ESC-11-01	Construction of Cable Routes & Associated Civil Works

2 Buildings for Housing of Equipment

2.1 General

This section specifies the requirements of buildings specifically provided for the housing of equipment.

Equipment installed trackside shall be housed in buildings or location cases.

Where the floor area requirements exceed 10.0 square metres, a building will be provided constructed of:

- cavity brick or
- waterproof cavity concrete blocks or
- prefabricated sandwich panel type construction.

Where the floor area requirements do not exceed 10.0 square metres, the equipment housing may be a:

- prefabricated sandwich panel (e.g. Level crossing location); or
- pre-cast concrete construction; or
- location case type of housing.

Requirements for location cases and other special housings are covered in Sections 4 and 5 of this document.

All buildings for the housing of equipment shall be suitable for the climate of the area. They shall be weatherproof, with particular attention given in the design to the provision of features, which reduce degradation due to environmental factors, and overall ensure that it remains fit for purpose over its full life with minimal maintenance.

The floor level of buildings shall be 600 mm above the adjacent ground level or 150 mm above rail level whichever is the lower. However, where flooding occurs this floor level will be set higher, at least 250mm above calculated 1:100 yr flood level or 500mm above highest recorded flood level at the site.

Wire and cable entrances to all housings shall be sealed to prevent the ingress of moisture, rodents, termites and insects. The seal shall be easily removed for additions and modifications.

Relay and equipment racks in buildings shall be free standing and securely fixed to the floor.

Bollard poles shall be located on all corners of the building or a minimum of four (4) installed in such a manner as to afford an appropriate level of protection for the building from damage by vehicles. These bollards shall be typically constructed of scrap rail section or similar, be 1500 mm above ground level, 400mm in ground and painted with high gloss "white" paint.

2.2 Floor Area of Buildings

The buildings shall be sized to adequately house the equipment to be installed. The particular specification or project drawings detail the equipment to be included. The dimension of the buildings shall be determined from a consideration of the following minimum clearances:

- At rear of any rack that requires rear access 900 mm
- At front of any rack 900 mm
- Between racks which require front & rear access 1200 mm
- At equipment room door end of the rack 2000 mm
- Between one end of a rack and any other fixed object. 800 mm

(One end may abut a wall or other rack providing no Access is required)

The minimum internal width of a building shall be 2.4 metres.

All buildings and location cases shall provide sufficient unused space to allow for a 20% increase in the quantity of equipment to be housed therein.

The full details relative to Equipment Racks and the Termination of Cables and Wiring is contained in ESC-07-04 Installation of Equipment racks & termination of Cables & Wiring.

Typical installation and interface arrangements for Cable Pits and Ground Level Troughing can be found in ESC-11-01 Construction of Cable Routes and Associated Civil Works.

2.3 Site Works

2.3.1 General

The Contractor is responsible for all site works associated with the provision of buildings to be used for housing of equipment. The works include but are not limited to:

- Site layout
- Site preparation
- Site drainage
- Provision of cables to/from buildings
- Access to site and buildings
- Security of the site
- Provision of third party services to the site

- External finishes around buildings
- Earthing

2.3.2 Siting of Buildings

The building shall be sited as specified in the particular specification or project documents. If the siting is not specified then the Contractor will carry out the necessary investigation and nominate the building set-out for approval by ARTC or ARTC's representative.

Care shall be taken to ensure that the buildings are positioned clear of:

- Structure Gauge
- Access roads and pathways, preferably no part of the building shall be closer than 1.5 metres to an access road.
- Drainage paths or structures unless measures are put in place to provide for continued operation of drains.
- The area where catch points or a derail will deflect a derailed vehicle.
- The ends of sidings where error may lead to overrun.
- Non-interlocked (hand thrown) points in yard areas.

Where used to house level crossing equipment or located close to a road crossing, the building shall be positioned as close as practicable to the ARTC boundary and be positioned to cause the least obstruction to the road vehicle driver's line of sight relevant to approaching trains.

2.3.3 Site Preparation

The site shall be cleared of all vegetation and topsoil stripped to a depth of 100mm and stockpiled for reuse. An area up to 5 metres away from the building on all sides is to be cleared and graded to achieve a minimum fall away from the building of 1:100.

Where it is necessary to excavate into a cutting wall or fill over a bank to locate the building a suitable retaining wall shall be provided and provision made for drainage around the building.

Earthworks shall be carried out as required or as shown on the Drawings to:

- Allow correct finished levels and falls for floor slabs and external paved or graded areas.
- Allow for underground services such as storm water drainage, sewerage, power cable, earthing cable, cable route entry to the building, pits, ducts etc. included on the Drawings or in the Specifications.

2.3.4 Site Earthworks

To achieve an acceptable pad for the building and surrounds the site may require excavation or filling.

The building finished floor levels, grading around the building, cut and/or fill batters and details of retaining walls if required will be as specified in the particular specification or project drawings.

Excavation shall be carried out to achieve design finished levels where shown on plans. Excavated material will be either disposed of or used as fill. Excavated material shall be selected to ensure that the best quality material – lower plasticity, evenly graded, no organic content, high CBR value, available from the excavation is used for any filling or backfilling. Any unsuitable materials – high clay content, soft silts or containing significant organic content will be disposed of.

Excess or unsuitable excavated material may be disposed of by spreading elsewhere on or near the site. Any such disposal site must be clear of any access roads, must not impede or restrict access to trackside equipment or obstruct or restrict any drainage paths. If no suitable local site can be found spoil has to be disposed offsite by the Contractor in accordance with Local Council and Government regulations and requirements. The proposed method for disposal is to be agreed by ARTC or ARTC's representative.

Filling shall not be carried out before any unsuitable materials e.g. timber, rubbish soft and/or highly organic soils have been removed from the area to be filled. Any voids created by the removal of unsuitable materials will be backfilled with clean material consistent with the natural material on site or using imported materials. If material excavated on site is insufficient or unsuitable, then suitable filling material shall be provided. All filling or back-filling material shall be brought to optimum moisture content and placed in layers and compacted by an approved means to 95% Standard Density in accordance with AS1289.

All excavated and filled areas shall be finished to an even surface and be within +/- 25mm of specified levels.

2.3.5 Retaining Walls

Retaining walls shall be provided where stable batters to excavated or filled areas cannot be constructed without excessive earthworks or encroaching on other structures, drains, access ways or property boundaries. The requirement for retaining walls will be identified on the site grading plans described in section 2.3.4. Retaining walls shall be sited so that they are a minimum of 1200 mm from the building.

The retaining wall shall be constructed of stone, brick, block, or reinforced concrete materials in accordance with AS 4678. Retaining walls greater than 850 mm high shall be designed by a Structural Engineer. Proposed material type, foundations, wall cross-section and other necessary detail must be shown of site grading plan for all proposed retaining structures.

When retaining walls are required, a dish drain with minimum gradient of 1:100 shall be provided between the retaining wall and the pathway adjacent to the building.

Retaining walls shall be provided with weep holes at 600mm centres maximum, 100 mm above the adjacent dish drain. Where the retaining wall will be 1000 mm more in height at any point, a 300mm layer of free draining backfill shall be placed at the rear of the wall and shall be drained by a slotted 100mm pipe located at the base of the wall. This piped drain will be provided with either a free draining outlet with protective concrete surround or connected to an existing underground drainage system.

Areas above or below retaining walls away from the building will grade evenly and smoothly back to the natural surface.

2.3.6 Handrails

Handrails shall be supplied and installed where required in accordance with AS1657 to protect from falls and/or where any part of the path is within three metres of the nearest rail of any railway line.

Posts and top rails shall be constructed of 50mm NB galvanised steel pipe, and intermediate rails shall be 40mm NB. Posts will be at centres not greater than 1500 mm and shall be concreted 300 mm into the ground. The posts and rails may be connected using preformed bolt-on junctions or by fully welded joints. All welded joints shall be painted with a cold galvanizing coating. Any posts that extend above the top horizontal rail shall be fitted with galvanised steel caps.

2.3.7 Access to Buildings

Where necessary on embankments and/or cuttings the Contractor shall provide direct safe all weather permanent access and safety rails for maintenance staff to access buildings and location cases. Any such accesses and rails shall be subject to the requirements of the Occupational Workplace Health and Safety Regulations and AS1657.

Stairs and ladders shall be supplied and installed where required in accordance with AS1657 and shall be hot dip galvanised after fabrication.

2.3.7.1 Ladders

All Ladders to be in accordance with AS1657 and as below.

Ladders shall be 450 mm wide with rungs at centres not greater than 300 mm or less than 250 mm. The bottom ladder rung shall not be less than 300 mm from the bottom of the ladder.

Ladders shall be constructed using 50 mm x 10 mm steel plate stiles with 20 mm diameter steel rungs and shall be hot dipped galvanized following fabrication. Ladders shall be securely concreted into the ground.

2.3.7.2 Stairs

All Stairs to be in accordance with AS1657 and as below.

Stairs shall be designed by the Contractor and shall have tread size of no greater than 250 mm or less than 200 mm with a maximum riser height of 150 mm and minimum tread width of 600 mm.

Stairs shall use "Forgeweld" or similar treads with 6 mm chequer plate sides. The stairs shall have open risers. Stairs shall have 50 mm diameter steel handrails and posts on both sides of the stairs. The posts shall be at centres not greater than 1200 mm apart and shall be welded to the stairs. Stairs and handrails shall be hot dipped galvanized after fabrication. The stairs shall be securely concreted into the ground.

2.3.8 Concrete Pavement

The Contractor shall supply and install concrete paving around the building perimeter. The pathway shall be 1000 mm wide on sides with doorways and 750 mm wide on other sides. The path shall be formed to achieve a minimum fall away from the building of 1:100.

The paving will be 20 MPa concrete, 100 mm thick reinforced with one layer of SL72 mesh. Expansion joints shall be provided at 1800 mm intervals, changes in direction and/or adjacent to structures embedded in the paving. Finish shall be wood float and edges shall be rounded.

2.3.9 Security Fencing

All security fencing and gates shall be supplied and constructed in accordance with AS1725.

An 1800 mm high galvanised chain wire security fence shall be supplied and erected with access gates, except where this requirement is specifically excluded in the Particular Specification.

Unless otherwise nominated in the Particular Specification or precluded by site restrictions, the fence shall be constructed at a distance 3.0 metres from the walls of the building.

The security fence shall have three rows of galvanised barbed wire attached to the posts above the 1800 mm chain wire. The barbed wires shall be offset approximately 45° and positioned on the outside of the fence.

Buildings with two or more rooms shall have access gateways at each end of the building whilst one room buildings shall have one access gateway opposite the main entry door. The access gateway openings shall be a minimum of 3600 mm wide and shall consist of two equal width galvanised chain wire gates with three rows of galvanised barbed wire fixed in the same manner as the main fencing.

Where a boundary fence giving access to a public road or street is within 50 metres of the building, the Contractor shall modify the fence and supply and install a 900 mm wide x 1800 mm high galvanised chain wire mesh gate, with catch and provision for the Principal's standard access padlock.

2.3.10 Cable Pits, and Ground Level Troughing

The cable entry to the building shall be via cable pit/s that shall be a minimum of 1200 mm x 1200 mm x 900mm in depth for Signaling cables and 1000 mm x 1000 mm x 900mm for communications cables with adequate integral supports for the cables.

The pit/s shall be provided with lockable galvanised chequer plate steel covers fitted with two (2) lifting handles and be drained. These handles shall be positioned such that the cover may be raised without leaning over the cable pit. The pit shall be tied to the main structure and secured with padlock/s consistent with those currently in use on similar equipment in the rail corridor.

Cable entry aperture/s, with dimensions 1200mm x 300mm as a minimum, shall be provided in the signal equipment room floor (and where required, also in the power room floor) for cable

access to the building. The aperture/s shall connect to the cable pit by way of a re-enterable cable duct, the cable lid of which shall finish level with the floor. The final sizing of the aperture/s shall be determined by the overall requirements of the Signaling design and provide for an additional 20% useable spare capacity for future use.

The cable entry between the cable pit and the building shall be sealed appropriately to prevent the entry of vermin into the building.

Pits adjoining the pathway shall be level and flush with the top of the path. The pits shall be positioned as close as possible to and in line with the cable aperture.

Ground level troughing (GLT), where used, shall be positioned so that it aligns with the building cable aperture. Openings in concrete foundations, building base slabs, or paving shall be allowed for cabling to extend from troughing into the buildings. The top of the GLT cover shall not project above foundation level and all trough and cover joints shall be sealed with sand cement mix (3:1).

A minimum of 4 x 100 mm Class 9 uPVC pipes shall be installed in the foundation between the cable pit and the aperture in the equipment room floor. The wall thickness (or class) of the pipe shall be sufficient to guarantee that there will be no loss of cross sectional area after backfilling and encasement.

A single 100 mm Class 9 white uPVC pipe complete with draw wire shall be installed from the cable pit to a position directly under the position of the communications compartment. This pipe is to be capped in a manner that will enable ease of future access.

Where Supply Authority mains are connected to the building and /or a power room is provided, two (2) separate 100 mm orange uPVC rigid pipes shall be installed, one (1) from the cable aperture, protruding 3.0 metres from the building side-wall, in the direction of the incoming supply. The other, between the cable aperture and the cable pit to accommodate the outgoing Signaling supply(s). The radius of bends used in this pipe work is to be no less severe or acute than 30 degrees.

Typical installation and interface arrangements can be found in ESC-11-01 Construction of Cable Routes and Associated Civil Works.

2.3.11 Signaling Earthing

Separate earthing conduits are required for Signaling earth cables in accordance with ESC-09-02 Lightning & Surge Protection Requirements.

These conduits are to be 25 mm in diameter and shall be embedded in or installed below any foundations, base slabs, or paving and run directly between the earthing points and the cable aperture in the equipment room.

The positioning of the conduits is to be indicated on the Contractor's site drawings.

Buried ends of the conduits shall be capped and draw wires provided. The ends of the conduits complete with draw wires shall be temporarily buried under sand bags to enable ready access for others to install perimeter earthing cables.

2.3.12 Clean Up

On completion of installation of the building the site shall be restored to as close as possible to its original topography and (where previously improved, e.g. by landscaping) its original appearance. The Contractor shall grade the ground between the concrete walkway around the building and up to 5 metres away from the building and remove all rubbish, surplus materials and surplus excavated materials from the site.

Where special drainage provision has been made to protect the building, care shall be taken to ensure that run-off from these drains will not cause erosion or direct water onto access roads or pathways or into private property unless this is a natural drainage route.

2.3.13 Building Surrounds

Following completion of the clean up, the Contractor shall supply and compact a 50 mm layer of stabilised road base including a minimum 5% cement content, over the area graded for the building site.

Areas disturbed during construction beyond this area will be topsoiled using the stockpiled material removed at the commencement of the works. Respread topsoil is to be blended into surrounding natural levels. All topsoiled areas are to be re-vegetated using methods and materials that will stabilise the soil and blend with the surrounding environment.

2.4 Concrete Work

2.4.1 Formwork

Design and construction of formwork shall produce concrete elements which will conform with the specified tolerances to shapes, lines, levels, dimensions and quality of surface finish required by the Contract.

Unless stated otherwise on the Contractors Drawings, this maximum tolerance shall be 25 mm whilst irregular/abrupt deviations shall not exceed 6 mm.

Unless stated otherwise on the Contractors Drawings, the minimum stripping times shall be:

- Vertical Faces of Slabs on Ground 24 hours after completion of the pour
- Vertical faces, columns or walls 14 days after completion of the pour
- Suspended Horizontal Faces 14 days after completion of the pour

2.4.2 Reinforcement

All reinforcement including necessary tie wire, support chairs, spacers and the like shall be supplied and fixed in accordance with the Contractors Drawings and meet the requirements of AS 4671.

- Reinforcing steel shall have minimum yield strength of 250 MPa.
- Reinforcement shall be clean and free of loose rust.
- Unless stated otherwise on the Contractors Drawings, all reinforcement shall be located within a tolerance of 15 mm of its design location.
- Unless stated otherwise on the Contractors Drawings, the minimum concrete cover to the reinforcement shall be 50 mm on all surfaces in contact with the ground and 25 mm minimum concrete cover to reinforcement elsewhere.
- Conduits encased in the concrete shall be located at least 40 mm clear of any reinforcement and shall have a minimum concrete cover of one half the conduit diameter or 20 mm, whichever is the lesser.

To allow inspection of reinforcement, the ARTC representative shall be given not less than one working days prior notice of the intention to pour concrete.

2.4.3 Concrete

All concrete necessary for the works shall be supplied and placed in accordance with AS3600.

Concrete to be placed on the ground shall have an underlay of 50 mm of clean sand covered with Fortecon 200 microns or equivalent. The joints in the Fortecon shall be lapped 200 mm minimum and sealed with self-adhesive waterproof tape.

Unless stated otherwise on the Contractors Drawings, the concrete shall have a minimum 28-day compressive strength of 20 MPa with 20 mm maximum aggregate. Concrete shall be placed in a manner that will avoid segregation of material, compacted using mechanical vibration and finished off in a tradesman like manner.

Freshly placed concrete shall be protected from premature drying and excessively high or low temperatures. Curing of concrete shall be carried out for a minimum of seven days and this may be achieved by either keeping the concrete constantly wet or by the application of an approved curing oil membrane.

3 Building Works

This section specifies the requirements of buildings specifically provided for the housing of equipment. Buildings will conform to the requirements of the Building Code of Australia (BCA) and relevant Australian Standards.

Where the floor area requirement of a building to house trackside equipment exceeds 10.0 square metres, a building will be provided. These building/s may be constructed of:

- cavity brick
- cavity concrete blocks
- pre-cast concrete construction or
- prefabricated sandwich panel type construction.

Requirements for location cases and other special housings are covered in Sections 4 and 5 of this document.

3.1 General Building Requirements

3.1.1 Steelwork

The supply and installation of all materials necessary to complete any steelwork, including chequer plate, steel posts, pit covers, cable duct covers, purlins and grates shall form part of the contract.

Structural steel shall be a minimum Grade 250 unless otherwise stated on the Contractors Drawings and the fabrication will be carried out in accordance with AS 1554.1.

After the fabrication and the drilling of any necessary holes in the steel, the steel shall be hot dipped galvanised in accordance with AS1650. All bolts, nuts and washers used in steel work shall be hot dipped galvanised.

3.1.2 Metalwork

Metalwork shall be neat and tidy in appearance with accurate joints.

Ducted skirting shall be installed on all walls and shall consist of an extruded aluminum anodised dual cavity section to accommodate the electrical and telephone wiring.

3.1.3 Doors

3.1.3.1 General

Unless shown otherwise in the Contractors Drawings, doors shall have a minimum fire rating of 2 hours.

External doors shall be of all steel construction. The door shall have dimensions 2040 mm height x 820 mm width and shall consist of a 25 x 25 RHS perimeter frame with four cross members, two at mid height to support the locking mechanism and to enable ready access for the installation of pre-wired equipment racks.

The exterior skin shall consist of 2.4 mm (minimum) thick steel sheet with light cross breaks to prevent drumming. The skin shall either be folded around the frame and intermittently welded or if not folded shall be continuously welded to the frame all round. The lower section of the door shall be fitted with, or have pressed into the exterior skin, a 600 mm wide x 200 mm high vent panel. The panel shall be suitably proofed against vermin and insect entry.

Internal doors may be of any material but must meet the required 2 hour fire rating. The door shall have dimensions 2040 mm height x 820 mm width.

3.1.3.2 Door Jambs

Door jambs shall be formed from 3 mm steel and sized to match the door thickness and wall thickness which is dependent on the type of building construction. The type of construction and installation has to maintain the fire rating of the door system. They shall be fitted with a 50 mm wide awning over the doorway.

3.1.3.3 Corrosion Protection

External doors and jambs shall be coated with one coat inorganic zinc silicate primer to a dry film thickness of 75um and one coat white Vinyl Copolymer paint to a minimum dry film thickness of 100um. Painting shall be carried out after welding and assembling has been completed. Colour to be the same as the external walls of the building.

Internal doors are to be painted using a coating system appropriate to the door material. Colour and finish to be the same as internal walls.

3.1.3.4 Hardware

The doors shall be hinged with four (4) 100 mm stainless steel fixed pin hinges per door welded or screwed to the door and bolted or screwed to the door jamb. Unless otherwise nominated in the Particular Specification, doors shall be hinged on the left hand side as observed from outside of the building.

The doors shall include a Lockwood model 355 dead latch lock or equivalent with the strike plate set on the inside frame stop and be fitted with an exterior handle and lock guard. A catch, which fits over the handle to restrain the door in the open position, shall be fixed to the building wall with chemset anchors.

Bottom edge door seals shall be provided on all external doors and shall fit neatly in the recessed step to prevent water and vermin entry.

3.1.4 Windows

Unless otherwise nominated in the Particular Specification, windows are not required in buildings.

3.1.5 Electrical Services

3.1.5.1 General Requirements

The Contractor shall supply and install all wiring and electrical services associated with the buildings in accordance with AS3000.

Generally, all electrical services wiring shall be concealed or placed in ducted skirting as specified in Clause 3.1.3. When the wiring cannot be concealed, consideration will be given for the use of surface mounted conduit.

The Contractor shall arrange for and connect to the Supply Authority Mains and obtain all necessary inspection and service connection approvals.

The electrical circuit design shall be included in the Signal Circuit Book and a Certificate of Compliance for the installation shall be included in the test documentation for the location and retained as part of the commissioning documentation.

3.1.5.2 Equipment to be Supplied

The Contractor shall supply and install a 20-watt external vandal resistant and waterproof fluorescent light at the entrance to the Signaling equipment room. A waterproof push-button timer light switch (Clipsal 319HP or similar), set for an operating period of 5 minutes, shall be mounted externally adjacent to the door.

The fluorescent light fittings shall be single 240 volt x 40 watt with a minimum of two lights in each room for rooms up to 3.3 m long and four lights for rooms over 3.3 m long. The lighting in the main Signaling equipment room shall be such that the front and rear of the racks and the plan table area are well illuminated. A minimum of six (6) 240v AC 10A double wall mounted GPO's shall be provided and two (2) permanently wired outlets for battery chargers.

Individual circuits shall be run for the lighting, relay room GPO's, battery charger outlets, and generator room GPO's, originating from a distribution switchboard in the main signal equipment room.

The mains meter box shall be mounted on the external wall of the building. Dual access shall be provided to the meter box for both the Maintainer and the Supply Authority for maintenance and meter reading purposes.

3.1.5.3 Additional requirements for Power rooms

Where a power room or generator room is provided, the Contractor shall supply and install an additional 20-watt external vandal resistant and waterproof fluorescent light and push button switch at the entrance to the power or generator room similar to that provided for the entrance to the equipment building. The Contractor shall supply and install an approved step-down isolating transformer of at least 5kVA rating to convert 240v 50 Hz AC supply to the Signaling Ac supply voltage (typically 110/120volts) suitable for use on Signaling equipment. The transformer shall isolate the higher voltage supply so that the Signaling power supply remains unearthed under all conditions.

Adequate fluorescent lighting shall be provided in the motor generator/power room/s consistent with the requirements of equipment maintenance.

The power supply room shall have two (2) 100 mm diameter heavy-duty orange uPVC conduits from the power supply room cable aperture to a point three (3) metres outside the pathway. One conduit shall run in the direction of the normal supply, the other in the direction of the emergency supply. Buried ends of the conduits shall be capped and draw wires provided. The ends of the conduits shall be temporarily buried under sand bags to enable ready access for others to install power cables.

3.1.5.4 Additional requirements for Battery rooms

Where the building includes a battery room, lights, light switches and G.P.O.'s in the Battery Room shall be spark proof fittings satisfying the requirements of AS3000 Hazardous Areas Class 1 Zone 1.

3.1.6 Cable Trays

Overhead cable tray shall be 300 mm wide, standard duty cable ladder with hot dipped galvanised finish. It shall be suspended from the ceiling using hanging kits in accordance with the manufacturer's recommendations with the underside of the overhead cable tray 2200 mm above floor level. The overhead cable tray shall have a minimum 300 mm radius bend to meet the wall mounted cable tray thus providing continuous cable support.

The wall mounted cable tray shall be admiralty pattern cable tray with hot dipped galvanised finish. It shall be secured to the wall with the Manufacturer's recommended fasteners.

Each section of cable tray shall be bonded to the adjacent section with a 6mm lugged earth wire to provide a continuous electrical circuit.

3.1.7 Fire Protection

Unless otherwise specified in the Particular Specification, a fire detection system for buildings is not generally required.

3.1.8 Furniture

The Contractor shall provide the following items:

- Two (2) 900 mm high x 900 mm wide x 600 mm deep Brown Built or similar, two door sliding cupboards.

- One (1) timber step ladder 1000 mm high x 400 mm wide

3.1.9 Ventilation

3.1.9.1 Thermal Characteristics and Design

The thermal characteristics of buildings and location cases shall be designed to limit the dynamic range of temperature within the building to within plus 5 degrees Celsius of the external temperature throughout the whole year.

The thermal design shall take into account the power dissipated by the equipment installed in the building and the location of the building.

All ventilation in respect of buildings and location cases shall be passive. Air-conditioning is not to be used to achieve the thermal requirements of buildings and location cases.

Roof ventilation shall be provided in all equipment rooms and where provided, generator rooms. Vents in walls and doors may be required to meet thermal requirements.

In some environments the building fitted ventilation may be insufficient. In such cases sun shades may be provided.

Independent certification will be required relative to the buildings and location cases to verify conformity with the requirements of this specification.

3.1.9.2 Ventilation to buildings

Roof ventilation shall be provided by means of at least one (1) rotary roof ventilator model IVR LTV 200 or equivalent per room and installed in accordance with the manufacturer's recommendations. Where the floor area of an equipment room exceeds 12 square metres, a minimum of two (2) ventilators shall be installed. These ventilators shall not be placed directly above equipment or equipment racks. The ventilators shall be ducted through the ceiling lining and shall include a removable insect mesh screen fitted to the ceiling.

Buildings with floor area of ten (10) square metres or less shall include two (2) 300 mm x 250 mm vermin and insect proof vents located in the wall opposite the door at a height 150 mm below the ceiling level. A single vent shall be provided in the lower section of the door. This vent shall have a minimum size of 0.03 sq.metres, be waterproof and filtered to minimize the entry of dust.

3.1.9.3 Ventilation to Generator Rooms

Roof ventilation shall be provided in generator room by means of one (1) rotary roof ventilator model WR8 or equivalent. A thermal extraction fan shall be installed as an integral unit in the rotary roof ventilator to exhaust air during operation of the diesel generator unit. It shall be IP 56 rated and wired from the lighting circuit with an in line switch for emergency isolation. The switch shall be located adjacent to the interior light switch and appropriately labelled. The roof ventilator and thermal extraction fan are to be installed in accordance with the manufacturer's recommendations.

The Contractor shall carry out a test on site to confirm and prove that the generator will run at 75% of its full load for twenty four (24) hours without any malfunction. Vents provided in the generator room shall have fixed metal blade louvres and external fixed wire insect screens. Special attention shall be given to ensuring that the vents are weather and insect proof.

Fixed aluminium louvres, 600 mm wide x 930 mm high, with framed opening and internally fitted wire insect screens shall be installed in the generator room. Two (2) of the louvres shall be installed 350 mm from the floor and the other two (2) installed 350 mm down from the ceiling.

3.1.9.4 Sun Shades

Over roof sun shades may be installed by the Contractor to assist in achieving and maintaining the thermal characteristics of the equipment building. Where this is the case the sun shade shall be designed to a W65 wind load rating and be installed by the Contractor complete with approved specifications and drawings.

The steel frame and support structure shall be hot dipped galvanised to AS1650, with the galvanising to take place after fabrication. The roof over shall be Colourbond metal roofing to AS1562 and be at least 200 mm clear of the highest point of the building roof line and protrude 1000 mm (minimum) outside the building walls on all sides.

The fall on the sun shade shall be 100 mm from front to back and drain away from the track.

3.1.10 Standby Generator

Where a standby generator is required or nominated in the Particular Specification it will be housed in a separate room.

Concrete foundations for standby generators shall be cast separately into solid ground, and separated from the concrete floor. Individual conduits shall be provided to accommodate fuel line and electrical connections.

Alternatively the standby generator may be that for a portable type installation.

In both cases the generator manufacturer shall provide a fully dimensioned drawing of the mounting base requirements, showing overall dimensions, the exact location of the anchor bolts, structural requirements of the concrete mounting pad and in the case of a portable installation, the position of cable access space. Details of the portable housing requirements can be found in Section 5.0.

3.1.11 Communications Compartment

Where required to ensure Third Party Communications access, a communications compartment 1200 mm high x 500 mm wide x 300 mm deep shall be fitted into the end wall beside the door.

The compartment and door shall be made from 3 mm steel and construction shall be generally as required for the main door and door jamb. The compartment door shall be hinged with two (2) 120 mm stainless steel fixed pin hinges. Locking shall be as required for the main door with accessibility from the outside only. Corrosion protection shall be as for the main door and jamb.

A 150 mm x 300 mm cable entry aperture shall be provided internally in the floor immediately under the communications compartment.

3.1.12 Nameplates

Room nameplates shall be provided on all doors and buildings with the building nameplate being secured on the brick wall facing the main railway line.

Nameplates shall be Architectural Bronze alloy plate stock, satin finished with engraved areas painted with Dulux Pioneer colour enamel or similar.

The lettering shall be Helvetica Medium or similar, with a height of 50 mm for doors and 100mm for buildings.

3.2 Cavity Brick or Cavity Concrete Block Buildings

3.2.1 Brick and Concrete Block Work

All brick and concrete block work associated with the building shall be supplied and constructed in accordance with AS 3700, AS1225 and AS4455.

The external face bricks and concrete blocks shall be of similar colour and texture to any adjacent buildings and the internal surface shall be smooth surfaced face and of light colour.

Footings shall be constructed in accordance with the Building Code of Australia and in accordance with AS 2870. The top of footings will be a minimum depth of 300mm below finished level and founded in the natural ground. Footings may need to be stepped to suit natural ground levels. Following the excavation and before any concrete is placed, a certificate from a Structural Engineer certifying the suitability of the foundations for the proposed building, recognising the geotechnical conditions, shall be supplied.

Walls shall be 280 mm cavity brick or 200 mm waterproof cavity concrete blockwork with waterproof mortar. Walls shall have all necessary damp proof courses, cavity flashings etc. Concrete block walls shall have bond beam and reinforced masonry lintels as required. The roof shall be anchored to the footings by galvanized wall cyclone bolts.

Brick and concrete blocks shall be laid in a mortar using a mix ratio of 1: 1: 6, cement: lime: sand, unless stated otherwise on the Contractors Drawings and shall be laid to give a regular pattern. Mortar shall be placed such that beds and perpends are filled solid with mortar.

Finished brick and concrete block work shall be acid cleaned with a solution containing 1 part Muriatic acid to 10 parts water. Following the acid cleaning, the brickwork shall be thoroughly washed down with clean water.

Hot dipped galvanised mild steel flat or angle lintels shall be supplied and installed over masonry openings. For spans of less than two (2) metres, the lintels shall have a minimum bearing at each end of 150 mm. For spans of greater than two metres and up to three metres, the minimum bearing area at each end shall be 230 mm.

Damp course and flashing shall be provided where necessary or shown on the Contractors Drawings and shall be bitumen coated aluminum 0.7 mm thick.

Joints in internal face brick and concrete block work shall be cut flush. External face brick and concrete block work shall have 5 mm deep-ironed joints. Where control joints are required, unless shown otherwise on the Contractors Drawings, they shall be 15 mm wide, and shall be completely filled with an elastomeric sealing compound.

3.2.2 Roofing

3.2.2.1 Roof Cladding

Roofing shall be constructed in accordance with AS1562.1 and be consistent with good building practice. It shall comprise colour bonded metal roofing and reflective thermal insulation sarking, plus mineral wool insulation.

Mineral wool insulation and double-sided aluminium reflective thermal insulation shall be placed on bird wire placed on top of the roof purlins and shall be mineral wool batts, 75 mm thick with a minimum Rating R2.5. Reflective thermal insulation shall be Sisalation 430 or equivalent.

Metal roofing shall be Klip-Lok Hi-Ten 0.65 mm or Spandek Hi-Ten 700 0.53 thick or similar steel sheeting with Colourbond finish, colour to be matched to the local environment. Ridge capping shall be preformed Colourbond, colour to match the roofing sheet.

The roof slope shall be a minimum 3 degrees, with the high point being on the front side of the building.

Eaves closures shall be factory formed eaves with the Colourbond finish, colour to blend with the brickwork and roofing colours. Barge flashings shall include preformed barge capping with Colourbond finish, colour to match the eaves closures.

Metal cladding and accessories shall be installed in accordance with good building practice and the Manufacturer's Specifications.

3.2.2.2 Gutters

Roof gutters shall be Lysaght Sheerline or equivalent, Colourbond finish, colour to match the barge flashings, with overflow slots and supported on brackets at no greater than 900 mm centers.

3.2.2.3 Down Pipes

Down pipes shall be size 100 x 75 x 0.7 mm constructed from steel with Colourbond finish, colour to match the guttering, and supported with matching straps not exceeding 1200 mm centres. The down pipes are to discharge into a stormwater drainage system where available or over a 300 mm x 300 mm x 100 mm splash pads or the concrete apron. In all situations these shall drain away from the track.

3.2.3 Timberwork

Unless otherwise nominated in the Contractors Drawings, timber shall be Grade F5 as a minimum and shall be clean and straight and shall be fixed using galvanised fastenings.

3.2.4 Eaves Lining and Ceilings

Eaves lining shall be 6mm fibrous cement sheeting e.g. Versilux or equivalent. Ceilings shall be minimum two (2) hour fire resistant plaster board. All joints shall be taped and plastered.

3.2.5 Finishes

3.2.5.1 Walls

Unless otherwise nominated in the Particular Specification, there is no requirement for the rendering of concrete block or brick partition walls.

3.2.5.2 Painting

All exposed surfaces (excluding external brickwork and steel chequer plate) which have not been paint finished at manufacture shall be painted in accordance with AS4548 and other any other Australian Standards relevant to the exposed surface.

Prior to the application of any coating, the surface shall be properly prepared. The finishes to be applied depend on the surface material as set out in the following table.

Surface	Paint System
Woodwork	primer coat, undercoat and two finishing coats
Steelwork and metalwork	primer coat and two finishing coats
Internal brick and concrete block walls	two coats of clear silicone based sealer
Cement render	sealer coat and two finishing coats
Fibrous Cement and Plaster Board	sealer/undercoat coat and two finishing coats
Cement flooring	sealer coat and two finishing coats of paving paint
Cement flooring where batteries are installed	paving paint will be of the electrolyte resistant type and shall have a sealer coat and two finishing coats

The INTERNAL finishing coat shall be Dulux Weather-shield Gloss paint or equivalent. Colour "Surf" for cement rendered walls and "Ceiling White" for ceilings.

The EXTERNAL finishing coat shall be Dulux Weather-shield Gloss paint or equivalent. Colour "Cane" walls with "Saddle" trim.

Concrete flooring finish coat shall be Dulux heavy duty paving paint. Colour "Saddle"

3.3 Pre-cast Concrete Construction

3.3.1 General

This part of the Specification sets out the requirements for the manufacture and installation of pre-cast concrete type small buildings to a maximum size of two rooms. The type of building specified herein shall be supplied and constructed in accordance with AS3735, and is one which is manufactured complete off-site and lifted or slid into place on a prepared foundation.

This type of building shall not be used in areas, which are known to be subject to (local) flooding.

3.3.2 Inspection

Access to the Contractor's and/or Manufacturer's premises shall be provided during the construction of this type of building for inspection purposes by ARTC's nominated representative.

3.3.3 Warranty

The building shall be warranted free of defect in manufacture and installation for a period of two (2) years from the date of installation.

3.3.4 Roof, Wall and Floor Construction

Cement mortar used in the construction of the pre-cast buildings shall have strength not less than 32 MPa at 28 days.

The floor thickness shall be a minimum of 125 mm with two (2) layers of SL82 reinforcing mesh. Starter mesh to tie the floor to the walls shall be two (2) layers of G113 galvanised wire mesh with a minimum overlap of 300 mm.

Cable entry aperture(s) shall be provided in the floor suitable for the accommodation of 4 x 100 mm Class 9 uPVC pipes.

Lifting hook sizes and positions shall be determined by the manufacturer and the capacity of the hooks to withstand all lifting and handling loads shall be the responsibility of the manufacturer.

Walls shall be manufactured from cement mortar placed over two (2) layers of G113 galvanised wire mesh and shall have a minimum rendered thickness of 60 mm. The walls shall be vertical and have regular line and finish.

Roofs shall be manufactured from cement mortar placed over two (2) layers of G113 galvanised wire mesh and shall have a minimum rendered thickness of 60 mm and shall be waterproof. Roof slope shall be 3 degrees or more with the high point at the centre (or on the centre line) of the building.

Additional reinforcement around apertures shall be positioned diagonally to corners and shall be not less than 25 mm from the aperture perimeter. The reinforcement shall be G113 galvanised wire mesh.

Buildings shall be cured for at least fourteen (14) days following manufacture and shall not be transported, lifted or otherwise moved from their place of manufacture for twenty eight (28) days following manufacture to ensure stability during construction handling.

3.3.5 External and Internal Finishes

The EXTERIOR surface shall be smooth rendered without voids and with a uniform architectural stipple. The surface shall be coated with one coat of acrylic sealer/undercoat and two finish coats of full gloss acrylic in accordance with AS4548. Colour is to be consistent with similar type buildings in the area and that of the local environment.

The INTERIOR roof and wall surfaces shall be smooth rendered and free of voids. These surfaces shall be painted with one coat acrylic sealer/undercoat and two finish coats of Dulux heavy duty acrylic paving paint or similar. Colour white full gloss.

The floor shall be coated with Dulux heavy duty paving paint or similar. Colour "Saddle" full gloss.

3.3.6 Ventilation

The thermal characteristics and thermal design of the pre-cast building shall be consistent with the requirements in Section 3.1.9.

Additional consideration of the thermal design has to be given as precast concrete buildings do gain and retain heat significantly. Additional venting and/or sun shading is likely to be required.

3.3.7 Electrical

The Contractor shall supply and install all electrical services associated with the building in accordance with AS3000 and section 3.1.5.

Cabling to light fittings and switches shall be installed in surface mounted conduits securely fixed to the internal walls/ceiling. All fluorescent fittings shall be double insulated and not earthed.

3.3.8 Installation

3.3.8.1 Foundation

A foundation of a minimum of 200 mm of a cement stabilised fine crushed rock suitable for road construction, compacted to 98% modified maximum dry density (MMDD) shall be placed over the graded building site. Cement content shall be at least 3% and aggregate size shall not exceed 20 mm.

The height of the foundation pad shall be 50 mm minimum above ground level whether natural level ground or leveled area. Variation to level is not to exceed 5 mm. The foundation pad shall cover the total area of building and surrounding path plus 150 mm and shall be battered to ground level at not more than 30 degrees.

A layer of sand not less than 50 mm deep shall be laid between the foundation pad and the building floor. A waterproof membrane (Fortecon or similar) shall be laid between the sand and building floor to extend at least 300 mm outside the building.

Provision shall be made for underground services such as storm water, drainage, sewerage, power cable, earthing cable, and cable route entry to the building, pits, and ducts etc. the details of which are to be included on the approved site drawings.

3.3.8.2 Handling of Building

The building shall be lifted onto or may be slid off a tilt tray directly onto the foundation pad. If slid off the tilt tray, care shall be taken to ensure that the prepared sand surface on the foundation pad is not disturbed causing voids under the floor.

3.4 Prefabricated Sandwich Panel Buildings

3.4.1 General

The building shall be a prefabricated type transportable building, constructed of steel framing with walls and roof of metal sandwich panel, similar to those manufactured by "Retracom".

The building shall be suitable for installation and pre-wiring of the equipment to be housed off site then for transporting and erecting on site.

The building shall be designed to withstand weather conditions for the area in which it is to be installed but shall have as a minimum W65 wind load rating. The building shall be robust and designed to withstand all but the most determined attempt at forced entry. The insulation materials used to maintain the required temperature range shall be sufficiently robust that they are not easily damaged.

The racks for Signaling relays and/or supervisory equipment shall be free standing and securely fixed to the floor and shall have minimum clearances consistent with Section 2.2. These clearances shall be maintained when determining the building size as will the minimum width, which shall be 2400 mm. A separate room shall be provided for a standby generator or alternatively accommodated by way of a portable Standby generator as described in Section 5 in this document.

The Contractor will be required to prepare drawings and specifications/documentation for the building as part of the Contract and provide a Certificate of Approval from a registered Engineer/Architect prior to commencing construction. The Contractor shall provide cable diagrams to show all wiring that has been run in the building for Electrical services.

The Contractor will be required to allow inspection of the building, by ARTC's nominated representative, at any stage of it's construction and prior to delivery to site.

3.4.2 Frame

The base frame shall be constructed on skid bearers 250 mm x 50 mm x 4 RHS set at 1800 mm centres. The joists shall be welded to the bearers and side frame. The skid bearers shall have 50 mm towing and lifting holes drilled close to each end. The skid bearers shall have provision for bolting the prefabricated building to the base slab and/or supports.

Provision shall be made for a cable entry area to all external cable pits. Where the building is for a motor generator a cut out (1020 mm x 670 mm) in the base frame and floor will be allowed to accommodate the generator concrete base block. The frame and floor shall be appropriately braced in these areas.

The frame shall be galvanised, and the base frame shall be hot dipped galvanised after welding and drilling, and then protected during manufacture of the building.

3.4.3 Walls and Roof

Walls shall be constructed of 75 mm (minimum) thick sandwich panels, using 0.6 mm metal sheeting inside and outside, with fire resistant insulating material between.

The roof shall be constructed of 100 mm (minimum) thick sandwich panels, using 0.6 mm metal sheeting inside and outside, with fire resistant insulating material between.

All internal and external joints shall be neatly trimmed and sealed with silicone. Stainless steel rivets, sealed with silicone shall be used throughout.

The walls and roof shall have a colourbond baked polyester low gloss finish, off white in colour.

The panels shall be sufficiently strong for equipment to be fixed to the walls.

Special attention shall be given to preventing the entry of ants into these panels and to this end, drain holes should not be provided in the wall panels. A non-volatile residual insecticide shall be used to achieve this requirement.

Colourbond roll-form barge capping shall be used.

The roof shall have a minimum fall of 3% across the building. All buildings shall be provided with galvanised sheet steel gutter and downpipe discharging into a stormwater drainage system where available or over 300 mm x 300 mm x 100 mm splash pads or the concrete apron. In all situations these shall drain away from the track.

3.4.4 Foundation and Floor

The building may be set directly onto a reinforced concrete raft slab or set on supporting galvanised steel posts. If set on posts the floor shall not be higher than 600mm above the surrounding ground level.

Foundations shall be constructed generally in accordance with the manufacturer's recommendation and shall be designed to meet the site conditions and buildings characteristics, e.g. weight, size, bearing points etc.

The design will detail an appropriate method of fixing the building to the foundation to ensure it resists all loadings.

If the building is mounted on posts concrete paving 75mm thick shall be provided under the building and extending at least 600 mm beyond the walls. Buildings intended to house motor generators shall incorporate a correctly sized concrete generator block isolated from other foundations and/or paving. The raft slab or concrete paving will accommodate the requirements for cable pits.

3.4.5 Generator Block

Where a Generator Room is provided, the concrete block for the generator shall be cast separately into solid ground and be 20Mpa concrete. Any gap between the floor and the

generator foundation shall be sealed with flexible material. The flooring in the generator room shall be designed to drain and expel any spillage of diesel fuel to an external containment area. Any such design shall not allow the ingress of water or vermin.

In situations where portable standby units are approved, the Generator block shall be installed in accordance with Section 5.0

3.4.6 Flooring

The floor shall be constructed of 19 mm minimum thickness structural tongue and groove water resistant plywood, mechanically fastened to the floor joists.

The floor shall be finished with 2 mm thick acid resistant sheet vinyl, bonded to plywood. The vinyl shall be supplied in minimum roll widths of 2000 mm, and all joints welded using a hot air welding gun and welding rod matching the colour of the vinyl. The vinyl shall be covered up the walls to a height of 100 mm above floor level. The cove is to be formed using the heat method. All corners in the coving shall be fabricated using the envelope method. Mitred corners will not be accepted.

Vinyl floors shall be cleaned then sealed with two coats of sealer within two days of laying. Two coats of polish shall then be applied. The type and application of sealer and polish shall be to the vinyl manufacturer's recommendations. Aluminium nosing shall be provided at the door sills.

3.4.7 Doors and Windows

External doors shall be of sufficient size to allow easy access for the installation of replacement or housed equipment.

Doors and windows will be provided in accordance with sections 3.1.3 and 3.1.4.

3.4.8 Steps

Where a building is set on posts and the floor is more than 300mm above the surrounding level a set of full width galvanised steps shall be provided for each entry.

The metal stringers and stair treads shall be hot dipped galvanised and are to be of an open mesh construction.

Provision shall be made to allow the top of the steps to be bolted to the frame of the building and the base to be secured to the concrete pathway around the building.

3.4.9 Ventilation

The thermal characteristics and thermal design of the building shall be consistent with the requirements of Section 3.1.9.

3.4.10 Electrical services

The Contractor shall supply and install all electrical services associated with the building in accordance with AS3000 and Section 3.1.5.

3.4.11 Battery Cupboard

The battery cupboard where required shall be constructed of 15 mm thick (minimum) exterior grade waterproof plywood, 1100 mm high x 440 mm deep, with the length to suit the location battery requirements and attached to the internal wall of the building.

Three (3) sliding doors shall be provided, and a lower and mid shelf, each suitably braced to support a battery weighing 125kgs without sagging. The upper and lower shelves shall be adjustable and removable to allow for housing of different battery configurations.

Alternatively the same battery cupboard may be supplied with external opening doors of pre-fabricated type, steel framed, and clad with matching colourbond as all other external doors.

3.4.12 Cable Entry

Provision shall be made for cable access areas, 1200 mm long x 300 mm wide. Such cable entry points shall be located to suit the equipment layout within the building. They are to be kept clear of any main element of the framework and the framework adjusted and appropriately braced around any opening to accommodate the access area. The floor in these areas shall be left intact and openings made on site to suit cable layout.

The cable entry to the building shall be via cable pit/s in accordance with section 2.3.10. and that of ESC-11-01 Construction of Cable Routes & Associated Civil Works.

4 Location Cases, Termination Cases and General Purpose Cases

4.1 General

This section of the Specification sets out the requirements for location cases, termination cases, and general purpose cases, including Emergency Point Machine Lock (*EPML*) and Emergency Operator's Lock (EOL) boxes, and battery well enclosures.

For the purposes of this Specification, location cases are defined as free standing cases 900 mm or more high.

Termination/distribution cases are defined as post or wall mounted cases less than 900 mm high.

General-purpose cases (including *EPML*/EOL boxes) are defined as cases up to approximately 600 mm high x 600 mm width.

Battery Well enclosures are defined as on ground or part in ground concrete enclosures for housing batteries up to approximately 950 mm dia. X 600 mm deep (round type) or alternatively 950 mm x 950 mm x 600 mm deep.

4.2 Warranty

All location cases, termination cases and general-purpose cases shall be warranted free of defect for a period of two (2) years from the time of installation.

4.3 Location Cases

4.3.1 Construction

Location cases shall be designed and constructed so that the equipment is mounted on a central frame, and the case can be removed without interference to the equipment.

Locked access doors shall be provided both front and rear, and the top of the case shall extend over the doors to form weather protection.

4.3.2 Materials

Location cases and termination boxes shall be manufactured from either:

- AS1449 grade 304 stainless steel of 1.6 mm minimum thickness and 2B finish
- 3CR12 corrosion resistant steel of 1.6 mm minimum thickness and
- 2B finish Aluminum alloy 5052-H32 of 2.5 mm minimum thickness.

Case sides, case top and doors shall be reinforced as required by "cross breaking" or by the addition of stiffeners to provide adequate rigidity.

4.3.3 Welding

Welding shall be carried out in accordance with AS1665 for Aluminium and AS1554 Part 1 for Steel.

4.3.4 Doors and Door Hardware

Swing doors shall be provided front and rear. The maximum width of a single door shall not exceed 1125 mm.

Doors up to 1500 mm high shall be hinged on two (2) 100 mm stainless steel fixed pin hinges. Doors over 1500 mm high shall be hinged on three (3) 100 mm stainless steel fixed pin hinges. All doors shall be secured with a three point locking system (top, bottom and centre) and the door handle shall be recessed when in the locked position.

Door handles shall be secured with the standard padlock currently in use on the rail corridor, samples of which are available on request. Doors shall be provided with automatic latching top and bottom stays to support the door in the open position (which shall generally be approximately 135 degrees) in wind speeds up to 45 m/sec. The stays shall be secured to door and case such that the method of securing is stronger than the stay.

Door sealing shall be with synthetic rubber or PVC foam material securely and permanently attached to either case or door.

4.3.5 Ventilation

4.3.5.1 Thermal Characteristics and Design

The thermal characteristics and thermal design location cases shall be consistent with the requirements in Section 3.1.9.

As a minimum, all location cases, whether they are single or double, shall be ventilated by the provision of vents in the top and bottom sections of both front and rear doors or alternatively in the top and bottom sections of the location case side-walls.

All vents shall be waterproof, covered with metallic fly screen mesh to prevent insect entry, and shall be filtered to minimise dust entry. Each vent shall have a minimum size of 0.03 square metres and shall be distributed to achieve maximum airflow through the location case.

4.3.5.2 Sun Shades

Over roof sun shades may be installed by the Contractor to assist in achieving and maintaining the thermal characteristics of location cases.

Where this is the case the sun shade shall be designed to a W65 wind load rating and be installed by the Contractor complete with approved specifications and drawings.

The steel frame and support structure shall be hot dipped galvanised to AS1650, with the galvanising to take place after fabrication. The roof over shall be Colourbond metal roofing to AS1562 and be at least 200 mm clear of the highest point of the location case and protrude 1000 mm (minimum) outside the location case on all sides.

The fall on the sun shade shall be 100 mm from front to back and drain away from the track.

4.3.6 Lighting

Lighting fed from the 110/120v Signaling supply shall be supplied through a 2 Amp fuse (Klippon type SAKS3), and switch. A single tube fluorescent light (110/120v x 20 watt) shall be provided in both the front and rear section of each location case for maintenance purposes.

The fittings for these fluorescent lights shall be double insulated and not earthed.

4.3.7 Communications Compartment

New Communications equipment shall be housed in a separate location case or in a general-purpose location case mounted on the sidewall of the Signaling equipment location case to enable Third Party access.

All work shall be undertaken in accordance with the requirements of PART 9 of the Australian Communications Authority (ACA).

4.3.8 Storage of Maintenance Record Documents

Pockets shall be provided for storage of track circuit history cards either on doors or in the case. If on the door(s), the pocket shall be provided with a waterproof cover and a drain hole. History cards are approximately 160 mm wide x 200 mm long.

The contractor shall supply and install a plan holder, (100 mm PVC conduit with end caps) suitable for protecting rolled up A3 size circuit drawings.

4.3.9 Installation

Location cases shall be generally mounted on a concrete foundation with the base of the location case being not less than 300 mm above the concrete area surrounding the location case.

Where it is not practical to install on concrete foundations, raised metal platforms shall be provided. The platforms shall comply with the relevant parts of AS1657.

Regardless as to the type of installation, all work shall be undertaken in accordance with ESC-11-01 Construction of Cable Route and Associated Civil Works.

4.4 Termination/Distribution Cases

4.4.1 Construction

Termination/distribution cases shall be constructed such that the back or base of the case forms the support for the termination rack within. The back of the case shall be of sufficient strength or sufficiently stiffened to support the case and rack without distortion when bolted or clamped to a single steel post 150 mm or less wide.

Generally termination cases should not exceed 900 mm in height and 450 mm in depth.

4.4.2 Materials

Termination/distribution cases shall be manufactured from the materials specified in Clause 4.3.2.

4.4.3 Welding

Welding shall be carried out in accordance with AS1665 for aluminum and with AS1554.1 for steel.

4.4.4 Door and Door Hardware

Termination/distribution cases shall include a single front door hinged on two 100 mm stainless steel fixed pin hinges.

Hinged doors shall be provided with two point fastening up to 900 mm high and three point fastening over 900 mm high. The handle shall be recessed when closed and provision shall be made to accept a padlock that is currently in use on similar equipment in the rail corridor.

4.4.5 Ventilation

Ventilation is not required when used as a Termination/Distribution case.

Where used as a Signaling equipment housing, the cases shall be constructed in accordance with Clauses contained in Section 4.3.5.

4.4.6 Lighting

Lighting is not normally required in termination/distribution cases.

Where used as equipment housing the requirements of Clause 4.3.6 shall apply.

4.5 General Purpose Cases

4.5.1 Material

General-purpose cases may be manufactured from:

- AS1449 grade 304 stainless steel of 1.6 mm minimum thickness,
- 3CR12 corrosion resistant steel 1.2 mm thick or
- Aluminum grade 5052 H32 2.0 mm thick.

4.5.2 Door and Door Hardware

General-purpose cases shall include a single front door hinged on two 100 mm stainless steel fixed pin hinges.

The door shall be effectively weather sealed either by shape or by synthetic rubber or PVC foam seals.

Single point locking is required to accept the padlock currently in use on similar equipment in the rail corridor.

4.5.3 Ventilation

Unless otherwise nominated in the Particular Specification, ventilation in this situation is not required.

4.5.4 Lighting

Unless otherwise nominated in the Particular Specification, lighting in this situation is not required.

4.5.5 Installation

General-purpose cases are generally post mounted. They shall be installed in accordance with ESC-11-01 Construction of Cable Routes & Associated Civil Works.

4.6 Special Applications

4.6.1 EPML / EOL Boxes

Where a general purpose case is an Emergency Point Machine Lock (EPML) box or an Emergency Operator's Lock (EOL) box, the door shall be constructed such a manner that it cannot be closed and locked until the crank handle or key has been restored to the normal position in the EPML or EOL.

Door locking in this application shall be consistent with that currently in use on similar equipment in the rail corridor.

4.6.2 Battery Well Enclosures

Where the general purpose case is a Battery Well enclosure the equipment enclosure shall be mounted a minimum of 4.5 metres from the centre line of the track and constructed in accordance with typical drawings A3 88 -155 / 156 / 157 / 158 /159.

The enclosure shall be a separate compartment from other equipment and be of concrete construction either round or square in shape.

The batteries within the enclosure are to be seated on a timber flooring consistent with that shown in the typical drawings, similarly the battery well lid shall be timber lined.

4.6.3 Installation

4.6.3.1 EPML / EOL

EPML and EOL cases are generally post or rail mounted. They shall be installed in accordance with ESC-11-01 Construction of Cable Route and Associated Civil Works.

4.6.3.2 Battery Wells

Where Battery Well enclosures are required a foundation pad of 100 mm cement stabilised fine crushed rock suitable for road construction, compacted to 98% modified maximum dry density (MMDD) shall be provided. Cement content shall be at least 3% and aggregate size shall not exceed 20 mm.

The foundation pad shall span the total area of the battery well and a surrounding area no less than 500 mm.

A layer of sand not less than 50 mm deep shall be laid between the foundation pad and the battery well floor. A waterproof membrane (Fortecon or similar) shall be laid between the sand and battery well to extend at least 300 mm outside the building.

4.7 Prefabricated Sandwich Panel Housing - Other

Where the floor area requirements do not exceed 10.0 sq.metres and prefabricated sandwich panel construction is being installed, they shall be constructed in accordance with Section 3.4 above.

The ventilation shall be provided in accordance with Section 3.1.9.

All electrical services shall be in accordance with the Signal Design, equipment requirements and / or as nominated in the Particular Specification.

The building and doors shall be robust and designed to withstand all but the most determined attempt at forced entry.

5 Freestanding Standby Generator Housing

5.1 General

The motor/generator unit must be a diesel type unit. Under no circumstances are petrol type units to be used for this type of installation.

The motor/generator sub-chassis shall be supplied as part of a complete functional unit including fuel tank and control panel, mounted in a completely enclosed self-contained housing. This housing shall be of similar design to, and provide at least the same degree of protection as, the standard all steel substation 'kiosk' used by electricity supply authorities.

5.2 Housing

The housing shall provide a well ventilated, vandal and weather proof enclosure for the motor generator plant, and shall require no additional form of external protection. The housing shall incorporate one or more lifting eye lugs suitable for lifting the entire unit onto or off a truck by truck mounted crane.

The housing shall be provided with sufficient doors to enable free access to all parts of the installation for maintenance and repair. All doors shall be fitted with cylinder type locks suitable for fitting of barrel locks consistent with those currently in use on the rail corridor. The housing shall provide adequate passive ventilation for proper operation of the plant under all probable weather conditions.

5.3 Foundation/Base

The base shall be of a design suitable to act as a sled for moving the unit, and shall be provided with loops or cutouts to enable the unit to be winched onto or off a tilt bed truck or trailer.

The base of the housing shall be suitable for installation by bolting directly to a flat topped concrete block. This concrete block shall be cast separately in solid ground and be 20Mpa concrete to detail supplied by the generator manufacturer. Any gap between the block and the concrete pathway shall be sealed with flexible material. Holding down bolts shall only be accessible from inside the housing.

The supplier shall provide all necessary installation hardware, and any gaskets or sealing material required between the base and mounting pad.

5.4 Control Equipment

Control equipment shall be suitably arranged, and the housing so constructed, to provide for the entry of control and power cable conduits through the mounting pad, in the position shown on the manufacturer's drawing. A clear space of at least 150 mm x 300 mm shall be allowed in the base for this access. Cable terminals shall be mounted at least 300 mm above the inner edge of this space.

5.5 Starter battery

The starter battery shall be provided with suitable mounting arrangements to protect the housing from damage by spilt electrolyte. The battery shall be located within the housing.

5.6 Fuel tank

Portable installations may incorporate fuel tanks set lower than the engine provided that the fuel pumping system fitted does not require priming either after prolonged periods of storage or non-use, or after the fuel system has been drained.

Provision shall be made for the convenient draining of the fuel tank to empty out any condensation or contaminated fuel. The stopcock for this drain shall also be located within the housing.

The minimum run capacity for the unit shall be a minimum 36 hours continuous at 75% capacity loading.

5.7 Lubrication

Provision shall be made for the engine lubricating oil to vent outside the housing, with the drain outlet placed to allow for convenient collection of the drained oil for removal. It shall not be possible to drain the oil without first opening up the housing.

5.8 Exhaust / Muffling

The exhaust system and muffler shall be contained within the housing, and the outlet shall be provided with simple protection against the ingress of vermin, rain and other foreign matter.

Sufficient exhaust muffling and soundproofing shall be applied to enable the unit to comply with current environmental noise requirements.

Protection shall be provided in accordance with OH&S requirements relative to accidental contact with the exhaust system in general.

5.9 Pathway

A concrete pathway shall be provided similar to that in Clause 2.3.8.

This pathway is to be independent of the concrete block to which the standby generator will be mounted.

6 Particular Specification References

Section 1.1 – Scope

Section 1.4 – Drawings

Section 1.5 – Definitions

Section 2.2 – Floor Area of Buildings

Section 2.3.2 – Siting of Buildings

Section 2.3.4 – Site Earthworks

Section 2.3.9 – Security Fencing

Section 3.1.3.4 – Hardware

Section 3.1.4 – Windows

Section 3.1.7 – Fire Protection

Section 3.1.10 – Standby Generator

Section 3.2.5.1 – Walls

Section 4.5.3 – Ventilation

Section 4.5.4 – Lighting

Section 4.7 – Prefabricated Sandwich Panel Housing - Other