ROADS AND MARITIME SERVICES

TRAFFIC SYSTEMS

SPECIFICATION NO. TSI-SP-012

GENERAL REQUIREMENTS FOR ROADSIDE EQUIPMENT HOUSINGS

Issue: 2.0
Dated: 5 July, 2017
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## RECORD OF AMENDMENTS

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1 SCOPE

This specification covers the general requirements for roadside equipment housings. It is intended to be referenced by other roadside equipment specifications, and system and installation specifications, and shall always be read in conjunction with these referencing documents (known as Referencing Specifications).

The roadside equipment housings described in this specification are enclosures complete with electricity supply, cabling facilities and mechanical supports for the accommodation and protection of electrical traffic and transport related equipment which does not have its own standalone housing suitable for direct installation next to the road.

This specification does not cover roadside housings that are integral parts of equipment that is covered by a dedicated RMS specification, unless that specification refers to this Specification for requirements.

NOTE: Examples of equipment that has its own roadside housing include traffic signal controllers and uninterruptible power supplies for roadside systems.

NOTE: Manufacturers and/or suppliers are expected to demonstrate that their equipment is fit for purpose. RMS QA Specifications TS201 and TS202 provide guidance on the approval of equipment for generic use or specific project applications respectively.
2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian Standard Specifications

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1319</td>
<td>Safety signs for the occupational environment</td>
</tr>
<tr>
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<td>Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate</td>
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<tr>
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<td>Colour standards for general purposes</td>
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<td>AS/NZS 3000</td>
<td>Electrical installations (known as the Australian/New Zealand Wiring Rules)</td>
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<tr>
<td>AS/NZS 3100</td>
<td>Approval and test specification - General requirements for electrical equipment</td>
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<td>Approval and test specification – Residual current devices (current-operated earth-leakage devices)</td>
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<tr>
<td>AS 4086.2</td>
<td>Secondary batteries for use with stand-alone power systems, Part 2: Installation and maintenance</td>
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<tr>
<td>AS/NZS ISO 9001:2000</td>
<td>Quality management systems - Requirements</td>
</tr>
<tr>
<td>AS 60529</td>
<td>Degrees of protection provided by enclosures (IP Code)</td>
</tr>
</tbody>
</table>

2.2 RMS Specifications and Documents

The following RMS specifications (as amended) have been referred to in subsequent clauses of this Specification:

- QA Specification TS201 – Approval of ITS Field Equipment
- QA Specification TS202 – Approval of ITS Solutions for Projects
- TSI-SP-016 – General Requirements for Outdoor Electronic Equipment

2.3 Compliance with Specifications

All equipment and materials, where not otherwise specified, shall be in accordance with Australian Standard specifications, where such exist, and in their absence, with appropriate IEC or ISO specifications.
The equipment shall comply with the safety requirements of the National Electrical Codes AS/NZS 3000 and AS/NZS 3100. The equipment shall also comply with the requirements of the NSW Work Health and Safety Act 2011.

All electronic components and electronic assemblies shall comply with the requirements of RMS Specification TSI-SP-016 (as amended).

2.4 Precedence of Specifications

In the event of conflicts between the referenced specifications, the order of precedence shall be as follows:

(a) Australian regulatory requirements;
(b) the Referencing Specification (see definition in Clause 3);
(c) this Specification (as amended);
(d) other RMS specifications and documents;
(e) Australian Standard specifications; and then
(f) IEC and ISO specifications.
### 3 DEFINITIONS AND GLOSSARY OF TERMS

The following definitions and abbreviations shall apply:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACMA</td>
<td>Australian Communications and Media Authority</td>
</tr>
<tr>
<td>CB</td>
<td>Circuit breaker</td>
</tr>
<tr>
<td>Contractor</td>
<td>The contractor of the contract under which this Specification is part of the contract document</td>
</tr>
<tr>
<td>ELV</td>
<td>Extra-low voltage, as defined in AS/NZS 3000</td>
</tr>
<tr>
<td>equipment</td>
<td>Means roadside equipment housings covered by this Specification unless the context dictates otherwise</td>
</tr>
<tr>
<td>Housing, Housings</td>
<td>The housing(s) covered by this Specification</td>
</tr>
<tr>
<td>LSZH</td>
<td>Low smoke zero halogen</td>
</tr>
<tr>
<td>LV</td>
<td>Low voltage, as defined in AS/NZS 3000</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>The manufacturer of the Housing</td>
</tr>
<tr>
<td>MEN</td>
<td>Multiple Earthed Neutral, which is a system of electrical earthing specified in AS/NZS 3000</td>
</tr>
<tr>
<td>MOV</td>
<td>Metal Oxide Varistor</td>
</tr>
<tr>
<td>Referencing Specification</td>
<td>The document or specification that is applicable to the contract works and stipulates or requires compliance with Specification TSI-SP-012 in full or in part</td>
</tr>
<tr>
<td>Roadside Equipment</td>
<td>The roadside equipment of which the Housing is an integral part</td>
</tr>
<tr>
<td>RMS</td>
<td>Means Roads and Maritime Services, which is a New South Wales Government agency</td>
</tr>
<tr>
<td>RMS Representative</td>
<td>The person appointed by Roads and Maritime Services to carry responsibilities on behalf of Roads and Maritime Services for the execution of the contract under which the equipment housing covered by this Specification is supplied. A reference to the RMS Representative in this Specification shall be taken to include a reference to the representative(s) of the RMS Representative.</td>
</tr>
<tr>
<td>Supplier</td>
<td>The company or person that directly supplies the equipment covered by this Specification to RMS or works overseen by an RMS Representative</td>
</tr>
</tbody>
</table>

NOTE: The term “RMS Representative” may appear in bold fonts in this Specification for ease of location.
4 TECHNICAL REQUIREMENTS

4.1 General

Housings shall be of the ground-mounted type. The external dimensions of the Housings shall be within the following limits:

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>1200 mm</td>
<td>1700 mm</td>
</tr>
<tr>
<td>Depth</td>
<td>360 mm</td>
<td>420 mm</td>
</tr>
<tr>
<td>Width</td>
<td>750 mm</td>
<td>800 mm</td>
</tr>
</tbody>
</table>

NOTE: Subject to the prior approval of the RMS Representative, the external dimensions of a ground-mounted Housing may be increased as approved. A matching concrete footing will be required for the installation of the oversized Housing.

4.2 Identification

Each Housing shall have on the outside an identification label acceptable by the RMS Representative.

Where an identification label for the Housing is required under the Referencing Specification, the details of the label shall be in accordance with the Referencing Specification.

4.3 Construction

4.3.1 General

Each Housing shall be constructed with a body section, a roof, a base section and an access door.

All parts shall be of rigid construction formed from folded metal with welded joins.

The roof shall provide run off (e.g. of rain water) to the rear and/or sides of the Housing.

The exterior shell shall be free from irregularities and free from fasteners such as bolts, screws and pop-rivets, except for the lifting brackets referred to in Clause 4.3.3.

The interior and exterior of the Housing shall be free from sharp corners and projections, which may cause injury. All exterior corners and the roof shall have a minimum external radius of 3 mm. All edges shall be de-burred.

The Housing shall be designed to allow it to be installed with the rear side adjacent to a wall or fence or similar structure without impeding access to the interior of the Housing.

The top of the mounted Housing shall not deflect more than 10 mm when a force of 2 kN is applied at the top of the Housing in any direction.
4.3.2 Provision for Management of Condensation

The Housing shall be designed to protect its interior surfaces and all electrical equipment, modules and parts it accommodates from condensation inside the Housing. As a minimum, the following measures shall be provided:

(a) Drip tray(s) or equivalent to collect and guide condensation away to dedicated drain points;

(b) All provisions for mounting, support or installation of electrical equipment, modules and parts shall ensure that the electrical modules and parts are positioned away from the internal vertical surface of the Housing by a gap of between 5 – 10 mm wide by suitable means (e.g. spacers) that do not provide a path for condensation to reach the module or part.

4.3.3 Provision for Lifting of Housing

The Housing shall provide lifting brackets in accordance with Drawing VM625-30 to facilitate manoeuvring of the Housing during transportation and installation.

Fasteners for attachment of the lifting brackets to the Housing should be flush with the surface of the bracket.

NOTE: Refer to Clause 4.3.1 for requirements relating to sharp corners and projections.

4.3.4 Material

The complete Housings (i.e. body, roof, base and access door) shall be constructed from Alloy 5251 H32 aluminium sheet to AS/NZS 1734 with a minimum thickness of 2.0 mm. Reinforcing shall be provided as necessary to produce a rigid structure and to provide adequate strength against vandalism.

Alternative materials which provide at least the same, or greater, mechanical, structural and corrosion protection performance, as defined in this Specification or the Referencing Specification, as the above material may be considered on provision of supporting documentation.

4.4 Mounting

The ground-mounted Housing shall be constructed with a base section that provides strength for mounting on a concrete footing.

The Housing shall not distort when mounted on an uneven concrete footing.

Notwithstanding the requirements of Clause 4.3.4, it is permissible for the base section of a ground-mounted Housing to be a frangible aluminium alloy casting (or alternative material in line with the requirement of Clause 4.3.4). Where an aluminium alloy casting is used, the alloy shall contain not less than 5% silicon and the casting shall be suitably treated to prevent electrolytic and chemical corrosion.

If the base for the Housing is constructed from aluminium sheet, then the base shall include an integral reinforcing frame to provide rigidity and to provide adequate strength for the mounting bolts. The reinforcing frame shall be made from heavy gauge aluminium.
Unless otherwise approved by the RMS Representative, the mounting bolt positions for the
ground-mounted Housing shall be compatible with the requirements of Drawing VC002-83.
Oversize clearance holes shall be provided for 12 mm diameter mounting studs to facilitate
installation. Where an alternative footing is proposed, detailed drawings and supporting
documentation supporting adequacy of the alternative shall be provided, i.e. how the
alternative footing meets all the requirements contained in this Specification and the
functional needs for accommodation and protection of traffic and transport related
equipment.

Where the Housing is to be installed in a location that may be hit by errant vehicles, frangible
plates shall be supplied for mounting the Housing to the concrete footing. The frangible
plates shall be designed such that the Housing will be dislodged from its mountings, without
damage to the mounting bolts in the event of a severe impact. Notwithstanding, the frangible
plates shall withstand a minor impact from a motor vehicle or a vandal.

4.5 Access for External Cables

Access for all external cables shall be provided through the base of the Housing.

Drawing VC002-83 shows the cable entry opening in the concrete footing. As far as
practicable, the ground-mounted Housing shall be designed to provide corresponding clear
spaces for cable entry and for the telecommunications access conduit as follows:

(a) In the central region referenced to the mounting bolt locations, an opening not less
than 360 mm x 260 mm (width x depth); and

(b) In the region where the telecommunications conduit from the housing footing enters
the housing, an opening not less than 60 mm x 116 mm (width x depth) centred on
the telecommunications conduit entry point.

NOTE: It is preferable for the cable entry openings to be larger than the above specified
minimum dimensions as far as practicable.

No equipment shall be mounted within the space 150 mm above the bottom edge of a
ground-mounted Housing other than the clamps for securing incoming cables.

NOTE: The above requirement is to provide protection of equipment against minor flooding
and to ensure a minimum level of accessibility for installation staff.

4.6 Door

A door shall be incorporated in the Housing to provide direct access to all internal equipment,
including cable clamps and terminals for the connection of external wiring. The required
access shall be provided when the door is opened not more than 110 degrees from the
closed position.

The size of the door opening shall be as close as practicable to the external width and height
dimensions of the Housing, subject to the requirements for mechanical strength. A
supplemental door may be provided where a specific section of the Housing is isolated from
the main section.

The door shall be hinged on either the left or the right side.

The door hinges shall be of the concealed type and shall not restrict the door from being
opened a minimum of 110 degrees from the closed position.

The door hinges shall be of robust construction and shall be made of a corrosion resistant
material such as stainless steel. The hinges shall be of a type that does not require
lubrication to prevent seizing.
The door hinges shall not be damaged when the door is swung forcefully open or closed, such as may occur when the door is blown by a gust of wind.

The door shall swing freely without binding on any portion of the Housing.

Deformation of the housing along the hinged side makes the use of long hinges, such as "piano hinges", highly unsuitable. Any design which makes use of long hinges will need to be supported by significant evidence and testing of suitability.

4.7 Door Locks

4.7.1 General

The Housing locks shall be of one of the following types to be confirmed by the RMS Representative:

(a) Mechanical door locks in accordance with Clause 4.7.2; or
(b) Electronic door locks in accordance with Clause 4.7.3.

Where an electronic solution is required, the RMS Representative may direct a specific manufacturer to align with RMS existing systems, or suggest provision of the locking system without the electronic cylinder.

4.7.2 Mechanical Door Locks

The Housing door shall be fitted with not less than two (2) mechanical locks which shall be threaded stainless steel fasteners operated by means of a standard tubular security key approved by the RMS Representative.

NOTE: Details of the standard tubular security key is available from the RMS Representative. The particular key code to be used will be supplied by the RMS Representative after Contract award.

The fasteners shall screw into threaded mating sections in the Housing or shall operate levers that provide the locking action. In either case a minimum of one (1) full turn of the fastener shall be necessary to provide the locking action. Quarter-turn and half-turn type locking mechanisms shall not be used.

If the fasteners tap into mating sections, then the mating sections on the Housing shall be self-aligning within the movement tolerance of the door with respect to the Housing.

If the fasteners operate levers, then the levers shall provide a positive locking action and shall be designed such that pressure applied to the door does not allow the levers to be dislodged from their locking positions.

All threaded parts of the door lock mechanisms shall be made from stainless steel.

The action of securing the door locking mechanisms shall compress the door sealing gasket (see Clause 4.9), such that there is an effective weatherproof seal when the door is locked.

When the door is locked, the door locking mechanisms shall securely hold the door in the closed position.

4.7.3 Electronic Door Locks

The Housing door shall be fitted with one of the following locking configurations:
(a) Three-point locking operated by a handle which is secured by one (1) electronic lock/cylinder. In this configuration, the latching/locking locations shall be the top, bottom and side of the door;

(b) Two-point locking by two (2) electronic locks, with each locking point controlled by one (1) lock/cylinder. In this configuration, the latching/locking location shall be the side of the door.

The locking mechanism shall provide a positive locking action and shall be designed such that pressure applied to the door does not allow the levers to be dislodged from their locking positions.

The electronic locks shall be part of a high-security central key-centric locking system that provides the following:

(a) Unique individual electronic identifications for all locks and keys;

(b) Keys are self-contained with renewable or rechargeable electricity storage for operating electronic locks;

(c) A keys and locks management system on a computer. The system shall provide the following:

   (i) Validation and invalidation of all keys and locks;

   (ii) Recording of all key and lock operations, including times of operation and operator identities;

   (iii) Database functions relating to all operations conducted by operational personnel, and issuance of keys and locks.

4.8 Door Retainer

A retaining device shall be provided for each door to securely hold the door in the open position under all weather conditions.

As a minimum, the retaining device shall provide for the door to be held open at 110 degrees and at 90 degrees from the closed position.

4.9 Weather Sealing and Weather Resistance

All doors of the Housing shall be provided with durable and resilient weatherproof sealing gaskets.

The sealing gaskets shall be made of an ultra-violet stable closed-cell material.

The sealing gaskets shall be securely held in position and shall be readily replaceable while the equipment is in service.

The complete Housing, when installed as in normal service, shall provide a degree of protection not less than classification IP45 in AS 60529.

4.10 Ventilation

Ventilation shall be provided to allow free airflow for cooling and to prevent condensation inside the Housing under all weather conditions.

The ventilation system shall be designed to permit the escape of any gas that may enter the Housing.
The ventilation system shall be designed to minimise the ingress of dust and insects into the Housing.

The ventilation openings shall be designed to prevent objects, such as wires, from gaining entry into the Housing and making contact with an electrical circuit.

If the Housing is intended to accommodate batteries, other than button cells (or other battery cells of similar charge capacity) that are directly mounted on a printed circuit board for supporting essential but otherwise volatile functions provided by the printed circuit board, then battery segregation (from other housing electronic or electrical modules/components) and ventilation (to permit escape of gas in the housing) shall be provided in accordance with AS 4086.2.

4.11 Resistance to Vandalism

The Housing shall be designed to withstand, or otherwise minimise the effects of, vandalism. As a minimum, particular attention shall be given to the design to preclude the following:

(a) Forcibly opening the access door;
(b) Opening the access door by simple tools or implements, such as by screwdrivers or pliers, or similar common tools being used to open the door locks or part the hinges;
(c) Forcibly pushing the Housing from its mountings; and
(d) Damage to the Housing or door or mounting base by kicking or pushing.

4.12 Plan Pocket

A storage pocket shall be provided on the inside of the access door for storage of binders with A4 size drawings. The pocket shall have the following internal dimensions:

<table>
<thead>
<tr>
<th>Table 4.12 Dimensions of Plan Pocket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width: 340 to 350 mm</td>
</tr>
<tr>
<td>Height: 220 to 230 mm</td>
</tr>
<tr>
<td>Depth: 25 to 30 mm</td>
</tr>
</tbody>
</table>

A finger slot or other suitable means shall be provided to facilitate removal of small items from the pocket.

4.13 Equipment Shelf and Mounting Panels

Unless otherwise varied by the Referencing Specification or RMS Representative, the Housing shall provide the following facilities for accommodation of traffic and transport related equipment:

(a) A mounting panel on the back of the Housing; and
(b) A mounting panel on each of the left and right sides of the Housing respectively.
These mounting panels shall cover the back and both sides of the Housing as much as possible without interfering with other provisions in the Housing, and shall not extend into the space 150 mm from the base of the Housing.

The back mounting panel shall provide for accommodation of equipment by both of the following methods:

(a) Secured direct mounting of equipment on the mounting panel; and
(b) Secured installation of horizontal rack-mount shelves at various heights for accommodation of electrical traffic and transport related equipment. For the purpose of this requirement, the mounting panel shall provide pre-fabricated mounting provisions at 40 - 50 mm equal intervals throughout the height of the panel, except for the top 100 mm region. Unless otherwise specified in the Referencing Specification, a minimum of three (3) rack shelves including support brackets shall be provided with the Housing as accessories (i.e. not installed).

The left and right mounting panels shall provide for secured direct mounting of equipment on the panels.

The mounting panels, and rack-mounted shelves and support brackets shall be of a material that has relevant properties for the intended use including mechanical strength, durability, corrosion resistance and physical stability.

The rack-mounted shelves for the back mounting panel shall be 260 - 270 mm in depth and complete with perforation slots fully populating their central regions within 40 to 50 mm from the four (4) sides of the shelves to provide airflow to equipment on the shelves. Each perforation slot shall be 4 – 5 mm wide and 15 – 20 mm long, and separated from its adjacent slots by not more than 10 mm in both the left-to-right and front-to-back directions.

### 4.14 Finish

Both the interior and exterior of the Housing (body, roof, base, access door(s), and mounting panels and shelves) shall be suitably treated to prevent corrosion.

All exterior surfaces shall have a durable gloss finish of anti-graffiti polyester powder coating with a minimum thickness of 50 microns.

The colour of the exterior finish shall be Smoke Blue (Colour No. T33) in accordance with AS 2700, unless otherwise specified by the Referencing Specification or RMS Representative.

**NOTE:** Overspray is permitted on the interior of the Housing, but electrical earthing points must be kept free of paint and other non-conducting surface coating to ensure earthing continuity.

### 4.15 Nameplate

A nameplate shall be affixed in a permanent manner to the exterior of the Housing.

The nameplate shall provide the following information:

(a) Manufacturer;
(b) Roadside Equipment Type, (space for name(s) and identifying number(s));
(c) Roadside Equipment Serial Number, (space for serial number(s));
(d) Housing serial number.

A high quality process (such as photo engraving, anodising, etc) shall be used to produce the legends on the nameplate. The legends shall be clearly legible, indelible, and non-fading.
The nameplate shall be made from aluminium, or a suitable alternative material approved by the RMS Representative. Adhesive labels shall not be used.

4.16 Cable Clamping Bars

Clamping bars shall be provided for securing and supporting all external cables (other than telecommunications lines). The edge of all clamping bars shall be rounded to prevent damage to cables.

The clamping bars for each group of cables shall be positioned in the immediate vicinity below the respective termination points for the cables.

The method for clamping the cables shall be such that all cables shall be uniformly clamped regardless of the mix of cable types and sizes.

The clamping bar for the consumers mains shall accommodate two (2) double-insulated single-core cables with sizes from 6 mm² to 16 mm².

4.17 Telecommunications Line Facility

For all Housings that are intended for accommodating equipment with telecommunications functions, capability or interfaces, provisions shall be provided for the installation of telecommunications wiring into the Housings in accordance with Drawing VM621-33. Provisions shall also be made for installation of the telecommunications wiring inside the Housings, including any necessary cable management systems for both fibre-optic and non-fibre-optic communications cables.

4.18 Switchboard and Mains Fuse

4.18.1 General

All Housings shall be provided with an appropriate fault current limiter, main switch, surge diverter and main switchboard, and also as a separate item an underground or overhead mains fuse complete with fuse box/enclosure (see Clause 4.18.2). Housings that are not required to be equipped with a main switchboard shall be provided with a submains.

NOTE: The above requirements and other requirements in 4.18 sub-clauses and clauses 4.19 may be varied in accordance with AS/NZS 3000 where the source of electricity supply is from a stand-alone (i.e. isolated) extra-low voltage source (e.g. an extra-low voltage solar supply).

The fault current limiter, main switch, switchboard, submains and wiring shall strictly comply with all relevant requirements of AS/NZS 3000.

NOTE: The main switchboard (or submains) may be of a self-contained type with additional Neutral Link(s) and Earth Link, or may be assembled from separate components.

The switchboard shall be mounted in a readily accessible position in the lower part of the Housing. With the Housing access door open, the fault current limiter, main switch and circuit breakers shall be directly accessible without the need to remove or swing back any panel or any equipment in the Housing.

NOTE: If the switchboard has a protective cover, such as provided on commercially available switchboard assemblies, then it is acceptable for the protective cover to be raised to gain access to the main switch and circuit breakers.
NOTE: Refer to Clause 4.18.5 for requirements for mounting of the surge diverter.

The switchboard shall be suitably positioned to be protected from rain, as far as is practicable, when the access door is open.

NOTE: Refer to Clause 4.5 for prohibition of installation of equipment within the space 150 mm above the bottom edge of the Housing.

4.18.2 Additional Main Fuse

The underground or overhead main fuse referred to in Clause 4.18.1 shall be provided for field installation where the Housing is supplied with a main switchboard.

NOTE: The additional main fuse is intended to be located in a separate dedicated assembly that is to be installed outside of and away from the Housing in a suitable location, to provide overcurrent protection to the consumers mains and allow the complete isolation of the Housing from the mains supply in the event isolation is required.

Where electricity supply is obtained from overhead mains, the additional main fuse and associated enclosure and connections shall be suitable for installation in accordance with Drawings VE500-15, VM007-4 and VM007-5.

Where the supply mains is underground, the additional main fuse and associated enclosure and connections shall be suitable for installation in accordance with Drawings VE500-16 and VE500-17. The location (i.e. pit) of the underground fuse should be as near as possible to the point of connection to the incoming supply mains.

4.18.3 Main Switch and Fault Current Limiter

The main switch shall control the supply to all circuit breakers in the switchboard, but shall not control supply to the fault current limiter.

When switched on, the main switch shall also be connected to the surge diverter referred to in Clause 4.18.5.

The main switch shall be appropriately rated.

The fault current limiter shall be an appropriate, rated replaceable low voltage (LV) cartridge fuse.

The fault current limiter shall be suitably positioned to facilitate connection of the active conductor of the consumers mains.

4.18.4 Circuit Breakers

A total of not less than six (6) circuit breakers shall be provided, including the provision of necessary spare terminals on the earth link and neutral link(s), as follows:

(a) An “Auxiliary” circuit breaker, rated at 10A with a breaking capacity of not less than 8 kA, shall be provided for controlling the socket outlets (Clause 4.19.1) and any auxiliary circuits;

(b) A “Logic/Equipment 1” circuit breaker, rated at not greater than 10 A with a breaking capacity not less than 8 kA, shall be provided to supply low-power equipment in the Housing (such as the controller of the main traffic/transport related equipment on site);
(c) Four (4) “Equipment” circuit breakers (identified as “Equipment CB2”, “Equipment CB3”, etc.), rated at not greater than 10 A with a breaking capacity of not less than 8 kA, shall be provided to supply other equipment inside the Housing.

4.18.5 Surge Diverter

The surge diverter shall provide protection against surges on the incoming mains supply, such as surges induced by lightning, switching spikes, and similar transients.

Where a surge diverter incorporates one or more Metal Oxide Varistor (MOV) devices, it shall include an indicator which shall be lit while the MOV devices are functional, and extinguished when any of the MOV devices has failed.

If a commercially available surge diverter is used, it may be either a rail-mounted type or a panel-mounted type.

Discrete component surge diverters shall be mounted on terminal blocks provided specifically for this purpose. Surge suppression devices shall not be mounted as “flying lead” devices in any terminal of the main switch or any circuit breaker, and shall be kept clear of all cables.

The positioning and mounting of consumable surge suppression devices, such as Metal Oxide Varistor (MOV) devices, shall facilitate inspection and replacement of these devices.

The surge diverter shall be effectively isolated from the mains supply when the main switch is in the open position.

4.18.6 EMI Filters

An in-line electromagnetic interference (EMI) filter shall be provided and connected directly to the load side of each of the ‘Equipment’ and ‘Logic/Equipment’ circuit breakers referred to in Clause 4.18.4, to provide further connection to and EMI suppression for the electrical traffic and transport related equipment that will be accommodated by the Housing. Alternatively, a single in-line EMI filter may be installed after the Main Switch but before these circuit breakers to provide EMI suppression.

NOTE: The use of a single in-line EMI filter stated above to provide EMI suppression to loads under different circuit breakers requires the use of a second Neutral Link (referred to as Neutral Link 2). See Table 4.18.7.

The EMI filter(s) shall be adequately rated for LV operation and the maximum power capacity of the circuits referred to above.

The EMI filter(s) shall be capable of safely carrying a fault current five (5) times its/their rated current value without damage.

Each EMI filter shall be clearly labelled “EMI FILTER” and indelibly marked with the following information:

(a) The name, trade name or trademark of the manufacturer or supplier;
(b) The load voltage and current ratings of the filter;
(c) The inductance of the filter;
(d) The maximum permitted value of d.c. current through the filter;
4.18.7 Switchboard Component Marking

Each component of the switchboard shall be clearly and indelibly marked with an appropriate designation to indicate the function.

The Fault Current Limiter shall be clearly labelled as follows:

![FAULT CURRENT LIMITER xxA, NOT CONTROLLED BY MAIN SWITCH.]

**NOTE:** Replace “xx” in the label with the rated current value of the Fault Current Limiter.

Each of the switchboard components shall be clearly labelled either as shown in the “Marking” column or “Device” column in the following table:

<table>
<thead>
<tr>
<th>Item</th>
<th>Device</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fault Current Limiter</td>
<td>FAULT CURRENT LIMITER</td>
</tr>
<tr>
<td>2</td>
<td>Main Switch</td>
<td>MAIN SWITCH</td>
</tr>
<tr>
<td>3</td>
<td>Neutral Link</td>
<td>NL1</td>
</tr>
<tr>
<td>4</td>
<td>Neutral Link 2</td>
<td>NL2</td>
</tr>
<tr>
<td>5</td>
<td>Earth Link</td>
<td>EL</td>
</tr>
<tr>
<td>6</td>
<td>Terminal Block</td>
<td>TB</td>
</tr>
<tr>
<td>7</td>
<td>Auxiliary CB</td>
<td>AUX 10A</td>
</tr>
<tr>
<td>8</td>
<td>Logic/Equipment CB1</td>
<td>LOGIC/EQT1 10A</td>
</tr>
<tr>
<td>9</td>
<td>Equipment CB2</td>
<td>EQT2 10A</td>
</tr>
<tr>
<td>10</td>
<td>Equipment CB3</td>
<td>EQT3 10A</td>
</tr>
<tr>
<td>11</td>
<td>Equipment CB4</td>
<td>EQT4 10A</td>
</tr>
<tr>
<td>12</td>
<td>Equipment CB5</td>
<td>EQT5 10A</td>
</tr>
</tbody>
</table>

**NOTE 1:** If the Main Switch is a Circuit Breaker, then its current rating shall also be appended to the legend "MAIN SWITCH".
NOTE 2: This item is required only if a single in-line electromagnetic interference (EMI) filter is provided immediately after the Main Switch and before (some) circuit breakers (see Clause 4.18.5). Special attention will be required to ensure that only the neutral returns of those circuits protected by the single in-line EMI filter are terminated on Neutral Link 2.

Note that Neutral Link 2 will need to be connected to the primary Neutral Link via the ‘return’ line of the single in-line EMI filter.

NOTE 3: For items 7 to 12, if the circuit breaker current rating has been changed, the corresponding marking shall be updated.

4.19 Socket Outlets

4.19.1 Socket Outlet in the Auxiliary Circuit

The switchboard shall be fitted with a double socket outlet with an integral 30 milliampere Type II Residual Current Device, complying with AS/NZS 3190. This socket outlet shall be protected by the “Auxiliary” circuit breaker (refer to Clause 4.18.4).

The socket outlet shall be mounted in an accessible position in the Housing. Where the socket outlet is mounted on the switchboard, a barrier shall be provided to segregate the rear of the socket outlet from the switchboard components and wiring.

The socket outlet shall be mounted such that it provides for unobstructed insertion of mains power plug-packs, and operation of inserted mains power plug-packs with the door of the Housing closed.

4.19.2 Socket Outlets for Equipment

Two or more socket outlets shall be provided and distributed evenly at the top of the back mounting panel referred to in Clause 4.13. These socket outlets shall be protected by one or more of the “Equipment” circuit breakers (refer to Clause 4.18.4).

The socket outlets shall be mounted in an accessible position close to the respective equipment shelf, and shall provide for unobstructed insertion of mains power plug-packs, and operation of inserted mains power plug-packs with the door of the Housing closed.

4.20 Field Terminal Blocks

Where field terminal blocks are implied or required by the Referencing Specification, the requirements in this clause apply unless they explicitly conflict with applicable requirement(s) in the Referencing Specification. The Contractor / Supplier shall provide the required quantities of field terminals as follows:

(a) For all inputs and outputs requiring field connection; and

(b) For the maximum likely quantities of cables/wires to be connected to each of the inputs and outputs. For the purpose of this requirement, each source connection (input or output from the roadside equipment) shall be terminated and occupy one connection point on its own, whereas up to a maximum of two field connections may be terminated in one field terminal.
Unless otherwise specified in the Referencing Specification, the field terminals shall be rail-mounted screw-clamp types with spring-loading. Multi-pin connectors may be used for ELV field connections via a multicore field cable or field cables bundled in a loom.

The terminals used for connection of LV cables shall have voltage rating not less than 500 Volts r.m.s. and continuous current rating not less than 30 A. The terminals shall be capable of accepting conductors with cross sectional areas from 0.5 mm² to 4 mm².

The terminals used for connection of ELV cables shall have voltage rating not less than 250 Volts r.m.s. and continuous current rating not less than 10 A. The terminals shall be capable of accepting conductors with cross sectional areas from 0.5 mm² to 2.5 mm².

The design of the terminals shall accept crimp type lip-blade terminal lugs.

Flash barriers shall be provided between adjacent low voltage (LV) circuits, and between adjacent low voltage and extra-low voltage (ELV) circuits.

Multi-pin connectors for ELV field connections, where used, shall have voltage rating not less than 160 Volts r.m.s. and continuous current rating not less than 8 A. The terminals shall be capable of accepting conductors with cross sectional areas from 0.14 mm² to 1.5 mm².

All field terminals and multi-pin connectors shall comply with relevant applicable Australian or international standards.

NOTE: The types and quantities of field terminal blocks required depend on the specific application of the Housing. The Contractor should confer with the RMS Representative on details of this information if not already available.

4.21 Electrical Wiring

4.21.1 General

All electrical wiring in Housings shall comply with the requirements and safety standards specified in AS/NZS 3000 and AS/NZS 3100, and statutory requirements under the NSW Work Health and Safety Act.

Crimp lugs shall be fitted to flexible cables at all terminations, except multi-pin connectors. The crimp lugs shall be robust types which retain the cable insulation and which provide adequate current carrying capacity.

Sufficient slack cable shall be provided at each termination point to allow each cable to be re-terminated twice.

4.21.2 Accidental Contact of Live Parts

The live terminals at the switchboard, all terminal blocks, all relays, all contactors, and all transformers shall be protected against accidental contact.

Preference shall be given to terminal blocks, relays, contactors, transformers and other components which prevent accidental contact by design.

All live terminals which are readily accessible, and which do not prevent accidental contact by design, shall be protected by suitable covers.
4.22 Identification Markings

Cables and wires shall each be identified physically by durable marking codes based on numbers, letters and/or colours.

Where provided, all connectors and terminal blocks shall be legibly and indelibly marked with an identifying code. Preferably this code shall correspond to the circuit references in this Specification (e.g. Clause 4.18.5).

4.23 Wiring Protection and Mechanical Support

Wires shall be arranged in an orderly manner in the Housing, such as by using sleeving to group wires where appropriate. Cables and wires shall be routed such that there is no risk of damage due to normal maintenance activities.

LV cables and wires exposed to contact shall be double-insulated or enclosed in sleeving.

Cables and wires shall be mechanically supported by saddles or clamps. Exposed metal edges shall have grommet material where necessary to prevent damage to cables and wires. Adhesive fixing systems shall not be used.

Wires shall be mechanically supported, (e.g. by lacing), to prevent a wire dislodged from one circuit from coming into contact with another terminal or circuit. LV and ELV circuits shall be segregated as far as practicable to prevent LV from being inadvertently applied to any ELV circuit.

4.24 Equipotential Bonding

All metal parts of the Housing shall be electrically bonded together and bonded to earth by means of a connection to the Earth Link at the switchboard.

The access door shall be bonded to the Housing body by flexible cable(s) or copper braid.

The equivalent cross sectional area of each bonding conductor shall be not less than 6 mm².

4.25 Insulation Resistance

A factory insulation test shall be performed on the Housing wiring. The factory insulation test shall be performed on each Housing as follows:

(a) A prerequisite condition is that all electrical equipment and wiring that is part of the Housing shall be installed and connected;

(b) If the Housing is already connected to an external supply (e.g. the power grid), then disconnect the incoming Mains ‘Active’ and ‘Neutral’ feeds to the Housing and secure safely;

(c) Disconnect the MEN link;

(d) Disconnect the earth connection(s) of the surge protection circuit(s);

(e) Connect the Housing’s internal supply ‘Active’ and ‘Neutral’ together.

**NOTE:** Care must be exercised to ensure that there is no confusion arising from mixing up the internal supply ‘Active’ and Neutral’ with the incoming Mains ‘Active’ and ‘Neutral’ connections stated above in (b);

(f) Switch all circuit breakers to ON;
(g) Connect a 500 V d.c. insulation tester between Housing internal supply ‘Active’ and Earth;

(h) Switch on the insulation tester and measure for 1 minute. Note the measured values.

For low voltage circuits, the insulation resistance between the Active and Neutral conductors to Earth shall be not less than 50 Megohm, when measured with a test voltage of 500 V d.c.

Following completion of successful insulation testing, the Housing internal ‘Active’ and ‘Neutral’ connections shall be restored to normal, and the MEN link and the surge protection circuit(s) shall be re-connected.

A copy of the insulation test report shall be provided with each Housing.

4.26 Information to be provided in Housings

All Housings shall be clearly marked on the inside in a durable manner with the following information. The labels and signs used for this purpose shall be durable material with permanent printing.

(a) The Manufacturer’s identification;

(b) Equipment code or type number;

(c) Date of supply (for warranty purposes);

(d) A Danger Sign complying with AS 1319. This shall be prominently displayed on the interior of the access door. The danger sign shall have the legend "MAINS VOLTAGE" in letters with a minimum height of 15 mm;

(e) A Housing Layout Diagram. This shall be displayed on the inside of the Housing door and shall provide a diagrammatic representation to identify the location of each component in the Housing. The diagram shall display the location of the following components:

   (i) All components related to the switchboard;
   (ii) The terminal blocks, multi-pin connectors and the connections for external cables;
   (iii) Manual switches and their connections if any;
   (iv) The connections for interfacing with external devices;
   (v) All relays and transformers and their connections if any;
   (vi) All sensors and sensing switches and their connections if any;
   (vii) All circuit modules if any;
   (viii) Socket outlet circuits; and
   (ix) Space for entry of other devices and functional assemblies that will reside in the Housing.

   The diagram shall clearly display the identification marking for all connectors mating with the Housing wiring, for each component module.

(f) The Housing wiring circuits. These shall be displayed in a simplified diagrammatic form on the interior face of the Housing door. The wiring diagram shall provide sufficient detail, including terminal numbers, connector pin numbers, wire numbers or codes and wire colour coding, to allow each wire to be traced in the Housing.
The Housing wiring diagram shall provide a note specifying the method for measuring the insulation resistance from the incoming consumers mains to earth. The note shall describe all necessary steps, such as disconnecting the MEN link, isolating the surge suppression filter, etc;

(g) Relevant approval numbers and labels. These shall be clearly displayed on the interior of the access door, and shall include the following:

(i) The reference number of the Certificate of Suitability issued by the NSW Fair Trading to certify compliance with AS/NZS 3000 (Australian/New Zealand Wiring Rules);

(ii) The ACMA Regulatory Compliance Mark (RCM) including applicable A-Tick and C-Tick approval labels, and the supplier number, and

(iii) The RMS Type Approval number if applicable.

NOTE: The Regulatory Compliance Mark (RCM), A-Tick and C-Tick are statutory requirements administered by ACMA. Refer to ACMA or its web pages for details;

(h) A unique serial number for the Housing. This shall be clearly and indelibly marked on the interior of the access door, and shall correspond with the serial number on the Housing nameplate (see also Clause 4.15).

4.27 Protection

4.27.1 Resistance to Atmospheric Pollutants

Adequate anti-corrosion measures must be taken in the design of Housings so that they are suitable for use in fume or salt laden atmospheres over a minimum useful life of 20 years unless otherwise specified in the Referencing Specification. In particular, Housings shall tolerate continuous exposure to high levels of motor vehicle exhaust gases, and salt laden atmospheres as found in coastal environments.

For the purpose of this clause, the typical values for atmospheric pollutants shall be as shown in the following table:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Suspended Particles 30-50 µm</td>
<td>23 - 300 µm/m³</td>
</tr>
<tr>
<td>Dust deposit &gt;30 µm</td>
<td>0.5 - 5 g/m²/month</td>
</tr>
<tr>
<td>Sulphur Dioxide</td>
<td>0.005 - 0.05 ppm (vol)</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>0.001 - 0.3 ppm (vol)</td>
</tr>
<tr>
<td>Hydrogen Sulphide</td>
<td>0.001 - 0.02 ppm (vol)</td>
</tr>
<tr>
<td>Airborne salt (NaCl) deposited</td>
<td>2 - 30 g/m²/month</td>
</tr>
</tbody>
</table>

NOTE: These typical pollutant levels have been taken from information previously supplied by the NSW Pollution Control Commission.
All metallic parts of Housings, including fasteners and accessories, shall be suitably protected to prevent corrosion for the levels of atmospheric pollutants specified above.

4.27.2 Galvanic Corrosion Protection

All metallic parts of Housings, including fasteners and accessories, shall be suitably protected such that dissimilar metals in contact shall have an electro-chemical potential difference not exceeding 0.5 volt.

4.27.3 Combustion

As far as practicable, all materials used in the construction and wiring of the Housing shall be of a composition which does not support combustion, or which is self-extinguishing.

For Housings intended to be installed in confined locations that may have periods of low or weak ventilation, consideration should be given to the need to use only low smoke zero halogen (LSZH) cables for all electrical wiring in the location.
5 DOCUMENTATION

Documentation shall be provided in accordance with the Referencing Specification.

In addition, as a minimum, a technical reference manual shall be provided for the Housing. The following information shall be included, suitably organised into sections:

(a) A detailed design specification summary for the Housing;
(b) A detailed list of all relevant approvals and certifications for the Housing;
(c) An overview description of the Housing and its provisions;
(d) A detailed description of the installation process including a list of materials and equipment required, supplemented with illustrative drawings and diagrams;
(e) A detailed description of the mechanical/physical construction supplemented with assembly diagrams;
(f) A detailed description of the electrical system supplemented with circuit schematics;
(g) A detailed description of any cleaning and preventive maintenance procedures;
(h) A detailed description of fault finding and repair in the workshop where applicable;
(i) Detailed component schedules for all components (mechanical and electrical);
(j) Tabulation of the pin functions and connections for each of the connectors and terminals, and conductor colours and/or cable markings; and
(k) Relevant work health and safety related instructions.
6 QUALITY ASSURANCE

The Supplier and Manufacturer of the Housing shall operate a quality management system complying with AS/NZS ISO 9001 or ISO 9001. This quality management system shall be certified by a quality management system certification body either accredited under the criteria laid down in the Joint Accreditation System of Australia and New Zealand (JAS-ANZ), or listed in the International Standards Organisation ISO Directory of ISO 9000 and ISO 14000 Accreditation and Certification Bodies.
7 PACKAGING

The Housings and any spare parts, tools and ancillary equipment shall be packed to protect them from damage during transport and handling. All fittings liable to damage during shipment shall be removed and packed separately. Where necessary, reusable transit bars or other forms of additional support shall be provided with the Housing.

The Housings shall not be damaged and preset adjustments shall not be affected when subjected to the shock and vibration of normal transport between the Supplier’s premises and the nominated delivery point and point of installation. Unless otherwise directed, the Supplier shall select the means of transport and pack the Housings to ensure compliance with this clause.
APPENDIX A - LIST OF DRAWINGS

This Appendix lists the drawings directly referred to in this Specification. A copy of these drawings is appended to the end of this Specification. The issues of drawings that are appended were current at the time this Specification version was approved, but may have been subsequently superseded by newer issues. Unless otherwise specified, the applicable issue of a reference drawing shall be the issue current at the date one week before the closing date for tenders. It shall be the responsibility of the Tenderer to obtain the applicable issue of such drawings from the tender-issuing office and relevant RMS Offices.

<table>
<thead>
<tr>
<th>RTA Drawing</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC002-83</td>
<td>Footing for ground-mounted roadside equipment housing (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VE500-15</td>
<td>General arrangement of consumers mains from overhead supply for roadside equipment housings (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VE500-16</td>
<td>Installation of underground fuse box for roadside equipment housing (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VE500-17</td>
<td>Underground fuse box assembly for roadside equipment housing (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VM007-4</td>
<td>Pole mounting fuse box for roadside equipment housings (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VM007-5</td>
<td>Retroreflective label for pole mounted fuse box for roadside equipment housings (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VM621-33</td>
<td>Telecommunications line facility for roadside equipment housing (referenced by Specification TSI-SP-012)</td>
</tr>
<tr>
<td>VM625-30</td>
<td>Lifting bracket details (sling mounting) for roadside equipment housing (referenced by Specification TSI-SP-012)</td>
</tr>
</tbody>
</table>
GENERAL REQUIREMENTS FOR ROADSIDE EQUIPMENT HOUSINGS  (Copyright RMS 2018)
NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.

2. PLAN SHOWS TYPICAL ARRANGEMENT OF CONSUMERS MAINS FROM OVERHEAD 240V, 50Hz SUPPLY.

3. THE INSTALLATION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SUPPLY AUTHORITY.

4. FOR UNDERGROUND SUPPLY REFER TO PLANS VE500-16 & VE500-17.

5. CABLE & CONDUIT BETWEEN FUSE & OVERHEAD WIRE TO BE SUPPLIED BY CONTRACTOR WHEN REQUIRED BY SUPPLY AUTHORITY.

6. THE FUSE BOX MUST NOT BE INSTALLED IN AN EARTHED SITUATION AS DEFINED IN AS/NZS3000. WHERE THIS CANNOT BE AVOIDED, THE SUPPLY AUTHORITY SHALL BE CONSULTED CONCERNING THE NEED TO EARTH THE BOX.

7. ALL SADDLES SHALL BE DOUBLE HOLE GALVANISED AND ALL FASTENERS SHALL BE GALVANISED.
GENERAL REQUIREMENTS FOR ROADSIDE EQUIPMENT HOUSINGS (Copyright RMS 2018)
ITEM 2, FUSE HOLDER MOUNTING BRACKET
MATERIAL: LEAD, EXCEL 3 Polycarbonate

NOTES
1. FUSE LINK (ITEM 4) SHALL BE BOLTED CONNECTION TYPE A2, go (GENERAL PURPOSE TYPE) MATED AT 32AMPs, IN ACCORDANCE WITH AS 50260.2.1.
2. FUSE HOLDER (ITEM 3) SHALL BE THE FRONT CONNECTED TYPE, COOPER BOSMANN CAMASTER NO. CH33F, IN ACCORDANCE WITH AS 50260.2.1 AND SUITABLE FOR ITEM 4.
3. FUSE ENCLOSURE TO BE CLEARLY AND INDUBLY MARKED TO INDICATE MANUFACTURER'S IDENTIFICATION AND DATE OF MANUFACTURE.
4. FUSE ENCLOSURE TO BE INDIVIDUALLY PACKED FOR PROTECTION IN TRANSPORT AND CLEARLY MARKED EXTERNALLY WITH:
   a) DESCRIPTION OF CONTENTS,
   b) MANUFACTURER'S IDENTIFICATION.
5. ALL ITEMS TO BE SUPPLIED FITTED BY MANUFACTURER EXCEPT FOR TWO SPARE GLAND INSERTS WITH -8mm CABLE ENTRY HOLES TO BE PLACED IN A PLASTIC BAG INSIDE THE ENCLOSURE.
6. THE ENCLOSURE TO BE SUPPLIED FITTED WITH TWO GLANDS WITH INSERTS WITH -8mm CABLE ENTRY HOLES.
NOTES

1. LABEL TO BE MADE FROM CLASS 2, YELLOW, RETROREFLECTIVE SHEETING MANUFACTURED TO AS 1906 (e.g., 3M SCOTCHLITE TYPE 6142), WITH BLACK LEGEND SCREEN PRINTED STRICTLY AS RECOMMENDED BY THE RETROREFLECTIVE SHEETING MANUFACTURER.

2. A FORMAL 4 YEAR GUARANTEE IS REQUIRED AGAINST ANY DEFECT IN COLOUR OR ADHESION WHEN APPLIED TO A VERTICAL SURFACE COATED WITH "RILSAN NYLON 11 BLACK SEMIGLOSS" (COATERS ARE PLASDIP PTY LTD OR PETER SNELL PTY LTD) AND EXPOSED TO ALL WEATHER CONDITIONS.

3. THIS FULL SCALE DRAWING MAY BE USED AS THE ARTWORK FOR THIS LABEL.

4. TEXT "ROADS AND MARITIME SERVICES" TO BE 0.7MM THICK AND THE TEXT "ROADSIDE ITS" TO BE 2MM THICK. TEXT AND SYMBOL TO BE CENTRE JUSTIFIED.
GENERAL REQUIREMENTS FOR ROADSIDE EQUIPMENT HOUSINGS (Copyright RMS 2018)