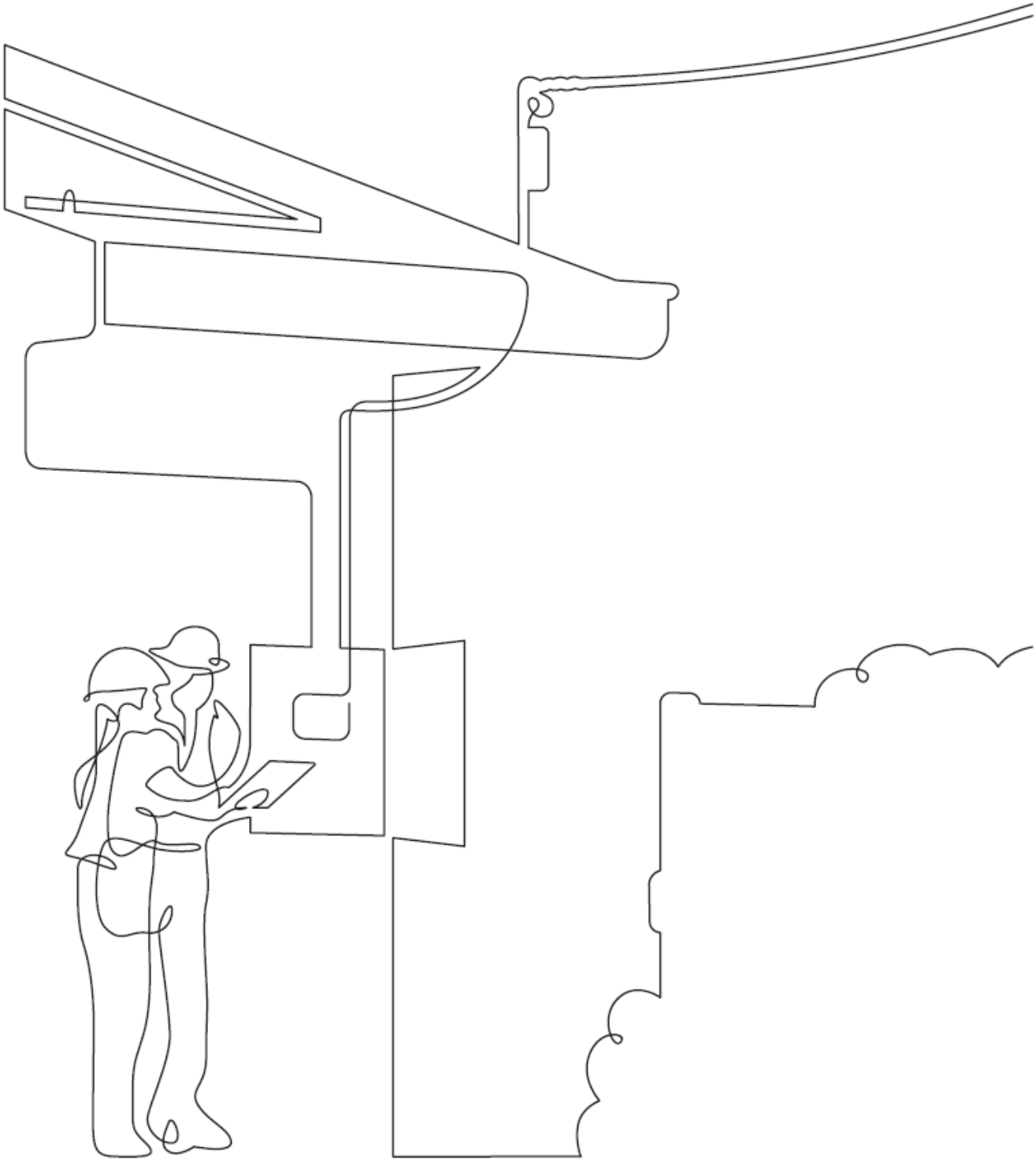

# Service and Installation Rules

Published: May 2025

SA Power Networks

Empowering South Australia

## SA Power Networks:

SA Power Networks, ABN 13 332 330 749, a partnership of:

Spark Infrastructure SA (No.1) Pty Ltd, ABN 54 091 142 380
Spark Infrastructure SA (No.2) Pty Ltd, ABN 19 091 143 038
Spark Infrastructure SA (No.3) Pty Ltd, ABN 50 091 142 362
each incorporated in Australia
CKI Utilities Development Limited, ABN 65 090 718 880
PAI Utilities Development Limited, ABN 82 090 718 951
each incorporated in The Bahamas

1 Anzac Highway, Keswick, South Australia, 5035.

## SA Power Networks' Disclaimer:

1. The purpose of these Rules is to set out standards with which equipment connected to the SA Power Networks electricity distribution network must comply to facilitate the safe and effective operation of the distribution network. However, SA Power Networks makes no representation of any nature that the fact customer or generator equipment complies with these standards means that the equipment will be suitable for a particular customer's or generator's needs and electricity requirements. Each customer/generator must seek their own advice as to these matters from licensed electricians or other suitably qualified professionals and is solely responsible for ensuring the equipment installed at its premises is suitable for the use the customer or generator wishes to make of that equipment.

2. These Rules are subject to change from time to time.

3. Nothing in these Rules constitutes endorsement of any third-party product or service. As noted in paragraph 1, each customer and generator must make their own assessment of the suitability for their needs of third-party products and services and seek appropriate professional advice.

## SA Power Networks' Copyright©2025:



## Revision Notice:

| Date | Details | Author | Authorised |
|---|---|---|---|
| 1 May 2022 | Complete rewrite of document | J Case<br>A Bird | M Napolitano |
| 1 May 2023 | Document updated; please refer to *Amendments for 2023 SIR* document. | J Case | M Napolitano |
| 12 May 2025 | Document updated; please refer to *Amendments for 2025 SIR document*. | J Case | A Walsh |

# Preface

SA Power Networks operates the electricity distribution network in South Australia. This document is intended for contractors, designers, customers, consultants, manufacturers and our employees involved in the design and connections of electrical installations to the distribution network.

These Rules may not cover all circumstances. Where this is the case, or the situation is unusual, you can contact SA Power Networks for advice.

This document is electronically accessible with hyperlinks included in the document to improve the user experience. Please download a copy to your device via the QR code on the front cover.

This revision has considered these guiding principles:

- In all activities undertaken, SA Power Networks is committed to the safety of our employees, contractors, customers, and the community.
- South Australia has the highest adoption of Distributed Energy Resources (DER) in Australia. A dedicated section has been made in this new version of SA Power Networks Service and Installation Rules to assist the industry with SA Power Networks requirements for this two-way energy flow.

We look forward to your continued support and involvement in the future editions of these rules.

Any improvement to this document please contact networkstandards@sapowernetworks.com.au.

# Contents

# Figures

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# 1. Introduction

All electrical installations connected to SA Power Networks distribution network shall comply with these Service and Installation Rules, the requirements specified in the Electricity Act 1996, the Electricity (General) Regulations 2012, the Australian Standards and other relevant Regulations.

## 1.1 Objective

These Rules are SA Power Networks requirements to facilitate an ongoing safe and reliable connection to the distribution network.

## 1.2 Scope

These Rules apply to new installations, alterations/repairs or additions to existing installations that are connected or intended to be connected to the distribution network.

These Rules are not intended for:

- Embedded networks beyond the MSB parent meter.
- Off-grid networks.

## 1.3 Technical Installation Rules (TIR)

In accordance with Regulation 76 of the Electricity (General) Regulations 2012 under the Electricity Act 1996, these Rules incorporate the Technical Installation Rules which are denoted by the abbreviation TIR. The Technical Installation Rules are approved and enforced by the Office of the Technical Regulator.

The eCoC certifies compliance to the Electricity Act 1996 which includes these TIRs.

## 1.4 Non-compliance with these Rules

Where an installation does not satisfy the requirements of these Rules, the connection of electricity supply may be delayed or withheld. Installations that have been supplied with electricity in violation of these Rules may be disconnected until such time as the non-compliance(s) has been rectified.

## 1.5 Further information for Electrical Contractors, Retailers, and Metering Providers

Further information can be found on our website and in the following documents:

Electrical Contractors Handbook

Retailer and Meter Services Provider Handbook

SA Power Networks Connections & Ancillary Network Services Manual 18

## 1.6 Innovation

These Rules do not preclude innovation or technology that achieves the same outcomes as detailed in this document. Refer to clause 5.2.3 for the approval process.

## 1.7 Who to contact in SA Power Networks

For support regarding these Rules or your connection, contact our Customer Service number, and a team member will assist or direct you to the appropriate SA Power Networks Customer Solutions Manager.

https://www.sapowernetworks.com.au/contact-us/

**13 12 61**

For faults and emergencies, please call our 24/7 phone line:

**13 13 66**

# 2. Publication and revision

## 2.1 Administration

The revision, development and publication of these Rules are compiled and administered by SA Power Networks and subject to the Office of the Technical Regulator's approval.

## 2.2 Publication Application

The latest version of this document is available on SA Power Networks website at sapowernetworks.com.au. SA Power Networks reserves the right to revise this publication.

These Rules are applicable from 12 May 2025. As per Electricity (General) Regulations 2012, Regulation 11, generally work on an installation completed within 6 months of the publication of this version of these Rules may be carried out in accordance with the preceding version of the Service and Installation Rules.

Further transitional arrangements may be provided by SA Power Networks in accordance with Regulation 11.

# 3. Definitions and abbreviations

## 3.1 Definitions

Definitions and abbreviations are as defined in AS/NZS 3000 except for those defined below.

| | |
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| **Aggregator** | A person registered by AEMO as a small generation aggregator and supplies electricity from one or more small generating units to a distribution system. |
| **APA Group** | APA Group operates the majority of the South Australian gas distribution network. |
| **Authority to Connect form** | An Authority to Connect (ATC) form is a temporary substitution for an eCoC, which may be accepted by SA Power Networks in certain situations when it is not reasonably practicable to provide a printed eCoC, (for example, because the electrician's electronic device cannot connect to a telecommunications network in the relevant location). Refer to clause 5.2.2.<br>The ATC shall contain a valid eCoC number. |
| **Australian Energy Regulatory** | The AER regulates wholesale and retail energy markets, and energy networks, under national energy legislation and rules. |
| **Connection point** | In this document connection point has the same meaning as point of supply as defined in AS/NZS 3000. |
| **Connection terminals** | Terminals contained within the connection point for the connection of the consumer mains. |
| **Customer Service Protection Device** | A circuit breaker provided by the customer, to protect SA Power Networks upstream assets. Installed where SA Power Networks has provided an un-protected connection point. |
| **Distributed Energy Resources** | Power generation and/or energy storage units that are connected to the distribution network via the customers installations. |
| **Distribution network** | The assets (e.g. poles, wires, underground cables, transformers, substations) operated by SA Power Networks, which transports electricity to and from a customer's connection point. |
| **Domestic** | Private dwelling or living unit. |
| **Electricity Distribution Code** | The Electricity Distribution Code made by ESCOSA in accordance with Section 28 of the Essential Services Commission Act 2002. |
| **Embedded Generation** | A generating system connected within a distribution network and not having direct access to a transmission network. |
| **Electronic certificate of compliance** | An electrical certificate of compliance provides evidence:<br>• that the work that has been completed is safe to energise and complies with necessary regulations, rules and standards, and<br>• outlines the extent and nature of the completed electrical work.<br>Certificates of compliance shall be certified before energising/making available to energise and then provided to your customer and submitted online to the Office of the Technical Regulator via the electronic certificate of compliance website within 30 days of completing the work.<br>Refer to clause 5.2.2 for SA Power Networks eCoC requirements for connection. |
| **Embedded network** | Embedded networks are privately owned, and managed electricity networks connected to the distribution network through a single connection point, beyond the parent meter. |

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| **Energy Distributor** | The operator of the asset that supplies energy to customers connected to the distribution network. |
| **Energy storage system** | Plant that can both store electricity and discharge electricity to (ie. act as both a load and a generating system). |
| **Firm** | Capacity is reserved for the customer (including in demand/constraint forecasting) when SA Power Networks does network planning. However, it is not "Guaranteed". Meaning that under different network scenarios capacity can still be curtailed to manage network requirements – normally during outage events. |
| **Flex** | Where the customer has agreed to dynamically adjust their import or export power profile to operate within network constraints. |
| **Faults and Emergencies** | The point of contact for anyone needing to report a fault or emergency with SA Power Networks infrastructure. |
| **Generation Licence** | ESCOSA administered licence as required by the Electricity Act 1996 (Electricity Act). |
| **Installation** | Installation is used to mean an electrical installation unless the context is otherwise. |
| **Inverter** | Device that may form part of the generating system which converts direct current to alternating current. |
| **Inverter Energy System** | A system consisting of one or more inverters that connect to the grid and operate by converting direct current to alternating current. In the context of system capacity, this definition includes the capacity of AC coupled energy storage systems. |
| **Meter** | The revenue meter. |
| **Meter isolator** | A circuit breaker that isolates the supply to the metering equipment and the corresponding installation or tenancy. |
| **Metering** | Includes metering instruments and associated fuses, links, transformers and wiring installed by a Metering Provider. |
| **Metering Coordinator** | Is a person so registered by AEMO who engages in the coordination and provision of metering services. |
| **Metering point** | Is the physical and electrical location at which metering equipment is connected. |
| **Metering Provider** | Company registered with AEMO that provides and maintains metering installations in accordance with the National Electricity Rules and a prescribed Person under the Electricity Act 1996. |
| **Model Standing Offer** | The Terms and Conditions for basic connection services for retail customers, other than embedded generators. The Model Standing Offer forms the contract between SA Power Networks and the customer. |
| **National Electricity Rules** | The rules as defined in the National Electricity Law as set out in the Schedule to the National Electricity (South Australia) Act 1996. |
| **Non-domestic Installations** | These installations include but are not limited to – individual or multiple commercial or industrial electrical installations, external public lighting installations, commercial or industrial portions of mixed installations. |
| **National Construction Code** | The National Construction Code is Australia's primary set of technical design and construction provisions for buildings.<br>As a performance-based code, it sets the minimum required level for the safety, health, amenity, accessibility and sustainability of certain buildings |

| | |
|---|---|
| **National meter identifier (NMI)** | Every metering point connected to the Distribution Network is assigned a unique 11-digit National Meter Identifier (NMI). The NMI is used as a reference to clearly identify the connection in:<br>• national market transactions (e.g. between distributor and retailer including usage data and service orders) and<br>• customer requests to distributor (e.g. alteration requests) and<br>• retailer correspondence and requests (e.g. bills, changing retailer)<br>Where a single connection is used to supply multiple tenancies then a NMI is assigned to each separate metering installation corresponding to each separate tenancy.<br>Any reference to NMI in this document refers to metering at the primary metering point that records flow from and to the grid only and does not refer to child or sub metering (NMIs) unless specifically stated. |
| **Network Protection Unit** | Network protection units (NPU) are designed to operate for abnormal conditions inside the protected zone while remaining stable for abnormal conditions outside the protected zone. They aggregate the embedded generation and protect the network. |
| **Office of the Technical Regulator** | Responsible for the electrical, safety and technical regulation of South Australia. |
| **Off-grid network** | Distribution Network NOT owned or operated by SA Power Networks NOR connected to the National Electricity Grid. |
| **Occupancy** | An installation or part thereof, which is supplied with electricity through a specific meter or meters. |
| **Parent Meter** | Generally, a retail meter before the embedded network. |
| **Prescribed Person** | A person or operator that holds the approved accreditation, that is used to perform a function, as required by legislation, under the Electricity Act 1996. |
| **Relevant Agent** | The Relevant Agent will initiate control of the output of the embedded generator as directed by the SA Government or other party with a lawful authority such as SA Power Networks. |
| **Responsible Officer** | A person engaged in the scoping, facilitating and physical connection to the distribution network on behalf of SA Power Networks. |
| **Rules** | Rules means the current version of SA Power Networks Service and Installation Rules. |
| **Retailer** | The holder of an electricity retail authorisation or exemption granted by the AER who is contracted to sell electricity to the customer. |
| **SA Power Networks Connection Agreement** | The contract formed if a connection applicant accepts a connection offer. |
| **SA Power Networks Customer Solutions Manager** | Leader of regional based SA Power Networks team that facilitates connections to the distribution network. |
| **SA Power Networks Engineering Report** | An engineering report written by SA Power Networks that is used to convey technical information and requirements to the customer. |
| **SA Power Networks Operations Centre** | SA Power Networks monitoring and control centre for the high voltage and low voltage switching on the distribution network. |
| **Service fuse** | Fuse provided by SA Power Networks to protect SA Power Networks assets. (Service protection device) |

| | |
|---|---|
| **Service protection device** | A device provided by SA Power Networks, generally a fuse, but may be a circuit breaker, to protect SA Power Networks assets (circuit breakers for larger installations may be provided by the customer). |
| **SWER** | Single Wire Earth Return. The SWER high voltage system of supply that employs one active conductor and the "Earth" as the return path for the load current. Generally used in rural applications. |

## 3.2 Property definitions

| | |
|---|---|
| **Community Title** | Division of land into at least two lots and with an area of common property. |
| **Common property** | Property within a Community Title that is owned by the community corporation or shared between owners. |
| **Contiguous land** | Contiguous land are parcels of land which abut (touch) one another or are separated only by certain types of public land, where the owner or occupier of all the land concerned is the same. |
| **Single domestic** | Single NMI metered installation. |
| **Multiple domestic** | Multiple NMI metered installation |
| **Easement** | Gives an individual or a company the right to use land for a specific purpose. |
| **Strata Title development** | A 'Strata Title development' is regarded as a 'Community Title development' for the purpose of this document. |
| **Subdivision** | The divisions of land into two or more parts which can be disposed of separately. |
| **Torrens Title (Fee Simple)** | A Torrens Title is a single certificate of title for an allotment of land. |

## 3.3 Terminology

| | |
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| **Shall** | Indicates a mandatory requirement. |
| **Should** | Indicates a recommendation that will not be mandatory, but CAN be imposed as deemed appropriate by SA Power Networks. |

## 3.4 Abbreviations

| | |
|---|---|
| **AEMO** | Australian Energy Market Operator |
| **AER** | Australian Energy Regulatory |
| **AS/NZS** | A jointly developed Australian and New Zealand Standard |
| **ATC** | Authority to Connect |
| **AS** | Australian Standard |
| **CMEN** | Common Multiple Earthed Neutral |
| **CTTS** | Closed Transition Transfer Switch |
| **DIT** | Department of Infrastructure and Transport |
| **DER** | Distributed Energy Resources |
| **EG** | Embedded Generation |
| **eCoC** | Electronic Certificate of Compliance |

| | |
|---|---|
| **EPR** | Earth Potential Rise |
| **ESS** | Energy Storage System |
| **ESCOSA** | Essential Services Commission of South Australia |
| **EV** | Electric Vehicle |
| **ICSN** | Incremental Cost Shared Network – The connection applicant's augmentation charge, and where applicable, the equalisation cost of establishment of the high voltage distribution network for Real Estate developers. |
| **IEC** | International Electrotechnical Commission |
| **IES** | Inverter Energy System |
| **LEG** | Large Embedded Generation |
| **MEG** | Medium Embedded Generation |
| **MEN** | Multiple Earthed Neutral |
| **MSB** | Main Switchboard |
| **MSATS** | Market Settlement and Transfer Solutions (AEMO) |
| **NATA** | National Association of Testing Authorities |
| **NCC** | National Construction Code |
| **NER** | National Electricity Rules |
| **NMI** | National Metering Identifier |
| **NPU** | Network Protection Unit |
| **OTR** | Office of the Technical Regulator |
| **OTTS** | Open Transition Transfer Switch |
| **Rules** | SA Power Networks Service and Installation Rules |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SEF** | Sensitive Earth Fault |
| **SEG** | Small Embedded Generation |
| **SLTS** | Soft Load Transfer Switch |
| **SPD** | Service Protection Device |
| **SWER** | Single Wire Earth Return |
| **SRMTMP** | Safety, Reliability, Maintenance and Technical Management Plan |
| **TIR** | Technical Installation Rule |
| **VPP** | Virtual Power Plant |

# 4. Regulations, Standards, Rules, and other publications

In an event where there is any inconsistency between legislation and regulations and these technical requirements, the legislation and regulations shall prevail.

The following listed documents are for additional information and other documentation may be required. All applicable, SA Legislative Regulations (under Acts), ESCOSA/ENA/AEMO documentations, relevant AS/NZS, IEC standards, and the SA Power Networks publications shall be complied with.

## 4.1 Legislation and Regulations

This section provides a list of the relevant legislation and regulations.

National Electricity (South Australia) Act 1996
Electricity Act 1996
Electricity (General) Regulations 2012
National Electricity Rules
Work Health and Safety Act 2012
Work Health and Safety Regulations 2012
National Construction Code

## 4.2 Standards

| | |
|---|---|
| AS 1319 | Safety signs for the occupational environment |
| AS 1397 | Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium |
| AS 2067 | Substations and high voltage installations exceeding 1 kV A.C. |
| AS/NZS 3000 | Electrical Installations “Wiring Rules” |
| AS/NZS 3010 | Electrical installations - Generating sets |
| AS/NZS 3012 | Electrical installations - Construction and demolition sites |
| AS/NZS 4777.1 | Grid connection of energy systems via inverters |
| AS/NZS 5033 | Installation and safety requirements for photovoltaic (PV) arrays |
| AS/NZS 5139 | Electrical installations - Safety of battery systems for use with power conversion equipment |
| AS 60038 | Standard voltages |
| AS/NZS IEC 60947.6.1 | Low-voltage switchgear and control gear |
| AS 61000.3.100 | Limits-Steady state voltage limits in public electricity systems |
| AS 60076 | The AS 60076 series for Power Transformers |
| AS/NZS 61000.3.2 | Limits - Limits for harmonic current emissions (equipment input current less than or equal to 16 A per phase) |
| AS/NZS 61000.3.3 | Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems, for equipment with rated current <+ 16 A per phase and not subject to conditional connection |
| AS/NZS 61000.3.4 | Limits - Limitation of emission of harmonic currents in low voltage power supply systems for equipment with rated current greater than 75A |
| AS/NZS 61000.3.5 | Limits - Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 75 A |
| AS/NZS 61000.3.6 | Limits – Assessment of emission limits for distorting loads in MV and HV power systems |
| AS/NZS 61000.3.7 | Limits – Assessment of emission limits for fluctuating loads in MV and HV power systems |

| | |
|---|---|
| AS/NZS 61000.3.11 | Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low voltage supply systems – Equipment with rated current less than or equal to 75 A and subject to conditional connection |
| AS/NZS 61000.3.12 | Limits - Limits for harmonic currents produced by equipment connected to public low voltage systems with input current > 16 A and ≤ 75A per phase |
| AS/NZS 61439.1 | Low-voltage switchgear and control gear assemblies, Part 1: General rules |
| AS 61869.1 | Instrument transformers - General requirements |
| AS 61869.2 | Instrument transformers - Additional requirements for current transformers |
| AS 61869.3 | Instrument transformers - Additional requirements for inductive voltage transformers |
| AS 62052.11 | Electricity metering equipment (ac) – General requirements, tests and test conditions; metering equipment |
| AS 62052.21 | Electricity metering equipment (ac) – General requirements, tests and test conditions; tariff and load control equipment |
| AS/NZS 7000 | Overhead line design |
| IEC 60255 series | Measuring relays and protection equipment |
| TR IEC 60725 | Consideration of reference impedances and public supply network impedances for use in determining the disturbance characteristics of electrical equipment having a rated current ≤75 A per phase |
| IEC 60934 | Circuit-breakers for equipment (CBE) |
| AS/NZS IEC 60947.6.1 | Low-voltage switchgear and control gear |

## 4.3 SA Power Networks documents and other publications

| | |
|---|---|
| Manual 18 | SA Power Networks Connections & Ancillary Network Services |
| NICC404 | Working in the Vicinity of SA Power Networks Infrastructure - Network Access Permit Access |
| NICC802 | Mk7 Padmount Transformers - General Information for Customers / Contractors |
| TS101 | Public Lighting - Design and Installation |
| TS102 | Easement Standard for Distribution Networks |
| TS108 | Distribution Equipment and Transformer Rooms |
| TS129 | Small EG Connections Technical Requirements - Capacity not exceeding 30kVA |
| TS132 | Low Voltage Embedded Generation Connection Technical Requirements - Capacity above 30kVALow voltage EG Connections above 30kW |
| TS133 | High Voltage Embedded Generation Connection Technical Requirements |
| TS134 | Communication Systems (inc. SCADA) for Embedded Generation |

# 5. General rules

## 5.1 Safety (TIR)

All works shall be performed in accordance with all relevant Acts, Regulations, Codes of Practice, Australian Standards, and the Rules within this document.

SA Power Networks may exercise its powers under the Electricity Act 1996 to refuse a connection or disconnect an installation where we have formed the opinion that it poses a risk to the safety of persons, livestock, or property.

The customer will be notified at the time of disconnection.

## 5.2 Compliance with Regulations, Standards, and Rules (TIR)

Any connection or reconnection to the distribution network is required to comply with the Electricity Act 1996, the Electricity (General) Regulations 2012, Australian Standards, Codes of Practice and any other relevant legislation.

### 5.2.1 SA Power Networks Terms and Conditions

SA Power Networks has Terms and Conditions that need to be entered into prior to a connection.

These Terms and Conditions require compliance with the Service and Installation Rules. It also requires any reasonable requirement SA Power Networks make in relation to the installation. e.g. SA Power Networks Connection Agreement and if applicable the SA Power Networks Engineering Report.

#### *5.2.1.1 SA Power Networks Connections & Ancillary Network Services Manual No.18*

Manual 18 outlines the list of fixed and quoted fees for Connection and Ancillary Network Services.

There are three distinct types of connection services; basic, negotiated and enhanced. These should be understood and read in conjunction with the associated model standing offers.

### 5.2.2 Electronic Certificates of Compliance - eCoC (TIR)

For SA Power Networks to make a connection, verification of compliance of the installation to the Electricity Act 1996 is required through a valid Certificate of Compliance (eCoC).

The eCoC is used to confirm the installation complies with AS/NZS 3000 and the Technical Installation Rules (TIR) in these Rules.

A copy of the eCoC shall be made available on-site. However, an Authority to Connect (ATC) form may be used where it is not reasonably practicable to provide a printed Certificate of Compliance on site, but it shall contain a valid eCoC number and outline all works which have been completed, including results of examination and testing.

The eCoC shall be issued as soon as is reasonably practicable after the electrical installation is made available for energisation and forwarded to SA Power Networks and the owner or operator of the installation.

If the certification is incomplete, or invalid or the installation is considered unsafe, then it will not be connected to the distribution network (refer to clause 1.4.

### 5.2.3 Equipment certification (TIR)

Service riser brackets, overhead service attachment brackets, service fuse enclosures and whole current metering enclosures, MSB and whole current metering enclosures, and hinged switchboard frames that are commonly distributed by electrical wholesalers and similar distributors or manufactured shall be identified as approved for use in South Australia.

In all cases approved equipment shall;

- have recognised certification and/or test reports, and
- comply with relevant AS/NZS standards, and

- comply with these Rules.

A MSB which has been manufactured for an individual customer requirement shall have a compliance plate attached, in accordance with AS/NZS 61439 series.

All enquiries relating to non-approved equipment, or requests for further information, should be forwarded to the SA Power Networks Customer Solutions Manager in the first instance.

### 5.2.4 Electrical interference (TIR)

If an installation causes undue interference to the customers installation, another customer or the distribution network, SA Power Networks may take, or direct the customers to take, corrective action and charges may apply for the upgrade to the existing connection point(s) (refer clause 1.4).

### 5.2.5 Protection and Distributed Energy Resources protection coordination with the distribution network (TIR)

Distribution network protection settings may change from time to time. It is the customer's responsibility to ensure that the correct coordination with the distribution network protection is maintained after being advised of the change by SA Power Networks. SA Power Networks will not be responsible for any costs incurred in making such a change. If not acted on, the installation may be considered a potential cause of undue interference (refer clause 5.2.4).

### 5.2.6 Expenditure prior to confirmation of connection point and technical requirements

SA Power Networks will not be held financially responsible for work or procurement made on behalf of the customer that fails to meet the requirements of the Connection Offer. It is recommended that detailed design, procurement, and service contracts occur after acceptance of our Connection Offer to ensure the full technical requirements can be met.

### 5.2.7 Revenue Metering

#### *5.2.7.1 Retailer's responsibilities*

SA Power Networks is no longer responsible for the provision of revenue metering.

This responsibility now resides with Retailers to engage a Metering Coordinator who then engages the Metering Provider. The metering requirements and standards are covered by these Rules, Electricity Act 1996, National Electricity Rules, Electricity (General) Regulations 2012 and AEMO Metrology Procedures. Note that SA Power Networks is the Metering Coordinator / Metering Provider for legacy metering.

#### *5.2.7.2 Tariffs and metering requirements*

The Retailer will determine the retail tariff and metering requirements including number and type of meters.

CT type metering will be used where the maximum demand of any metered portion of an installation exceeds 100A per phase.

#### *5.2.7.3 Responsibilities*

The customer shall provide metering facilities to accommodate the metering equipment in accordance with section 8 and clause 10.4.11.

Metering equipment shall be supplied, installed, and maintained by the Metering Provider.

#### *5.2.7.4 Acceptance (TIR)*

Final acceptance of any metering installation configuration is the responsibility of the Metering Coordinator.

## 5.3 Unauthorised interference with infrastructure (TIR)

Any unauthorised interference with SA Power Networks infrastructure or any unmetered section of an installation may be in breach of the Electricity Act 1996 which may result in prosecutions under the Act.

This includes, but not limited to:

- service fuse removal and replacement, refer clause 5.19,
- unauthorised removal of SA Power Networks locks, and electricity industry security seals installed by SA Power Networks, Metering Providers, or other delegated authorities, refer clause 5.4,
- dismantling or detachment of any SA Power Networks cables or equipment,
- interference with electricity meters, time switches and unmetered wiring,
- interfering with the settings of a Network Protection Unit (NPU), and
- unauthorised entry of SA Power Networks assets, substations, transformers, pits, and pillars.

Note:

Removing pit lids/covers of approved pits, for inspection and/or the installation of consumer mains, is not considered unauthorised entry if SA Power Networks has identified this pit as the connection point for the installation and the person/s removing the pit lid/cover is suitably trained to complete this task.

## 5.4 Electrical industry security seal (TIR)

All portions of an unmetered supply to a customer installation, including access panels, junction boxes, metering equipment, lockable isolators, fuse boxes, and enclosures shall be sealed using an authorised industry participant (SA Power Networks and Metering Providers) security seal. Sealing shall not rely on holes to be aligned through nuts on threaded studs.

Escutcheon panels which provide access to unmetered sections or terminals of switchboards shall also be provided with sealing facilities. Any sealing hole/s shall be at least 2mm in diameter.

Where a SA Power Networks lock (refer clause 5.5) is used to secure unmetered portions of an installation, these shall be regarded the same as a security seal.

Electrical industry security seals shall also be used to secure settings on load control devices.

Alternative arrangements such as password protected settings may be used if approved by the SA Power Networks Customer Solutions Manager.

It is an offence to tamper with an electrical industry security seal. Any un-authorised person found tampering or removing an electrical industry security seal may be prosecuted under the Electricity Act 1996.

## 5.5 Locking facilities (TIR)

Security locks are required as specified in Table 1. This table covers the locks applicable to provide SA Power Networks exclusive access, as well as those that permit shared access.

It is an offence for any persons or industry participant to remove any industry lock without the express permission of the agency or authority which installed the lock. Persons removing these locks without permission are in breach of clause 5.3 and may face prosecution, refer clause 5.4.

For example, if the Office of the Technical Regulator has installed a lock, Metering Coordinators or persons acting on their behalf, are not allowed to remove this lock without the express permission of the Office of the Technical Regulator.

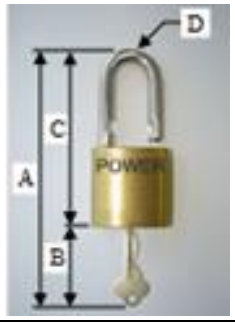
| Lock | Information | Use | Users |
|---|---|---|---|
| ES  | Master keyed lock to ES key (low security)<br>Customer purchases from electrical wholesaler or Master Locksmith | Enclosures such as meter boxes, access doors, gates, electric key switch etc. | SA Power Networks<br><br>Customer |
| CM   | Master keyed lock to CM key and individual customer key (higher security)<br>Customer purchases from electrical wholesaler or Master Locksmith | Metering enclosures, switch rooms, gates, personal access gates etc. | SA Power Networks (master key)<br><br>Customer |
| Service Fuse Enclosure Lock   | Customer purchases from electrical wholesaler or Master Locksmith<br>SA Power Networks replaces barrel at time of connection | Locking of service fuse enclosure | SA Power Networks (P3) |
| Meter Isolator Padlock  | SA Power Networks provides<br>A = 132mm<br>B = 45mm<br>C = 87mm<br>D = Dia. 5mm   | Locking of low voltage meter isolators and other devices | SA Power Networks (1266)<br><br>Office of the Technical Regulator |
| Switching Padlock   | SA Power Networks provides<br>A = 170mm<br>B = 50mm<br>C = 120mm<br>D = Dia. 10mm   | Locking of high voltage switchgear and earthing switches | SA Power Networks (P2) |

**Table 1 - Lock types and application**

## 5.6 Access requirements (TIR)

SA Power Networks and Metering Coordinators shall have safe and convenient access for the supply and ongoing maintenance of the connection. This includes;

Low voltage installations;

- connection points, refer clause 7.2.5, and
- SPD and Customer SPD clause 7.3.5, and
- the main switch, meter isolators and metering refer clause 8.1.

High voltage installations;

- connection points, refer clause 10.1, and
- the main switch, meter isolators and metering refer clauses 10.4.5 and 10.4.11.

Customer Energy Resource

- Network Protection Units (NPU) refer to clause 8.1, 8.1.2 and 9.1.1

Where this is not achievable, discuss with SA Power Networks Customer Solutions Manager.

### 5.6.1 Failure to provide access (TIR)

Failure to provide access as per clause 5.6 may lead to extended power outages and you may not be eligible to any claims. Where arranged works is not possible due to no access, you may be charged a wasted visit fee from the distributor (as specified in SA Power Networks Manual 18) or Metering Provider.

## 5.7 SA Power Networks supply rights from pits, pillars, and poles

SA Power Networks reserves the right to supply other customers from pits, pillars and poles installed on a third-party property.

In the situation where the underground consumer mains need to cross a third party's property to a SA Power Networks connection point which is not in the standard location or within 1m of the property boundary, a private registered easement granted by the third-party property owner is required.

Note: This registered easement is a private registered easement which SA Power Networks is not party to. However, an agreement shall be in place before a connection is completed.

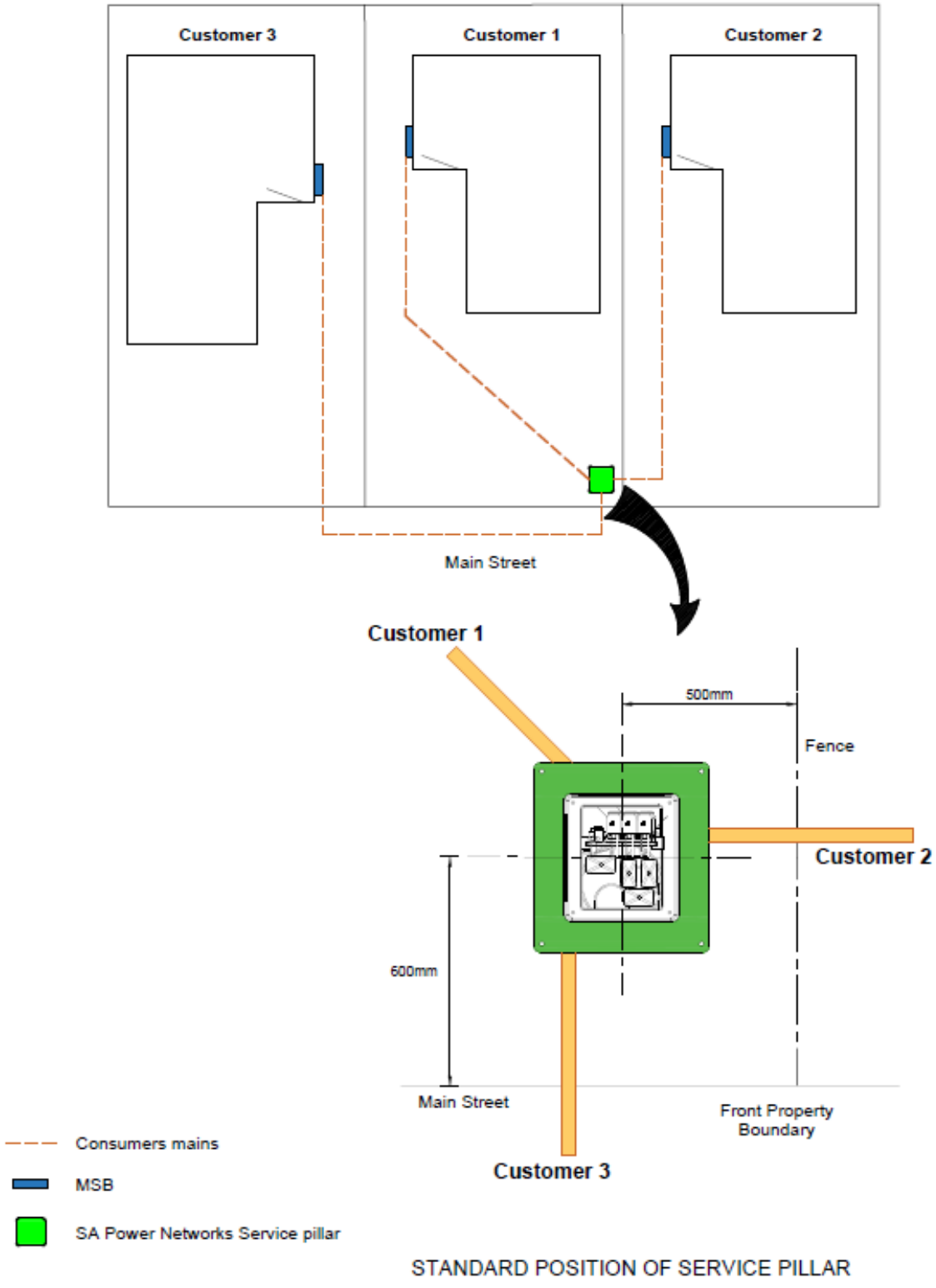



**Figure 1 - Access to pits and pillars on third party property**

## 5.8 Customer's equipment or property installed on SA Power Networks poles

For an electrical connection to the distribution network, the following equipment is permitted to be installed on an SA Power Networks' pole:

- Underground consumer mains, and
- associated mechanical protection as detailed in clause 7.6.3.

Other equipment can be installed on poles subject to prior agreement with SA Power Networks. For further information visit our website at www.sapowernetworks.com.au or use the links below:

Facilities access for third parties

NICC 210 Signage, banners, and temporary equipment on SA Power Networks assets

TS116 Attachment of Third-Party Equipment on SA Power Networks' Infrastructure

## 5.9 Integrity of customer's structures for SA Power Networks infrastructure (TIR)

The customer is responsible for providing and maintaining the necessary structure for the attachment of SA Power Networks and/or the customer's assets, necessary for the connection. This includes service brackets, customer installed riser brackets and customer supplied and installed private poles.

The integrity of the structure for the attachment of assets, shall be of adequate strength to withstand a force of 1kN applied in any direction.

## 5.10 Safety and clearances to the distribution network (TIR)

The Electricity Act 1996 and Electricity (General) Regulations 2012 require specific clearances to be maintained when building or working near the distribution network. The Office of the Technical Regulator is the authority with respect to these requirements and publishes information relating to:

Building safely near powerlines

Working safely near overhead powerlines

Working safely near underground assets

Trees and powerlines

Customers shall consider these requirements when planning any works or building near the distribution network.

Overhead service line clearances are covered in the Electricity (General) Regulations 2012 under façade mounted cable clearances.

Where these minimum safe clearances cannot be maintained, please contact SA Power Networks to arrange an isolation through our Network Access Process or to apply for an alteration to the distribution network (refer to clause 5.10.1 and 5.10.2).

### 5.10.1 Working in vicinity of SA Power Networks infrastructure (TIR)

Refer to SA Power Networks website for further details outlined in NICC 404 – Working in the Vicinity of SA Power Networks Infrastructure and our Network Access Process.

Customers shall contact ' Before Your Dig Australia' (www.1100.com.au) to obtain information on the location of any underground assets before any civil works commences.

### 5.10.2 Relocation of SA Power Networks equipment

Where a service point or SA Power Networks' equipment requires relocation, an application can be made and submitted via the SA Power Networks website. The relevant online application process is titled 'request for quotation for network extension/modification'.

### 5.10.3 Clearances between high voltage distribution earthing systems and low voltage installations (TIR)

Customers shall contact SA Power Networks Customer Solutions Manager to provide advice on the earthing system employed and follow the requirements of clause 5.10.1.

The distribution network employs either;

- multiple earth neutral (MEN), or
- common multiple earth neutral (CMEN) earthing system.

In areas where a MEN earthing system is used, the clearances between the customer's;

- main earth electrode and associated wiring system, or
- structural metalwork or metallic cladding which is in contact with the installation earthing system, including switchboards, metering enclosures, generators, opened doors etc., or
- wiring embedded in a concrete floor (including underfloor heating),

shall be a minimum of 4.0m from the SA Power Networks high voltage distribution pole, ground mounted transformers, switching cubicles, and associated earthing system.

This distance may be reduced in CMEN areas in consultation with the SA Power Networks Customer Solutions Manager.

Single Wire Earth Return (SWER) distribution transformers have extensive earthing systems.

The location of a MSB and its earthing shall be greater than 4m from the distance that may be specified on the SWER pole signage to ensure clearance from the SWER earthing system. If there is no sign on the pole or a requirement to excavate in the Restricted Excavation or Separation zone, contact the local Customer Solutions Manager

Example;

Distance on SWER pole sign is X metres:

Therefore, the clearance for excavations is X metres + 4 metres = X + 4 metres.

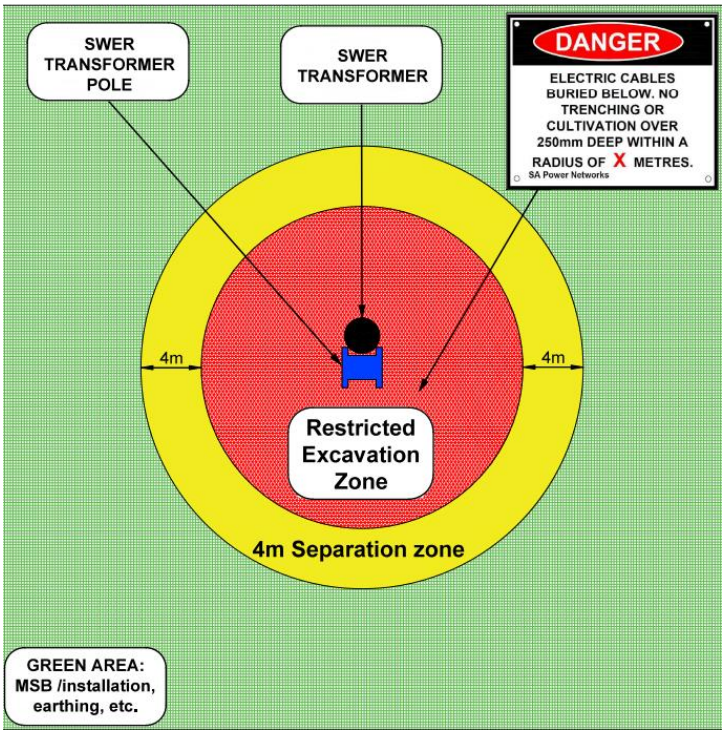



**Figure 2 - Clearance to SWER Transformer poles**

Customers shall contact SA Power Networks Customer Solutions Manager for advice before commencing any excavations within the restricted excavation zone, refer to Figure 2.

Note: Damage to a high voltage earthing system presents an extremely hazardous situation.

## 5.11 Clearances to other utilities or private infrastructure (TIR)

The customer is responsible for maintaining the required clearances to all other utilities and privately installed infrastructure in accordance with AS/NZS 3000 and other authorities' requirements.

In addition to the above, the APA Group's standard for domestic gas meter installations requires a 500mm clearance between gas meter boxes and an ignition point, including but not limited to MSB, meter panel, consumer mains and earth electrode are also considered as ignition points. Refer to clause 8.2 and Figure 11 for more details.

All overhead service lines and connection points shall be more than 600mm from overhead communication services.

## 5.12 Asbestos hazards in existing installations (TIR)

Customer's equipment, including low voltage and high voltage switchboards, metering enclosures, cables and cable enclosures being accessed by SA Power Networks shall be free of any loose asbestos fibers. Repairs may be permitted if it is not reasonably practicable to replace the equipment containing asbestos.

If approved to remove a Network Service fuse, in accordance with Clause 5.19, proceed with caution as some older styles of porcelain services contain asbestos arc matting. Should asbestos be suspected of being present, the contractor shall complete the isolation or make safe the area and call Customer Service on 13 12 61.

Some older style service pits and MSB meter panels may also contain asbestos. If asbestos is suspected of being present, a risk assessment should be completed, and appropriate asbestos safe working procedures used.

## 5.13 Agreed Service Capacity and Agreed Maximum Demand

The Agreed Service Capacity is the total capacity of the connection point including both firm and flexible load components that the site must not exceed, as agreed with the customer. The Agreed Maximum Demand is the load for which the customer has paid (ICSN) incremental cost shared network charges and will be reserved for the customer. The agreed firm connection load capacity is reserved for the customer at the time of the connection and maintained based on the on-going use of the connection at that level of demand and the corresponding payment of demand charges in the customers' network tariff.

### 5.13.1 Control of customer load or service capacity (TIR)

The customer is to provide a sealable (refer clause 5.4) circuit breaker irrespective of direction of energy flow, of capacity as close as reasonably practical to the agreed maximum demand.

Circuit breakers, including those with adjustable settings, shall meet the requirements of clauses 5.4, 7.4.1 and 10.4.5. Fuses are not an acceptable means of load control.

Note: Changing the maximum demand will require further assessment of consumer mains voltage drop requirements (refer clause 7.5.2).

## 5.14 Basic connection service

Typically, a Basic Connection Service type is a single phase, 63A supply, with an 80A SPD which is a HRC fuse. For services > 63A the installation shall be multi-phase (subject to network constraints).

Other available Basic Connection Service Types (subject to network constraints) are 80A and 100A supplies with a 100A SPD HRC fuse.

## 5.15 Connections, alterations, repairs, reconnections, and abolishment

For new connections, alterations, repairs, reconnections, and DER connections, refer clause 1.7.

While SA Power Networks will use reasonable endeavours to accommodate the customer's requirements, the location of the connection point will depend on technical requirements and the

customer should not assume a location is acceptable until this has been confirmed by SA Power Networks. (Refer clause 5.2.6).

### 5.15.1 Alterations to existing installations (TIR)

Typically, there are three areas of an installation where an alteration involves SA Power Networks. These are:

- The SA Power Networks connection point.
- The customer's consumer mains.
- The customer's MSB, including the main earth electrode, MEN point and unmetered sections.

For the intent of this clause each area can be considered separately. This means, an alteration to any one of the above areas does not mean the other areas need to meet the current SIR requirements, as they are still considered compliant with the version at that time.

It is only the area which work is being performed on that shall meet the current SIR requirements. However, all electricians have a duty of care to ensure the installation operates in the manner intended and does not pose a safety risk or have a negative impact on the network.

For the purposes of these Rules, the installation of a meter isolator as part of for a revenue meter change or reprogramming an existing smart meter for an additional tariff is considered metering works and not an alteration.

### 5.15.2 Repairs to existing installations (TIR)

A repair can be considered the work required after damage has occurred or deterioration.

Repairs carried out as per the below will not be required to meet the full requirements for new installations as per these Rules. A repair is considered the work to restore the installation to safe and compliant condition equivalent to the requirements of the Service and Installation Rules and AS/NZS 3000, at the date when the installation was initially energised.

For repairs to:

- Consumer mains refer clause 7.9.
- Meter panels and existing meter arrangements refer clause 8.4.4.

### 5.15.3 Reconnection to the distribution network after 12 months (TIR)

For installations disconnected for greater than 12 months from the distribution network, a safety inspection in accordance with the requirements of AS/NZS 3000 and an associated eCoC for the installation shall be completed and provided to SA Power Networks before reconnection.

### 5.15.4 Reconnection after the installation was disconnected for safety reasons (TIR)

For installations disconnected for safety reasons, an eCoC detailing relevant repairs for the installation shall be completed before reconnection.

A meter and/or panel isolator shall be installed as per clause 7.4.

### 5.15.5 Reconnection after the site had been previously abolished (total, permanent removal of supply) (TIR)

The site shall be managed as a new installation.

### 5.15.6 Abolishment

Abolishment of service is the permanent disconnection from the distribution network.

The customer is responsible for the removal of all portions of consumer mains and associated fixings from SA Power Networks infrastructure.

### 5.15.7 Solar and other generators

For solar and other generator technical requirements refer to CER section 9.

## 5.16 Contiguous land

Where supply has been provided to a property that comprises of contiguous land, and the installation and/or occupancies wiring extend into or across the property, the customer or controlling body will not have rights upon the land becoming non-contiguous. The supply will need to be rearranged to comply with these Rules and the Electricity Act 1996 and Electricity (General) Regulations 2012. Alternatively, we recommend the customer negotiate with the landowner for a registered easement to protect their wiring.

## 5.17 Label requirements (TIR)

Labels required by these Rules, AS/NZS 3000 and AS 2067 shall be in English, permanent, legible from normal viewing level and distance, and suitable for the environment for which it is intended for the life of the installation.

A minimum requirement for labels required by SA Power Networks is a product manufactured or printed in block lettering and numbers not less than 6mm in height. The ongoing maintenance and correctness of these labels is the customer's responsibility.

## 5.18 Safety signs (TIR)

Safety signs required by these Rules, AS/NZS 3000 and AS 2067 shall be in English, permanent, legible from normal viewing level and distance, and suitable for the environment for which it is intended for the life of the installation.

Safety signs shall be manufactured of suitable size to comply with AS 1319.

## 5.19 Operation of Service Protection Devices (TIR)

Fuse cartridges for service fuses shall be supplied and installed by SA Power Networks.

SPDs shall only be operated by;

- SA Power Networks, or
- persons authorised by SA Power Networks, or
- a prescribed person under the requirements of the Electricity Act 1996.

### 5.19.1 Emergency services personnel (TIR)

Emergency Services personnel shall only operate a SPD if authorised by their organisation and can only operate to de-energise an installation.

In all situations SA Power Networks shall be advised at the earliest opportunity.

### 5.19.2 Licensed electrical worker (TIR)

Licensed electrical workers shall only operate a SPD to de-energise an individual installation under the following conditions;

- authorisation has been granted by SA Power Networks (refer note below), and
- the SPD is ≤ 100A, and
- the SPD is mounted on either a SA Power Networks pole, a customer's structure, or housed in the customer's main switchboard and in a location that is easily accessible and in good condition, and
- the overhead service line is not an open wire construction, and
- the licensed electrical worker can demonstrate safe work methods are in place.

The installation shall only be re-energised by SA Power Networks.

**Note:** Authorisation to operate the SPD to de-energise the installation will only be given:

- For planned work, by calling Customer Service on 13 12 61 on the business day or the business day before the appointment and provided an appointment for the job has been booked and confirmed.
- For faults and emergencies by calling the Faults and Emergencies line on 13 13 66.

### 5.19.3 Licensed electrical worker operating on behalf of a Metering Provider (TIR)

A licensed electrical worker is a prescribed person in relation to the work of installing or replacing a meter and should only operate the type of SPD authorised by their organisation.

The work of installing or replacing a meter includes;

- the temporary disconnection of the electricity supply while the work is carried out, and
- installation of a meter isolator if required, and
- reconnecting electricity supply from the distribution network to the installation to which the meter is wired following the installation or replacement of the meter.

# 6. Low Voltage supply and responsibilities

## 6.1 Supply characteristics (TIR)

### 6.1.1 Distribution network configuration (TIR)

The electricity supply is in the form of alternating current of approximately sinusoidal waveform at a frequency of 50Hz.

The nominal supply voltage is 230/400V, maintained at steady state of +10% and -10%, measured over a 10-minute average, in accordance with AS 60038 and AS 61000.3.100.

SA Power Networks may, subject to availability, undertake to provide:

- 1 phase, 2 wire 230V system
- 3-phase, 4 wire 230/400V system
- 1 phase/split phase, 2 and 3 wire 230/460V system, for SWER or 11,000V single phase applications.

The supply arrangements may be restricted in some locations; for example, some country areas are limited to a SWER or single phase 11,000V supply. Similarly, some built-up areas are restricted to a single phase 230V system only.

**SWER Applications:**
A 3-phase service is not available to customers supplied via a 1 phase/split phase SWER system.

1 phase/split phase 230/460V 2 and 3 wire services are available from 10kVA and 25kVA transformers, and the capacity is specified in Table 2.

| | Standard arrangement 1 phase / 1 line (230V) | | Alternative arrangement split phase / 2 line (460V) | |
|---|---|---|---|---|
| **Transformer size (kVA)** | Connection size (230V) A | Meter isolator/main switch A | Connection size (460V) A | Meter isolator/main switch A |
| **5** | 20 | 20 | N/A | N/A |
| **10** | 45 | 40 | 20 A / line @ 230V | 20A (2 pole) |
| **25** | 100 | 100 | 50 A / line @ 230V | 50A (2 pole) |

**Table 2 - SWER transformer low voltage arrangements**

**Single Phase 11,000V supply applications:**

3-phase services are not available to customers supplied via a single phase 11,000V supply (2 x 11kV lines supplied transformer).

Single phase/split phase 230/460V, 2 and 3 wire services are available from 11,000V single phase transformers, and capacity can be confirmed by contacting the SA Power Networks Customer Solutions Manager.

**Note:** To assist in reducing voltage drop in long consumer mains, an alternative split phase / 2 line, 3 wire application may be applicable. Refer to Figure - 3.

Existing transformer sizes can be confirmed by contacting the SA Power Networks Customer Solutions Manager.

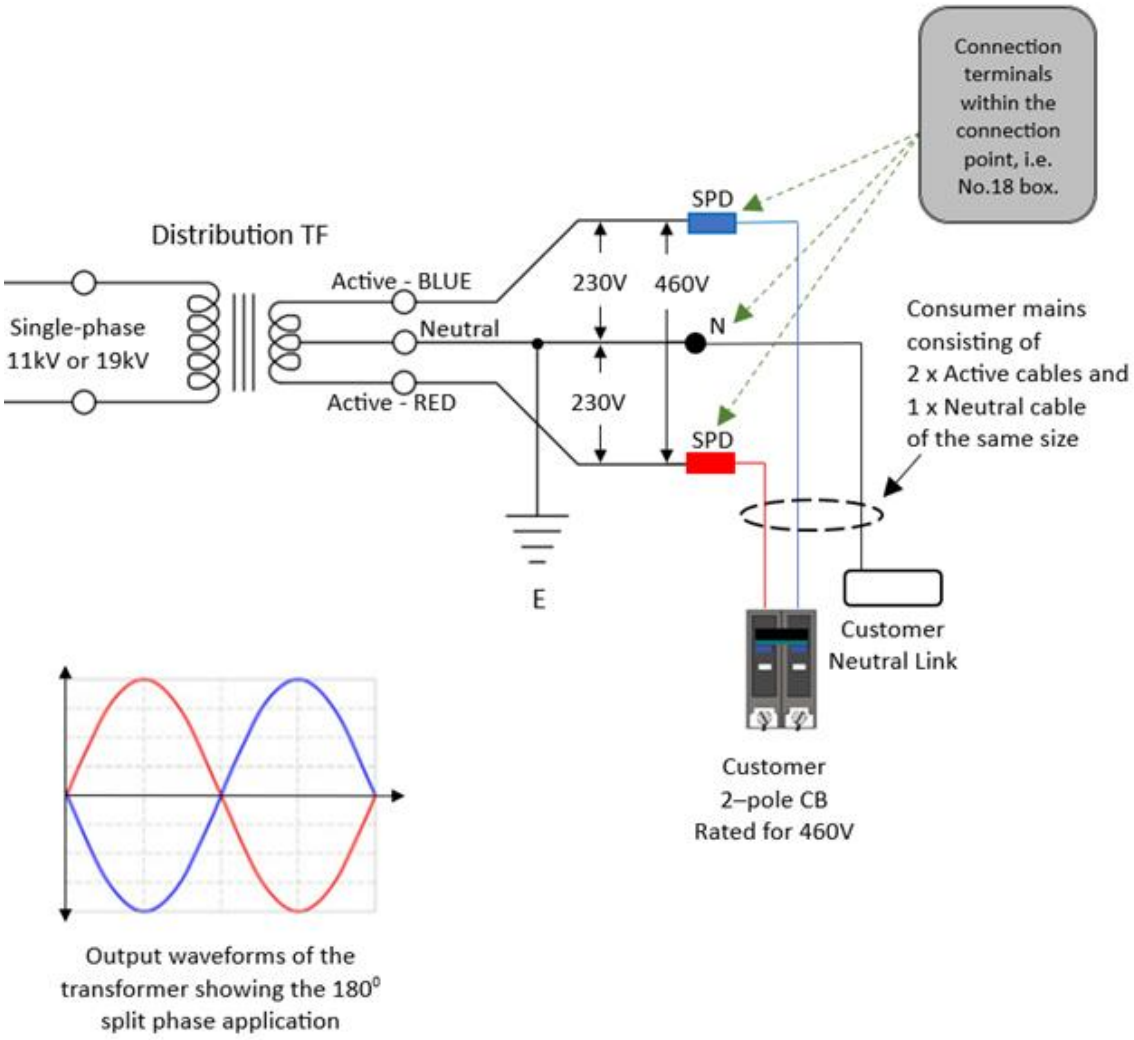



**Figure - 3 Split-phase SWER application**

**Note:** 460V supplies shall have appropriately voltage rated circuit breakers.

The maximum service capacity from a SWER line is 50kVA per connection. This arrangement can only be provided by negotiation with SA Power Networks Customer Solutions Manager.

### 6.1.2 Protective earthing systems (TIR)

The distribution network employs either;

- multiple earthed neutral (MEN), or
- common multiple earthed neutral (CMEN) system.

The SA Power Networks Customer Solutions Manager should be consulted on the precise configuration of the earthing system employed.

The service is supplied without an earth conductor. The neutral conductor performs the multiple functions of distribution network neutral and distribution network earth. The consumer mains neutral shall be installed as the Protective Earth Neutral (PEN) conductor as per AS/NZS 3000.

### 6.1.3 Earthing of electrical installations including multiple connection points (TIR)

The earthing of installation shall be in accordance with AS/NZS 3000 requirements for a MEN earthing system. The MEN connection and outgoing earthing conductors shall be accessible for inspection and testing without the need to interfere with SA Power Networks or the Metering Provider's security seal (refer clause 5.4).

Multiple connections points should not be provided to a building/structure which has the potential to create a parallel equipotential connection between the MEN points via a continuous conductive path. This includes a conductive roof, guttering and downpipes, conductive structure such as steel frames, or conductive pipework.

### 6.1.4 Supply disturbances (TIR)

SA Power Networks will endeavour to ensure voltage disturbances meet the requirements of AS/NZS 61000.3.3, AS/NZS 61000.3.5 and AS/NZS 61000.3.11 and harmonic distortion meet the requirements of AS/NZS 61000.3.2, AS/NZS 61000.3.4 and AS/NZS 61000.3.12. However, due to the nature of transient voltages, currents, and the uncontrollability of their source, SA Power Networks cannot provide any limitation on these types of supply disturbances.

Customers are advised to provide protection devices to protect equipment within their installation.

### 6.1.5 Phase failure protection (TIR)

Customers with sensitive equipment on multi-phase installations should provide appropriate phase failure, over voltage and under voltage protection against the loss of one or more phases.

### 6.1.6 Prospective fault current (TIR)

Prospective fault currents vary depending on the location of a customer's connection point on the distribution network and the type of asset supplying the customer.

Where the prospective fault current increases at the connection point due to an upgrade of supply, the customer shall be responsible for upgrading all their equipment to the revised prospective fault current.

The nominal prospective fault current at the SA Power Networks connection point is as per Table 3below. However, due to the impedance of the customer's consumer mains the prospective fault current at the customer's MSB may be lower. It is the customer's responsibility to ensure a circuit breaker with suitable fault current rating is installed in the main switchboard. In situations where the calculated fault current is less than 6kA, a minimum 6kA rated device shall be installed.

| Service size | Prospective fault current |
|---|---|
| Up to 100A service<br>(Greater than 50m from supply transformer)<br>Phase to earth bolted fault currents for new or upgraded installations | 6kA (Nominal)<br>Unless otherwise informed by SA Power Networks. |
| Up to 100A service<br>(Greater than 10m and less than 50m from supply transformer)<br>Phase to earth bolted fault currents for new or upgraded installations | 10kA (Nominal)<br>Unless otherwise informed by SA Power Networks. |
| Up to 100A service<br>(Service point 10m or less from supply transformer)<br>Phase to earth bolted fault currents for new or upgraded installations | Refer to SA Power Networks |
| All services within the Adelaide CBD | Refer to SA Power Networks |
| Greater than 100A service | Refer to SA Power Networks |
| SWER and single phase 11 kV applications | 6kA (Nominal)<br>Unless otherwise informed by SA Power Networks |
| Service supplied from a padmount transformer | NICC 802 Padmount Transformers – General Information for Customers/Contractors. |
| Service suppled from all other pad mount and ground level open bushing type transformers | Refer to SA Power Networks |

**Table 3 - Prospective fault currents**

## 6.2 Customer responsibilities (TIR)

The customer is responsible to ensure their load/export stays within specified limits. For additional generation requirements refer to DER section 9. In all cases the requirements in the SA Power Networks Connection Agreement and if applicable the SA Power Networks Engineering Report shall be met, which may be different to those below.

### 6.2.1 Obligations (TIR)

Customers shall ensure;

- protection equipment in the installation is effectively coordinated with the electrical characteristics of the distribution network, and

- the distribution network and the reliability and quality of supply to other customers are not adversely affected by the customer's actions or equipment, and
- the maximum current drawn by the installation does not exceed the authorised service capacity (refer 5.13).

### 6.2.2 Power factor (TIR)

The customer shall take all reasonable steps to maintain power factor, at all times within the relevant range set out in Table 4 below.

| Maximum demand of installation | | | | | |
|---|---|---|---|---|---|
| Up to 100kVA | | 100kVA to 2MVA | | Exceeding 2MVA | |
| Minimum lagging | Minimum leading | Minimum lagging | Minimum leading | Minimum lagging | Minimum leading |
| 0.80 | 0.80 | 0.85 | 0.80 | 0.90 | 0.85 |

**Table 4 – Low voltage power factor**

### 6.2.3 Harmonic distortion (TIR)

The customer shall ensure that harmonic distortion caused by the installation or by any appliances is not in excess of an appropriate allocation limits prescribed in AS/NZS 61000.3.2, AS/NZS 61000.3.4, AS/NZS 61000.3.12 (e.g. rectifiers, frequency converters, electronic load control devices, saturable reactors, and variable speed drives). Contact SA Power Networks Customer Solutions Manager to request allocation limits specific to each customer supply. Note that allocation limits are a fraction of Harmonic Planning limits as detailed in TR IEC 61000.3.6 Section 4.1 Table 1 and are to be maintained at the supply connection point.

### 6.2.4 Balanced load or source (TIR)

The load of an installation, or embedded generator, which is connected by more than one phase, shall be balanced as near as practicable over all phases.

Under normal circumstances, the out of balance current should not exceed 25A or 10% of the agreed maximum demand, whichever is greater.

### 6.2.5 Voltage disturbances (TIR)

The customer shall ensure the installation does not result in voltage disturbances to other customers greater than the limits prescribed in AS/NZS 61000.3.3, AS/NZS 61000.3.5 and AS/NZS 61000.3.11. (ie large or fluctuating loads demands, e.g. arc furnaces, welding machines, x-ray units, frequently started motors including air conditioning.)

As per TR IEC 60725, for the purpose of assessments to determine compliance for proposed equipment within an installation and impacts to voltage disturbances, the following network supply circuit reference impedances (refer Table 5 below) are to be used for a 230/400V supply less than or equal to 100A.

| Reference impedances for testing purposes | |
|---|---|
| Conductor | Impedances Ω |
| Phase conductor | 0.24 + j0.15 |
| Neutral conductor | 0.16 + j0.10 |
| Total | 0.40 + j0.25 |

**Table 5 – Reference impedance for testing purposes**

For services greater than 100A, please seek advice from SA Power Networks Customer Solutions Manager.

### 6.2.6 Voltage unbalance (TIR)

The customer shall ensure the installation does not result in a voltage unbalance to other customers greater than the limits in Table 6 below.

| Low voltage unbalance factor (%) | |
|---|---|
| Time period | Voltage unbalance factor (%) |
| 30-minute average | 2.0 |
| 10-minute average | 2.5 |
| 1 minute average | 3.0 |

**Table 6 – Low voltage unbalance factor (%)**

### 6.2.7 Switched loads (TIR)

100A supply or less shall not have 1 phase loads switched in excess of the values shown in Table 7 below.

| Local supply system | Load being switched |
|---|---|
| 1 Phase 230/460V | 20A |
| 2 Phase 230/400V | 20A |
| 3 Phase 230/400V | 25A |

**Table 7 - Switched loads 100A supply or less**

Approval may be given by SA Power Networks Customer Solutions Managers to switch larger loads.

An exemption for EV chargers may apply if approval is sought through SA Power Networks SmartApply application process.

### 6.2.8 Restart delay (TIR)

Where the installation's;

- total heating system is rated at 6kW or greater, or
- compressor equipment (including air conditioning) is rated at greater than 2.4kW,

the customer shall ensure that the equipment, appliance, socket outlet or final sub-circuit supplying the equipment has either,

- an under-voltage release with a manual reset, or
- an ON-delay timer which senses the supply voltage and, where automatically operated, has a minimum on delay of not less than 10 seconds,

after an outage of the distribution network supply.

### 6.2.9 Motor start current (TIR)

The starting current shall not cause a voltage disturbance as per clause 6.2.5. The starting current of a motor shall not exceed the value in Table 8 below for a basic connection. Contact SA Power Networks Customer Solution Manager if starting currents required are more than shown.

| Motor size | Allowable starting current I |
|---|---|
| All sizes | I = 45A per phase |

**Table 8 - Motors allowable starting current**

### 6.2.10 Power quality measurement data

SA Power Networks may require power quality measurement data (voltage level, harmonic distortion, flicker, and voltage balance at a 10-minute average) for a minimum of 7 days to be provided in a format suitable to SA Power Networks. Data logging shall be undertaken as close as possible to the customers connection point.

# 7. Low voltage supply arrangements

## 7.1 Connection point

SA Power Networks will provide a connection point. Contained within the connection point will be the connection terminals for the termination of the consumer mains refer Table 9.

The type of connection provided shall be determined by the;

- requested service capacity, and
- configuration and limitations of the local distribution network.

Connection equipment (e.g. transformers, service pits and pillars, SPD etc.) supplied by SA Power Networks generally remain the property of and are maintained by SA Power Networks.

Except for the SPD and retail metering, the customer is responsible for the supply, installation and on-going maintenance of all cables and equipment beyond the connection point.

### 7.1.1 Number of connection points

SA Power Networks standard arrangement is one connection point to a property.

Additional connection points may be considered in the following circumstances.

- Multiple occupancy;
  - comprising separate individual domestic installations intended to be occupied by different customers and does not include any common property assigned for MSB and group metering position, and
  - the land associated with each of the domestic installations directly abuts a road reserve, and
  - meets the earthing requirement of clause 6.1.3.
- Large properties such as schools, sporting clubs, local government reserves, rural situations, etc. requiring an additional service for ancillary functions:
  - Separation shall be maintained between the installation of different connection points and shall comply with the requirements of identification in clause 7.1.3 and the earthing requirements of clause 6.1.3.
  - For backup supplies refer to clause 7.1.4.
- EV Chargers
  - Separation shall be maintained between the installation of different connection points and shall comply with the requirements for identification in clause 7.1.3 and the earthing requirements of clause 6.1.3.
  - For backup supplies refer to clause 7.1.4.

Individual connection arrangements for separate buildings or properties will only be considered for developments where buildings and installations are constructed such that they do not cross property title boundaries (excluding consumer mains entering the road reserve or registered easement).

### 7.1.2 Subdivision connection points

#### *7.1.2.1 Subdivisions incorporating common property*

Requirements for subdivisions supplied by a single connection point;

- all allotments shall be supplied from a group metering position which is considered the MSB, , and
- the MSB, should be placed within the common property and shall meet the requirements of clause 8.1 and 8.3.3, and,
- each allotment should abut common property, and
- MSB/group meter boards may be installed in internal locations as per clause 8.1.1

Additional group meter boards may be supplied from the MSB and shall meet the requirements of clause 8.1, 8.1.1 and all relevant clauses for group meter boards. Refer to clause 7.8 for the requirements of un-metered submains.

Exception:

In a subdivision where some allotments do not abut common property, but face road reserve, a separate connection point can be requested. Refer to Figure 4 example 2 house 1 and clause 6.1.3.

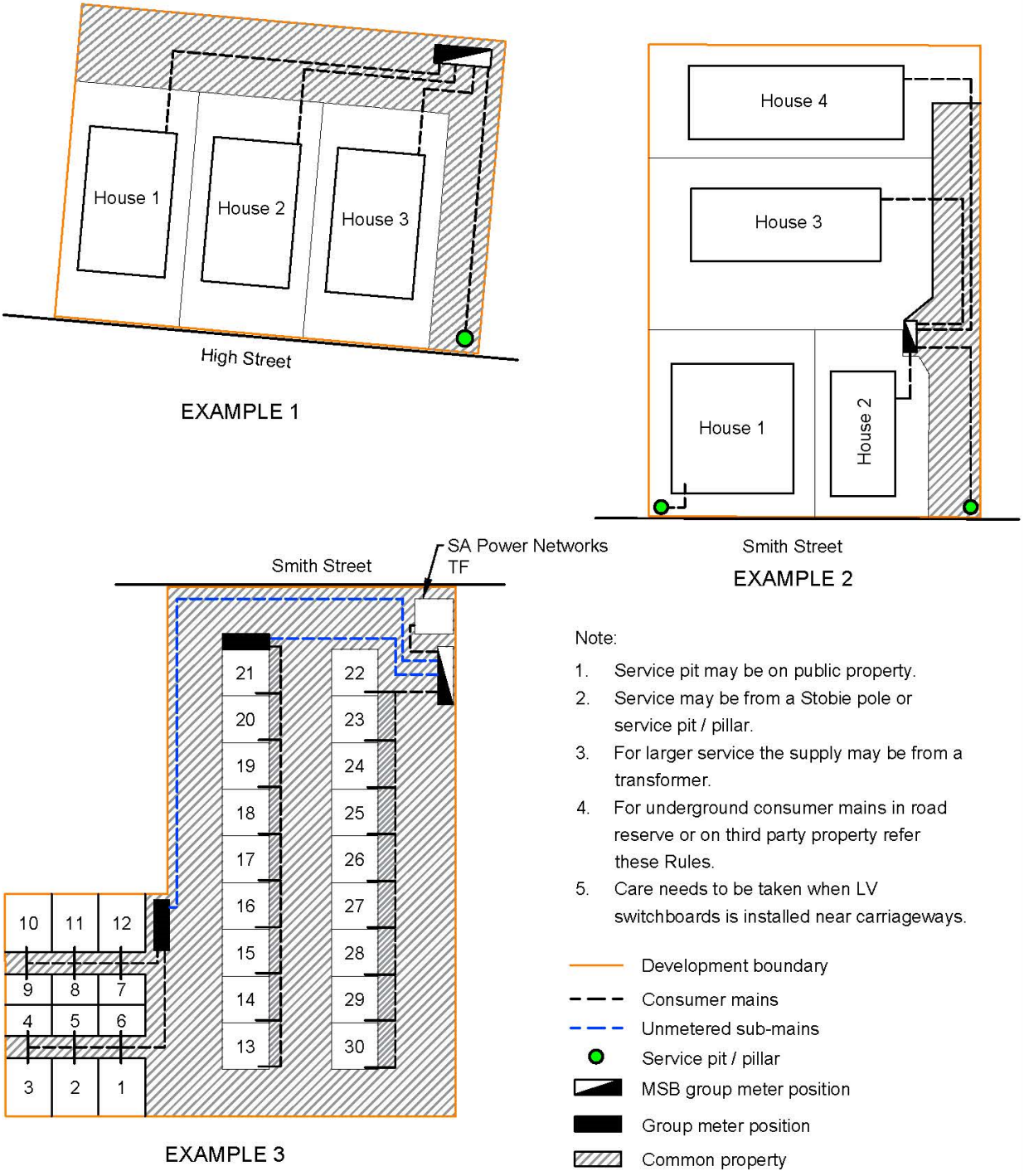



**Figure 4 – Typical supply arrangements for subdivisions (community title) incorporating common property**

#### *7.1.2.2 Subdivision not incorporating common property*

Subdivisions that do not incorporate common property and abut a road reserve, may be provided with a connection point for each allotment refer Figure 5. The MSB shall be arranged in accordance with clauses 8.3.1 and 8.3.2.

The subdivision must meet the earthing requirements of Clause 6.1.3.

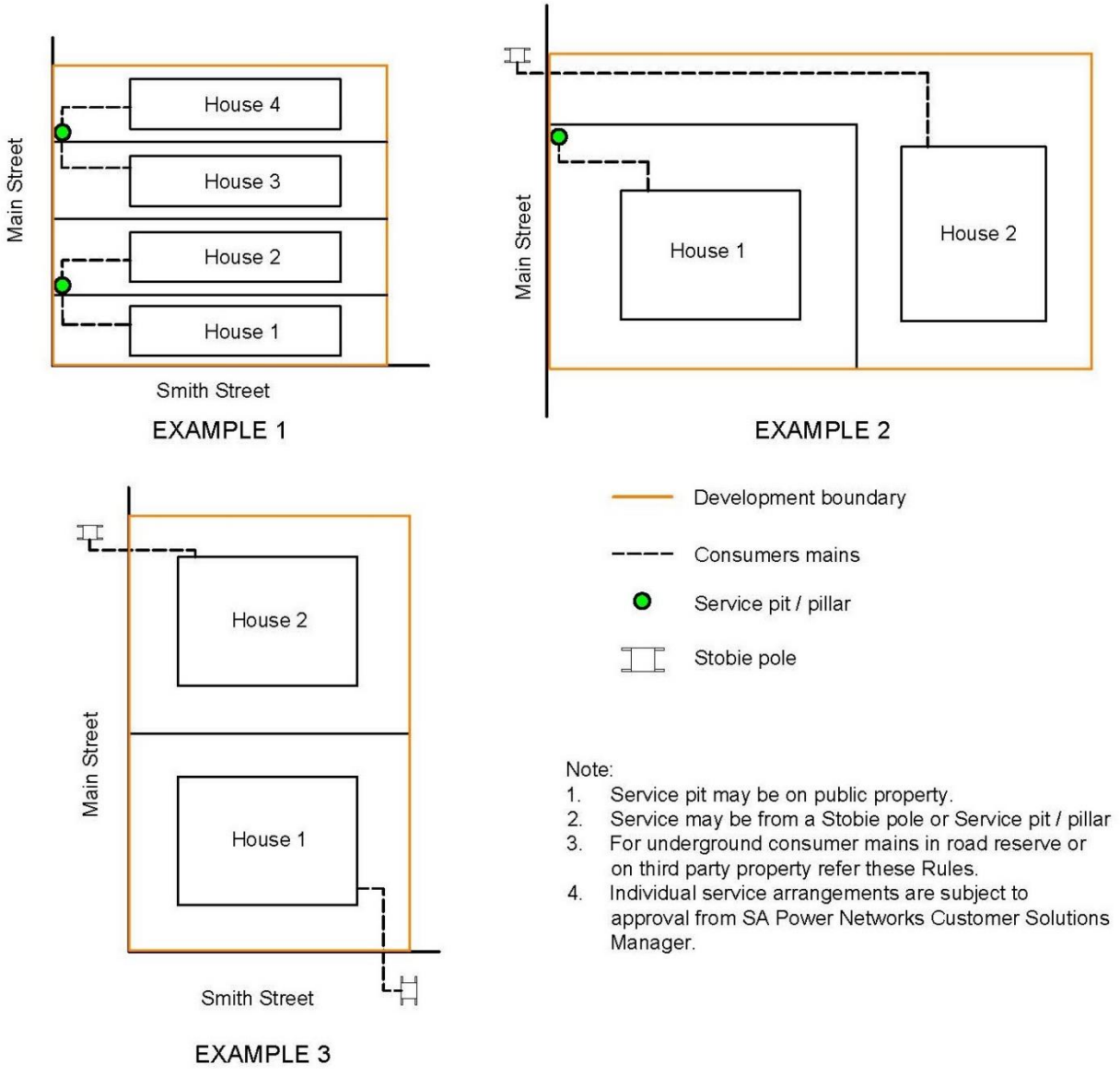



**Figure 5 – Typical supply arrangements for subdivisions (community title) NOT incorporating common property**

### 7.1.3 Identification of multiple connection points (TIR)

A prominent warning sign, (refer to clause 5.18), provided and installed by the customer, alerting to the presence of multiple connection points shall be installed on the exterior of each MSB and all relevant sub boards and fire panels.

This applies where;

- more than one connection point is provided to a property, and/or
- more than one set of consumer mains are connected within a connection point to the same property.

The requirements for multiple connection points are;

- site diagrams showing the location of the connection points, unmetered wiring and additional metering points, and
- the customer is responsible for the provision and maintenance of diagrams and labels to ensure they are permanent, legible, and current.

Where specific connection terminals are to be provided on a MSB or elsewhere for a temporary emergency generator, these shall be connected downstream of the revenue metering and after a physical isolation break point to ensure the revenue metering and SPDs cannot be energised from the alternative source of supply.

### 7.1.4 Interconnection of connection points

Interconnection of connection points or separately metered supplies needs to be negotiated and approved by SA Power Networks Customer Solutions Manager.

These types of developments are enhanced for customer requested reliability purposes where community safety, system stability for operations is required. Typical examples are shopping complexes, industrial situations, large CBD office buildings, Hospitals, Data Centre's etc.

### 7.1.5 Connection point for short-term supplies

SA Power Networks may provide a connection point for an installation for a short-term, e.g., temporary building supply and event type situations. The type of connection point will be determined by the load requested by the customer and the limitations of the distribution network.

For applications ≤80A in an overhead serviced area, this supply may be provided to a temporary private pole and switchboard location.

All reticulation beyond the connection point, including temporary switchboard arrangements and consumer mains, will be the customer's responsibility.

Where a short-term connection is provided, it shall be disconnected at the time of connection of the permanent supply or conclusion of the event. In some situations, short term supplies, suppling building site amenities can remain in place for an additional period by negotiation with SA Power Networks Customer Solutions Manager.

### 7.1.6 Connection point for unmetered supplies

A customer may apply to have the load connected as un-metered. SA Power Networks is not under any obligation to accept an un-metered supply request until all the following requirements have been met;

- the requested load needs to be registered on AEMO's load tables, and
- the load is to be located in an accessible public area (to permit inspection and validation), and
- load limiting circuit breaker with provision for SA Power Networks seal shall be provided and the circuit breaker is to be set at the load level being requested, and
- loads shall be hard wired, socket outlets are not permitted other than for an approved Type 7 load, and
- the connected equipment/load characteristics shall not be changed or altered without prior written notice to, and acceptance from, SA Power Networks (other than repair or replace like for like with same electrical ratings), and
- equipment specifications, inventory tables and test results shall be provided prior to a load being considered for connection.

Further details and requirements for unmetered supplies are described in SA Power Networks Connections & Ancillary Network Services Manual 18.

### 7.1.7 Open transition transfer switch (OTTS) "Break before Make" Source of Supply (TIR)

Where an alternative source of supply, such as a generator, is connected to an electrical installation, either automatically or manually by an OTTS device it must comply with AS/NZS 3000, AS/NZS 3010 and AS/NZS 3820. The arrangement shall be such that the revenue metering and SPDs cannot be energised from the alternative source of supply.

Any changeover device used to switch between supplies shall break connection from the SA Power Networks supply prior to making connection to the alternative source of supply.

The changeover device must incorporate a mechanical interlock to prevent the simultaneous connection of the alternative supply and the SA Power Networks Distribution network.

The opening or closing of any associated switchgear door or cover shall not affect the mechanical interlocking system.

A prominent label (refer clause 5.17) shall be fixed at the consumer terminals and the main switchboard and the sections of the electrical installation they supply including their point of control to show that such facilities exist.

If the alternative supply automatically comes into operation on the loss of SA Power Networks mains supply, a means of isolating the alternative supply shall be provided on the electrical installation main switchboard, or the distribution switchboard to which the alternative supply is connected.

#### *7.1.7.1 Generator connected under emergency conditions (TIR)*

Where a generator is connected under emergency conditions, the interlocking arrangement may be achieved by creating a physical break, e.g. disconnection of cables. The neutral shall not be switched or broken on the distribution supply (upstream) side of the MEN connection.

Refer also to the AS/NZS 3000 and AS/NZS 3010 for specific installation requirements.

## 7.2 Connecting to SA Power Networks low voltage network

The type of connection point, connection terminals and details outlining the size and types of consumer mains which may be connected are detailed in Table 9 below.
Also outlined are the responsibilities of the individual parties.

| Row | Connection details | | | | | Responsibilities | |
|---|---|---|---|---|---|---|---|
| | Type | Figure | Connection point / location | Fuse type & size (A) | Size and type of consumer mains | SA Power Networks | Customer |
| 1 | Overhead Service line to customer's building<br><br>(Protected connection Point clause 7.3.1) | Figure 31 and Figure 32 | No. 17 Service Fuse Box (1 Phase)<br>No.18 Service Fuse Box (Multi-phase)<br>Mounted on the customer's building within 20 metres of the SA Power Networks pole | HRC<br><br>32<br>45<br><br>80 | One conductor /phase of copper cables:<br><br>6mm² ≤ 35mm² of either:<br><br>• PVC insulated<br>• PVC insulated/ PVC sheathed<br>• Neutral Screened cables | • Supply and install No.17 or No 18 service fuse box and overhead line attachment brackets to customer's structure (except for a facia riser bracket).<br>• Connect consumer mains to connection terminals.<br>• Perform required checks prior to energising to open isolating device. | • Ensure suitable structure to mount service fuse box and attachment bracket (clause 7.2.7.2).<br>• Supply and install riser bracket if required (clause 7.2.7.3).<br>• Consumer mains installed as per clause 7.5 and 7.6.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>• Consumer mains prepared for final trim of conductor for connection to No. 17 or No.18 Service Fuse Box.<br>• If installing neutral screen cable; the cable gland must be installed, the sheath removed, the screen prepared and covered with black insulated sleeving and a crotch joint properly completed at the junction of the removed screen and insulated cores.<br>• If installing conduit into a No.17 or No.18 box, it shall be UV stabilised flexible or corrugated conduit.<br>• Provide 32 BSP adaptor, cable gland and sealing ring for consumer mains connection to connection box. |
| 2 | Overhead Service line to customer's support pole<br><br>(Protected Connection Point clause 7.3.1) | Figure 31<br>Figure 32<br>Figure 38 | No. 17 Service Fuse Box (1 Phase)<br>No.18 Service Fuse Box (Multi-phase)<br>Mounted on the customer's support pole within 20 metres of the SA Power Networks pole | HRC<br><br>32<br>45<br><br>80 | One conductor /phase of copper cables:<br><br>6mm² ≤ 35mm² of either:<br><br>• PVC insulated<br>• PVC insulated/ PVC sheathed | • Supply and install overhead service line to customer's support pole.<br>• Supply and install No.17 or No.18 box service fuse box on the customer's support pole.<br>• Connect consumer mains to connection terminals<br>• Perform required checks prior to energising to open isolating device. | • Supply and install customer support pole (clause 7.2.7.1).<br>• Consumer mains installed as per clause 7.5 and 7.6.<br>• In situations where the consumer mains are installed before the over/under the consumer mains shall be able to reach to a height of 4.0m on all faces of the pole.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>• Consumer mains prepared for final trim of conductor for connection to No. 17 or No.18 Service Fuse Box.<br>• Provide 32 BSP adaptor, cable gland and sealing ring for consumer mains connection to connection box. |

| Row | Connection details | | | | | Responsibilities | |
|---|---|---|---|---|---|---|---|
| | Type | Figure | Connection point / location | Fuse type & size (A) | Size and type of consumer mains | SA Power Networks | Customer |
| 3 | Service on a SA Power Networks' pole<br><br>(Protected Connection Point clause 7.3.1) | Figure 33 | No. 17 Service Fuse Box: (1 Phase)<br>No.18 Service Fuse Box: ((Multi-phase))<br>* Multi-phase only | HRC<br><br>32<br>45<br><br>80<br>100* | One conductor /phase of copper cables:<br><br>6mm² ≤ 35mm² of either:<br><br>• PVC insulated<br>• PVC insulated/ PVC sheathed | • Supply and install a No.17 or No 18 service fuse box on SA Power Networks' pole.<br>• Connect consumer mains to connection terminals.<br>• Perform required checks prior to energising to open isolating device. | • Consumer mains installed as per clause 7.5 and 7.6.<br>• In situations where the consumer mains are installed before the over/under the consumer mains shall be able to reach to a height of 4.0m on all faces of the pole.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>• Consumer mains prepared for final trim of conductor for connection to No. 17 or No.18 Service Fuse Box.<br>• Provide 32 BSP adaptor, cable gland and sealing ring for consumer mains connection to connection box. |
| 4 | Service on a SA Power Networks' pole<br><br>(Protected Connection Point clause 7.3.1) | Figure 33 | 100A Over/under service fuse box-(Multi-phase) | HRC<br><br>80<br>100 | One conductor /phase of copper cables:<br><br>6mm² ≤ 50mm² of either:<br><br>• PVC insulated<br>• PVC insulated/ PVC sheathed | • Supply and install 100A Over/under service fuse box on SA Power Networks' pole.<br>• Drill appropriate holes in 100A service box to suit customer consumer mains conduit fittings.<br>• Connect consumer mains to connection terminals.<br>• Perform required checks prior to energising to open isolating device. | • Consumer mains installed as per clause 7.5 and 7.6.<br>• In situations where the consumer mains are installed before the over/under the consumer mains shall be able to reach to a height of 4.0m on all faces of the pole.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>• Consumer mains prepared for final trim of conductor for connection to 100A Over/under service fuse box.<br>• Provide plain to screwed conduit adaptor(s) with locknut(s) for consumer mains connection to connection box.<br>• Provide M12 lug for neutral connection in 100A Over/under service fuse box. |

| Row | Connection details | | | | | Responsibilities | |
|---|---|---|---|---|---|---|---|
| | Type | Figure | Connection point / location | Fuse type & size (A) | Size and type of consumer mains | SA Power Networks | Customer |
| 5 | Service on a SA Power Networks' pole<br><br>(Protected Connection Point clause 7.3.1) | Figure 33 | 200A Over/under service fuse box- (Multi-phase) (FSD) | NH2<br><br>100<br>160<br>200 | One conductor /phase of copper cables<br><br>35mm$^2$ ≤ 95mm$^2$ of either:<br><br>• PVC insulated<br>• PVC insulated/ PVC sheathed | • Supply and install 200A Over/under service fuse box on SA Power Networks' pole.<br>• Drill appropriate holes in 200A service box gland plate to suit customer consumer mains conduit fittings.<br><br>• Connect consumer mains to connection terminals<br><br>• Perform required checks prior to energizing to open isolating device. | • Consumer mains installed as per clause 7.5 and 7.6.<br>• In situations where the consumer mains are installed before the over/under the consumer mains shall be able to reach to a height of 4.0m on all faces of the pole.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>• Consumer mains prepared for final trim of conductor for connection to 200A Over/under service fuse box.<br>• Provide plain to screwed conduit adaptor(s) with locknut(s) for consumer mains connection to connection box.<br>• Provide M12 lug for all active and neutral connections in 200A Over/under service fuse box. |
| 6 | Service on a SA Power Networks' pole<br><br>(Protected Connection Point clause 7.3.1) | Figure 34 | SA Power Networks' Isolator and fuse (short X- arm) | J-Type<br><br>250<br>315<br>400 | Up to two conductors /phase of copper or aluminum cables<br><br>95mm$^2$ ≤ 240mm$^2$ | • Supply and install low voltage short X-arm, SA Power Networks' isolator, and fuse on the SA Power Networks pole.<br>• Assist customer with installation of consumer mains and cable protection and perform all works above 2.5m.<br>• Connect consumer mains to connection terminals.<br>• Seal customer conduit to prevent water ingress<br>• Perform required checks prior to energising to open isolating device. | • Consumer mains to be installed as per clause 7.5 and 7.6 and with assistance of SA Power Networks.<br>• UV stabilised cable shall be used.<br>• Supply M12 crimp lugs for active and neutral conductors to suit J type fuses and crimping tool.<br><br>• Provide cable support arrangement to prevent mechanical stress on fuses.<br>• Provide conduit sealing compound<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4. |

| Row | Connection details | | | | | Responsibilities | |
|---|---|---|---|---|---|---|---|
| | Type | Figure | Connection point / location | Fuse type & size (A) | Size and type of consumer mains | SA Power Networks | Customer |
| 7 | Service on a SA Power Networks pole<br><br>(Protected Connection Point clause 7.3.1) | Figure 33<br><br>Figure 34 | SA Power Networks Fuse Switch Disconnect (FSD) | NH2<br><br>160<br>200<br>250<br>315<br>400 | Up to 2 conductors /phase of copper or aluminum cables<br><br>50mm² ≤ 185mm² | • Supply and install SA Power Networks FSD and fuse on the SA Power Networks pole.<br>• Assist customer with installation of consumer mains and cable protection and perform all works above 2.5m.<br>• Connect consumer mains to connection terminals.<br>• Seal customer conduit to prevent water ingress<br>• Perform required checks prior to energising to open isolating device. | • Consumer mains to be installed as per clause 7.5 and 7.6 and with assistance of SA Power Networks.<br>• UV stabilised cable shall be used.<br>• Supply M12 crimp lugs for neutral conductors and crimping tool.<br><br>• Provide cable support arrangement to prevent mechanical stress on FSD.<br>• Provide conduit sealing compound<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4. |
| 8 | Fused Pillar<br><br>(Protected Connection Point clause 7.3.1) | Figure 36 | Service pillar | HRC<br><br>32<br>45<br><br>80 | One conductor /phase of copper cables:<br><br>6mm² ≤ 35mm² of either:<br><br>• PVC insulated<br>• PVC insulated/ PVC sheathed | • Supply and install Service pillar.<br>• Connect consumer mains to connection terminals.<br>• Perform required checks prior to energising to open isolating device. | • Supply and install consumer mains as per clause 7.5 and 7.7.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4. |

| Row | Connection details | | | | | Responsibilities | |
|---|---|---|---|---|---|---|---|
| | Type | Figure | Connection point / location | Fuse type & size (A) | Size and type of consumer mains | SA Power Networks | Customer |
| 9 | Un-Fused pit<br><br>(un-protected connection point) clause 7.3.2 | Figure 37 | Pit | ≤100 | One conductor /phase of copper cables.<br><br>16mm2 ≤ 35mm² of either:<br>• PVC insulated/ PVC sheathed | • Supply and install un-fused pit.<br>• Connect consumer mains to connection terminals.<br>• Supply and install SPD on meter panel in customer's MSB.<br>• Perform required checks prior to energising to open isolating device. | • Supply and install consumer mains as per clause 7.5 and 7.7.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>• MSB meter panel to have adequate space for SPD, clause 8.4.2.<br><br>Note: Earthing requirements for unprotected consumer mains and MSB containing SPD refer to AS/NZS 3000. |
| 10 | Un-Fused pit<br><br>(un-protected connection point) clause 7.3.2 | Figure 37 | Pit | >100 to 400 | One conductor /phase of copper or aluminum cables.<br>35mm2 ≤ 240mm² | • Supply and install un-fused pit<br>• Supply service fuse rack.<br>• Connect consumer mains to connection terminals.<br>• Perform required checks prior to energising to open isolating device. | • Supply and install consumer mains as per clause 7.5 and 7.7.<br>• Supply and install customer enclosure for SA Power Networks Service protection device clause 7.3.3.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4.<br>Note: Earthing requirements for unprotected consumer mains and MSB and / or customer enclosures containing SPD refer to AS/NZS 3000. |
| 11 | Fused pit with submersible fuses (protected connection point) clause 7.3.1 | | Submersible fuses in the pit | HRC<br><br>32<br>45<br>80<br>100 | One conductor /phase of copper cables:<br><br>6mm2 ≤ 50mm² of either:<br>• PVC insulated<br>• PVC insulated/ PVC sheathed | • Supply and install pit with submersible fuses<br>• Connect consumer mains to connection terminals.<br>Perform required checks prior to energising to open isolating device. | • Supply and install consumer mains as per clause 7.5 and 7.7.<br>• Connect consumer mains to isolating device and neutral link in MSB as per clause 7.4. |
| 12 | Padmount Transformers | | Padmount Transformers – Low voltage compartment | Refer to NICC 802- Mk7 Padmount Transformer.<br><br>Connection to padmount transformer requires co-ordination on a case-by-case basis with SA Power Networks. | | | |

| Row | Connection details | | | | | Responsibilities | |
|---|---|---|---|---|---|---|---|
| | Type | Figure | Connection point / location | Fuse type & size (A) | Size and type of consumer mains | SA Power Networks | Customer |
| 13 | Other pole transformer arrangements < 500kVA | | | Refer to SA Power Networks Customer Solutions Manager | | | |

**Table 9 - Connection types and responsibilities**

### 7.2.1 Preparing for a connection

As per the Electricity Act 1996, SA Power Networks is required to apply a 'testing and inspection procedure' before connecting or reconnecting an installation. Ensuring that the requirements of these rules are met will assist in preventing delays. Where re-attendance is required, a wasted visit fee may be applicable as per Manual 18.

The eCoC shall be made available on site, refer clause 5.2.2.The installation shall be ready for the Responsible Officer to commence the connection on arrival. For any questions around work readiness call the Customer Service on 13 12 61.

Appendix B provides guidance to assist in preparing for your connection.

### 7.2.2 Cable types for connection into SA Power Networks infrastructure

For up to 100A connections from pits, pillars and pole or fascia mounted SPD the following cable types are deemed NOT SUITABLE for termination directly into SA Power Networks infrastructure:

- Neutral Screen marked UNDERGROUND
- Hard drawn copper
- XLPE
- Mineral insulated metal-sheathed cables (MIMS)
- Armoured cables
- Aluminium cables
- Flexible cables

These types of cables shall be converted to stranded copper PVC insulated. Refer clause 7.2.3.

The above conductors may be suitable for connection to other types of SA Power Networks infrastructure.

### 7.2.3 Converting cable size and type

Where cables have been installed that are not suitable for the connection terminals, they shall be converted prior to being connected.

This can be achieved with;

- inline crimp sleeves, or
- the use of an enclosure suitable for the application.
- For further information refer, (clause 7.9)

If the enclosure is attached to our infrastructure this needs to be approved by the SA Power Networks Customer Solutions Manager.

### 7.2.4 Existing breakdown boxes for multiple supplies

Existing breakdown boxes should be replaced with a group meter board. Where there is difficulty in achieving this requirement consult with the SA Power Networks Customer Solutions Manager for an agreed solution.

### 7.2.5 Required egress and access to connection point (TIR)

Where the connection point is located on the customer's property, the customer shall provide and maintain safe and unrestricted egress and access to the connection point at all hours; refer clause 5.6 if this access is compromised.

#### *7.2.5.1 Overhead connection points (TIR)*

A clearance area of at least 1.5m in front and 600mm both sides of the connection point shall be maintained to enable safe ladder access (refer Figure 31).

Structures (such as carports) shall not be built beneath the connection point.

Plants, trees, or other obstructions shall not be in the clearance area.

#### *7.2.5.2 Underground connection points (TIR)*

The customer shall maintain safe and unrestricted access to service pits/pillars installed on their property (refer Figure 6). For transformer access refer to NICC 802 Padmount Transformers – General Information for Customers/Contractors.

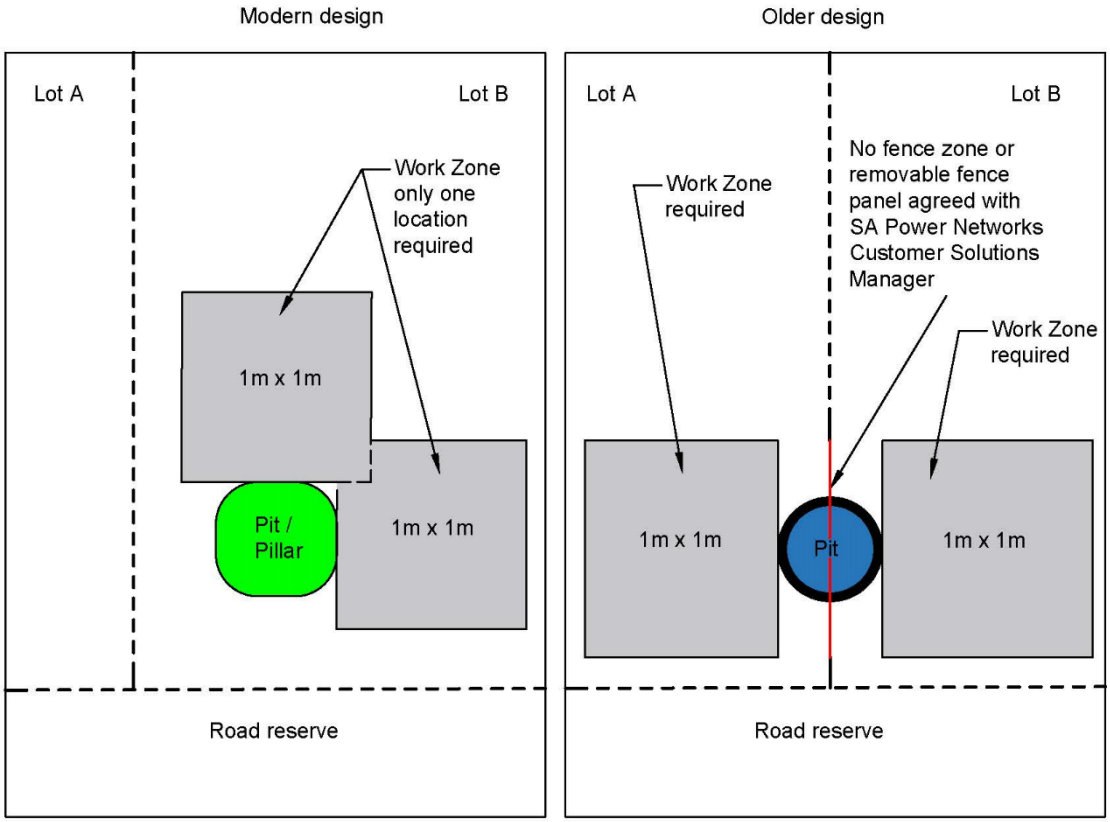



**Figure 6 - Service pit / pillar work zones**

### 7.2.6 Building and structural clearances to connection points (TIR)

Building and Structures shall not be built:

- Directly beneath an overhead connection point or in the clearance zone as per Figure 31.
- Within 1.2m of a Service pit or pillars as per Figure 7 .

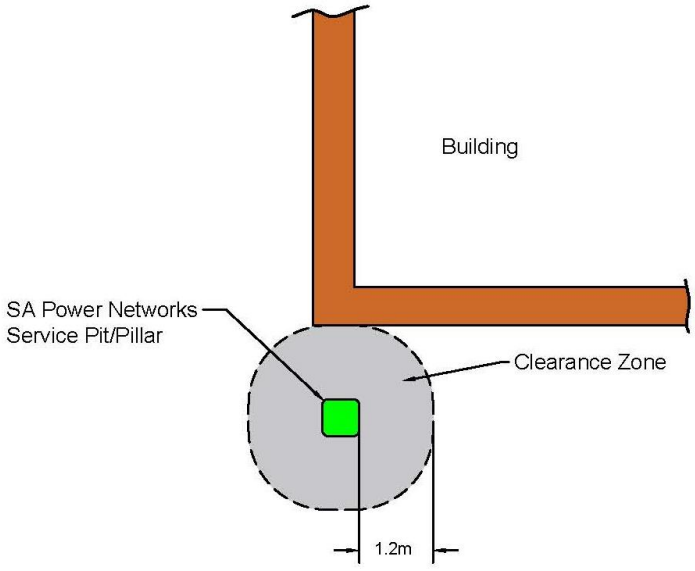



**Figure 7 - Service pit/pillar building clearance**

### 7.2.7 Overhead service lines

The overhead service line route shall consider the requirements of clause 5.10, site and vehicle access, vegetation and building clearances and;

- shall not be installed above existing verandas, carports and roofs, and
- shall be installed so vegetation does not breach clearances or restrict access, and
- shall not cross the boundary of an adjacent property, and
- should have a minimum 1m clearance to property boundary at maximum swing and sag, and
- should be located to limit the length of an overhead service line to 20m. Distances over 20m will require an overhead cable Registered Easement and specific network design.

Where a customer requests an upgrade of the overhead service and /or installation with the existing overhead service line passing over an adjacent property Statutory easement provisions will apply, refer to Figure 8.

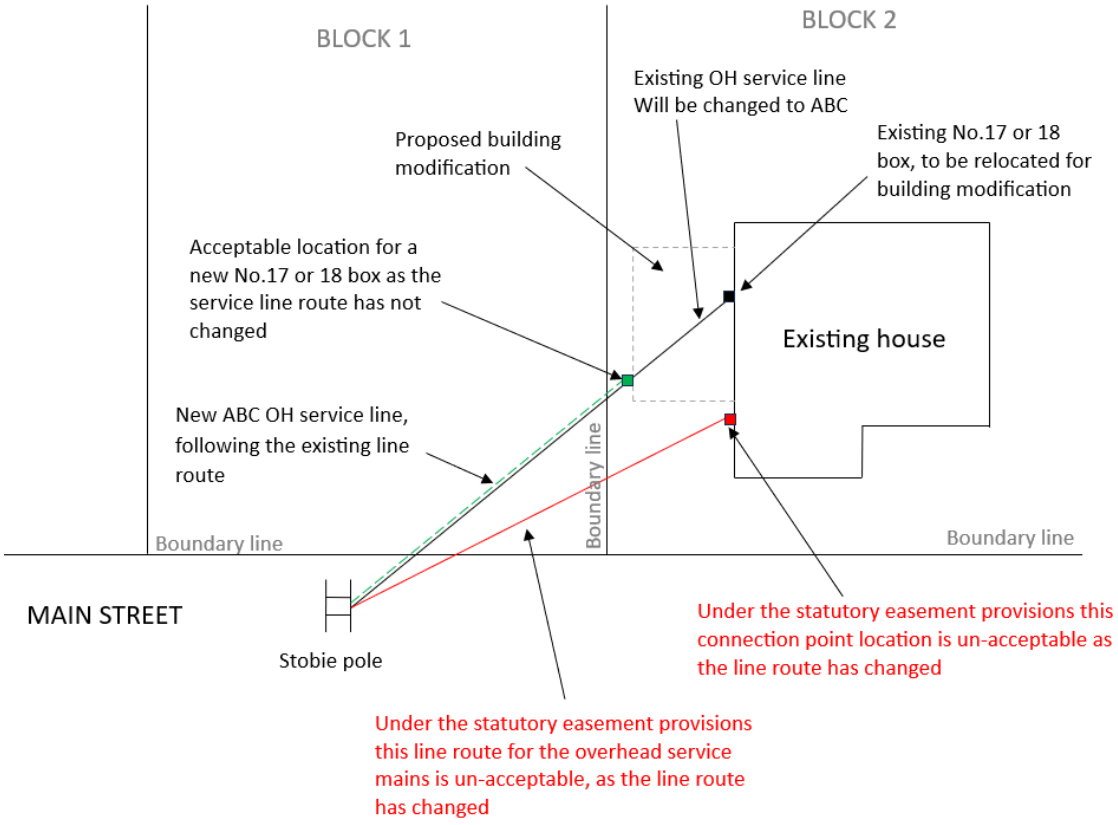



**Figure 8 - Statutory easement provisions**

#### *7.2.7.1 Customer private pole*

A private pole is a pole owned, supplied and maintained by the customer refer Figure 38 and installed within the customer's property. All requirements for access shall comply with clauses 7.2.5.1 and 7.2.7. Refer to 5.9 for maintenance responsibilities.

The SA Power Networks connection point shall be attached to this pole. Alternately the customer support pole may be used to support the deviation of the SA Power Networks overhead service line from the pole on the road reserve to the customer's house.

#### *7.2.7.2 Service bracket*

SA Power Networks supply and install these brackets which are attached to the customer's structure to provide a point of attachment for the overhead service line. It is the customer's responsibility to provide a suitable attachment point as per clause 5.9 and Figure 32.

#### *7.2.7.3 Service riser brackets*

A service riser bracket which is supplied and attached by the customer is defined as service riser bracket to provide a higher level of attachment of the service line. The customer shall ensure the structure is suitable as per clause 5.9. This service riser bracket is available from electrical wholesalers, refer clause 5.2.3.

Service riser brackets shall be clearly and permanently marked with the safe working load (SWL) and manufacturer identification. The SWL must be at least 1kN.

## 7.3 Service protection (TIR)

SA Power Networks connection points will either be;

- protected, where a SPD provides short circuit protection to prevent detrimental effects on the distribution network. The principal function of this device is to disconnect the electricity distribution network from the customer's installation, or
- un-protected, where no SPD is installed.

AS/NZS 3000 has specific requirements for consumer mains installed as either protected or un-protected.

In all situations overload protection shall be provided by the customer at the main switchboard.

### 7.3.1 Protected connection point (TIR)

SA Power Networks may provide a SPD rated in accordance with the agreed service capacity (refer to clause 5.13 and Table 9).

### 7.3.2 Un-protected connection point (TIR)

Where the connection point provided has no short circuit protection the customer shall provide an enclosure for the installation of SPD refer clause 7.3.3 or the customers SPD refer clause 7.3.4.

### 7.3.3 Customer enclosures up to 400A (TIR)

Below are the requirements for a customer provided enclosure for the SPD.

#### *7.3.3.1 Service protection enclosures (TIR)*

Enclosures shall;

- be an approved enclosure, and
- be installed in a location to minimise the risk of mechanical damage, and
- be suitable for the environmental conditions, and
- be located to meet the consumer mains requirements as per clause 7.5.2, and
- have the appropriate fault current rating, and
- metal enclosures shall be bonded to the neutral or earthed in accordance with AS/NZS 3000 and labelled as "Unprotected mains bonding conductor", and
- in situations where the enclosure has been bonded to the neutral, the enclosure shall not be attached to any conductive structure connected to the installations MEN, and
- be capable of being locked in accordance with Table 1 Table 1or sealed (refer clause 5.4).

#### *7.3.3.2 Main switchboard and metering enclosures (TIR)*

Where a SPD is installed in a MSB or metering enclosure the installation;

- shall comply with the requirements of AS/NZS 3000, and
- shall meet the sealing requirements of clause 5.4. and
- conductive MSBs and metering enclosures shall be bonded to the neutral or earthed in accordance with AS/NZS 3000 and labelled as "Unprotected mains bonding conductor" and
- meet spacing requirements as per Figure 24Figure 24 for fuses 100A or below, and
- in situations where the MSB or metering enclosure has been bonded to the neutral, the enclosure shall not be electrically continuous to any conductive structure connected to the installations MEN.

### 7.3.4 Customer's enclosures and protection device above 400A (TIR)

For a customer provided protection device and enclosure the requirements of clauses 7.3.3 shall be met.

The customer shall provide a single circuit breaker. This circuit breaker shall comply with IEC60934 and the following requirements;

- will be the installation's main switch and load control device, and
- ensure grading, with the upstream protection devices, and
- will be capable of being locked in the 'off' position by an SA Power Networks padlock as defined in clause 5.5, and
- will have SA Power Networks approved means to prevent unauthorised persons adjusting settings, (refer clause 5.4), and
- have all live terminals and connections enclosed, and
- will not have an auto reclosing facility, and
- have an instantaneous tripping characteristic settable between 2xIN and 10xIN, and
- have a rated short circuit current capacity equal to or greater than the prospective short circuit current at the point it is installed.

### 7.3.5 Location, egress, access and working clearances for service protection device (TIR)

Customers shall provide and maintain safe and unrestricted egress and access to the SPD or Customer Service Protection Device at all hours. Further requirements that shall be met, include:

- Access/egress shall meet the requirements of clause 8.1.
- Clearance requirements shall be the same as clause 8.1.4.
- Mounting height for ≤200A or less shall be a minimum of 300mm from the ground and maximum of 4m from ground level with the same requirements for ladder access refer clause 7.2.5.1.
- When mounted in the MSB additional requirements to the above are those specified in section 8.

Where the above is not achievable, discuss with SA Power Networks Customer Solutions Manager. Refer to clause 5.6.

## 7.4 Customer isolating devices (main switches, panel, and meter isolators)

### 7.4.1 General (TIR)

For the purposes of safety, load control and consumer mains overload protection, an installation shall have a lockable isolating device installed between the SPD and the revenue metering.

The isolating device shall be;

- installed to the requirements of AS/NZ 3000 if used as a main switch, and
- a circuit breaker with its operational status always visible, and
- appropriately sized in accordance with the agreed maximum demand, and
- accessible as per clause 7.4.3, and
- capable of being "Locked" in the "OFF" position only, (for meter isolators only), and
- orientated and spaced so any industry locks do not obstruct the operation of other protection devices or obscure labelling, and
- capable of being sealed to the requirements of clause 5.4, and
- in most situations shall not be "closed" remotely in the "on" position. However, subject to approval by SA Power Networks Customer Solutions Manager hardwired remote close from an adjacent location within sight of the isolator may be acceptable, and
- labelled as per clause 5.17 and the following sections.

Depending on the number of revenue meters installed, this isolator may be a;

- panel isolator, and/or a
- meter isolator, refer to Figure 9 .

And may also perform the function of a;

- main switch; and/or
- load control device.

Note:

Turning off a main switch or isolator may disrupt the communication between the remote read metering and the Retailer, indicating a loss of supply that will be investigated by the Metering Provider. A solution is to install an additional isolator on the load side of the meter. This is relevant where the customer isolates supply i.e. holiday type accommodation.

#### *7.4.1.1 Main Switches (TIR)*

Main Switches shall be located, arranged, and labelled (refer clause 5.17), to allow their effective operation in an emergency.

Main Switches shall be labeled as follows:

a) All Main Switches throughout the entire installation, shall have a permanent reference at the Main Switchboard e.g. inside the switchboard door, and
b) Shall be numbered corresponding with the total amount of Main Switches on the installation.

Example:

Main Switch for a single domestic installation shall be labelled as ‘MAIN SWITCH 1 of 1’.

The Main Switches for a single domestic installation with solar shall be labelled as

- ‘MAIN SWITCH 1 of 3 GRID’
- ‘MAIN SWITCH 2 of 3 SOLAR’
- ‘MAIN SWITCH 3 of 3 BACK-UP SUPPLY’

The labelling of Main Switches shall be updated for installation of alternative or supplementary supplies e.g. Solar/Battery/Generator. The installer of these supplies shall be responsible for these changes.

#### *7.4.1.2 Panel isolators (TIR)*

Panel isolators are required on all whole current metering installations which have two or more metering installation NMIs. Panel isolators allow the isolation of individual panels of meters, instead of the entire installation.

#### *7.4.1.3 Single panel of meters and labelling (TIR)*

The panel isolator will also be regarded as the Main Switch for the installation and shall be labelled as “MAIN SWITCH 1-1” and “PANEL ISOLATOR”. Additional labelling requirements are required if alternative or supplementary supplies are installed, refer clause 7.4.1.1.

#### *7.4.1.4 Two or more panels of meters and labelling (TIR)*

Each panel of metering requires a dedicated panel isolator and shall be labelled as,

“PANEL - A - ISOLATOR’, “PANEL - B - ISOLATOR” etc.

The Main switch in this case is a separate device that isolates the entire main switchboard from the distribution network. Additional labelling requirements are required if alternative or supplementary supplies are installed, refer clause 7.4.1.1.

### 7.4.2 Meter isolator (TIR)

For each NMI, a single meter isolator is required to provide isolation of all the meters associated with that NMI.

#### *7.4.2.1 Requirements to Install a Meter Isolator (TIR)*

A meter isolator with an accompanying sealable metering neutral link shall be installed:

- For all new installations including whole current, CT and high voltage.
- To existing installations where an additional tariff is requested. Refer to notes below.
- Where metering configurations are changed due to changes in authorised service capacity.
- To existing installations where an alteration and/or upgrade involving SA Power Networks has been requested.
- Customer initiated meter change.
- To any additional tenancy or landlord meter.
- For installations requiring reconnection to the distribution network after being disconnected for safety reasons, clause 5.15.4.

Note:

1. Where a Meter Isolator has been installed and labelled correctly, prior to attendance by a Metering Coordinator, and has not been connected, then it shall be tagged “Not in Service”. A typical scenario is for an additional tariff, e.g. solar.
2. The Meter Isolator shall be connected by the Metering Coordinator prior to, or at the same time of remotely programming the meter, reconfiguring the metering or a meter change occurs.

#### *7.4.2.2 Single revenue meter installation and labelling (TIR)*

The meter isolator will be the main switch and load control for the installation and shall be labelled as “MAIN SWITCH 1-1” and “METER ISOLATOR”, refer to Figure 9. Additional labelling requirements are required if alternative or supplementary supplies are installed, refer clause 7.4.1.1.

#### *7.4.2.3 Multiple revenue meter installations and labelling (TIR)*

Each Retailer revenue meter or meters associated with a single NMI shall have a meter isolator,( refer clause 7.4.1) and labelled as “METER ISOLATOR” with a reference to the corresponding revenue metering. The meter isolator shall be located;

- immediately adjacent to the corresponding meter or metering transformers, or
- in a separate electrical industry security sealed compartment of the same switchboard, or
- in an immediately adjacent switchboard.

Active links may be used for multiple meters requiring connection to the same phase refer Figure 9. The active and neutral metering link shall be mounted either on the rear of the meter panel or within the enclosure behind the meter panel/meter isolator compartment and sealed with the electrical industry security seal.

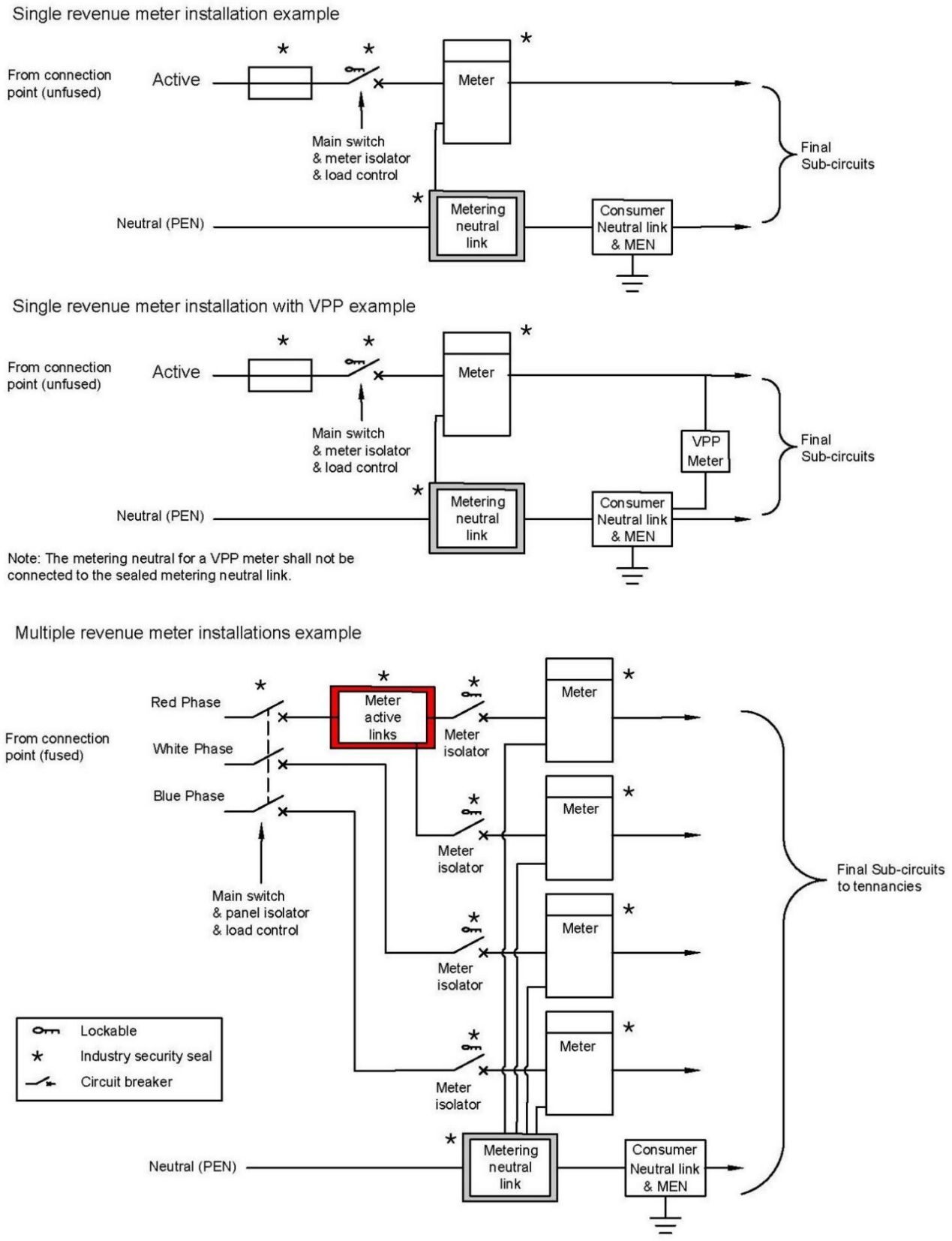



**Figure 9 – Typical single and multiple revenue meter installations and VPP meter connections**

#### *7.4.2.4 Exceptions for meter isolators (TIR)*

A meter isolator will not be required in the following situations.

Works initiated by a Meter Coordinator;

- maintenance of metering, meter exchange (meter churn only) but not initiated by customer works.

Customer initiated meter change for additional tariff for Inverter Energy Systems where;

- CT or high voltage meter change, and there is no change to the consumer mains, meter location, the authorised capacity, or.
- metering enclosure with metering facilities is remote (not within the same vicinity) to the main switchboard and the main earth is not within the same vicinity, or
- meter/s only (no customer equipment) are mounted on a SA Power Networks pole, or
- a Type 1 meter panel with a multi-phase meter and 3 service fuses on the panel and a meter isolator will not physically fit. Provided there is sufficient room for the revenue metering, then the main switch shall be changed for a circuit breaker as a load control device per clause 7.4.1, or
- there are multiple occupancy installations with grouped meter positions, and it is not reasonably practicable to be installed (such as no physical space or plug in metering)

Other works;

- consumer mains are repaired refer clause 7.9, or
- consumer mains length is modified to suit a change in location of connection point by SA Power Networks, or
- certain works in the Elizabeth area as specified in clause 8.5.2.

### 7.4.3 Location and access to customer's isolating devices

The customer shall maintain safe and unhindered access to all customer isolating devices as per clause 8.1.

#### *7.4.3.1 Strata or community title properties*

Installation subject to a Strata or community title, and supplied by a single connection point, customers isolating devices should be located on common property and accessible to all customers through common property.

Where there is no common property defined on the strata or community title, allocated for services, an agreed location between all parties and complying with the requirements of clause 8.3.3 shall be used.

Where the development is supplied by individual connection points, each single customer installation shall comply with clause 7.4.2.1 and 7.4.2.2.

#### *7.4.3.2 Multiple customers but not strata or community title*

Where the installation has multiple customers and is not subject to a strata or community title, all customer isolating devices should be located on common property which is always accessible to all customers.

## 7.5 Consumer mains

### 7.5.1 General (TIR)

Consumer mains are the electrical conductors owned and maintained by the customer, connecting SA Power Networks connection point to the customer's MSB or SPD enclosure, and forms part of the customer's installation.

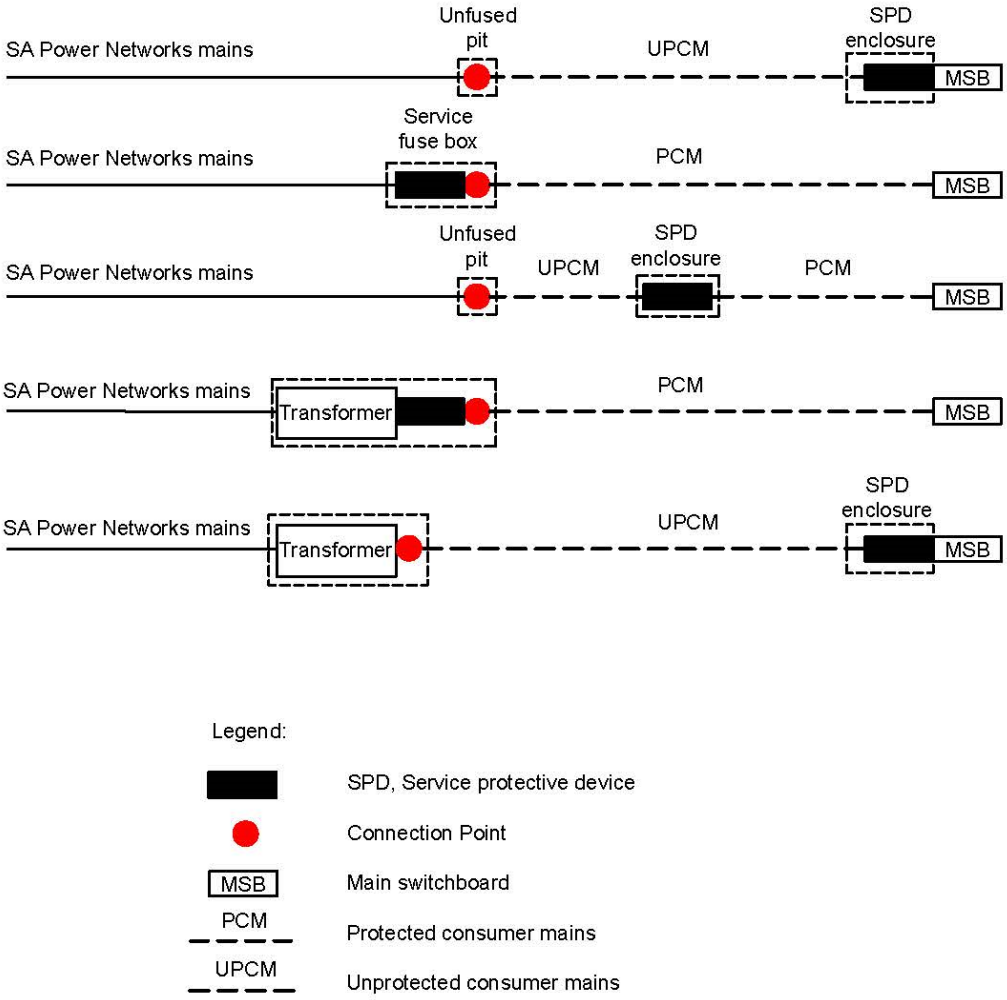



**Figure 10 – Typical consumer mains single line diagrams**

The type of consumer mains and method of connection to the SA Power Networks connection terminals shall meet the requirements of Table 9..

Consumer mains shall:

- Have the route of underground consumer mains clearly displayed within the MSB/enclosure of which they terminate.
- Meet the requirements of other authorities for use of a common trench including clearances to other services and minimum depth.
- be completely enclosed in an approved conduit or ducting. Enclosures will not be required for metal armoured cable, metal sheathed cable, neutral screened cable or where other types of cables or conductors are readily open to view or located in normally inaccessible places or underground.

#### *7.5.1.1 Additional requirements for un-protected consumer mains (TIR)*

Consumer mains which are not protected by SPD or Customer SPD shall meet the requirements of AS/NZS 3000 and;

- are not permitted to pass under any building, and
- shall meet the requirements of Figure 11, and
- meet the length requirements of clause 7.5.2.

Alternative arrangement:

Un-protected consumer mains and the MSB can be surface mounted to the external wall with the provision;

- the un-protected consumer mains have the appropriate mechanical protection, refer to Clause 7.5.1.2, and
- enter the main switchboard/enclosure from beneath, and
- clearances to gas services are maintained, refer Figure 11.

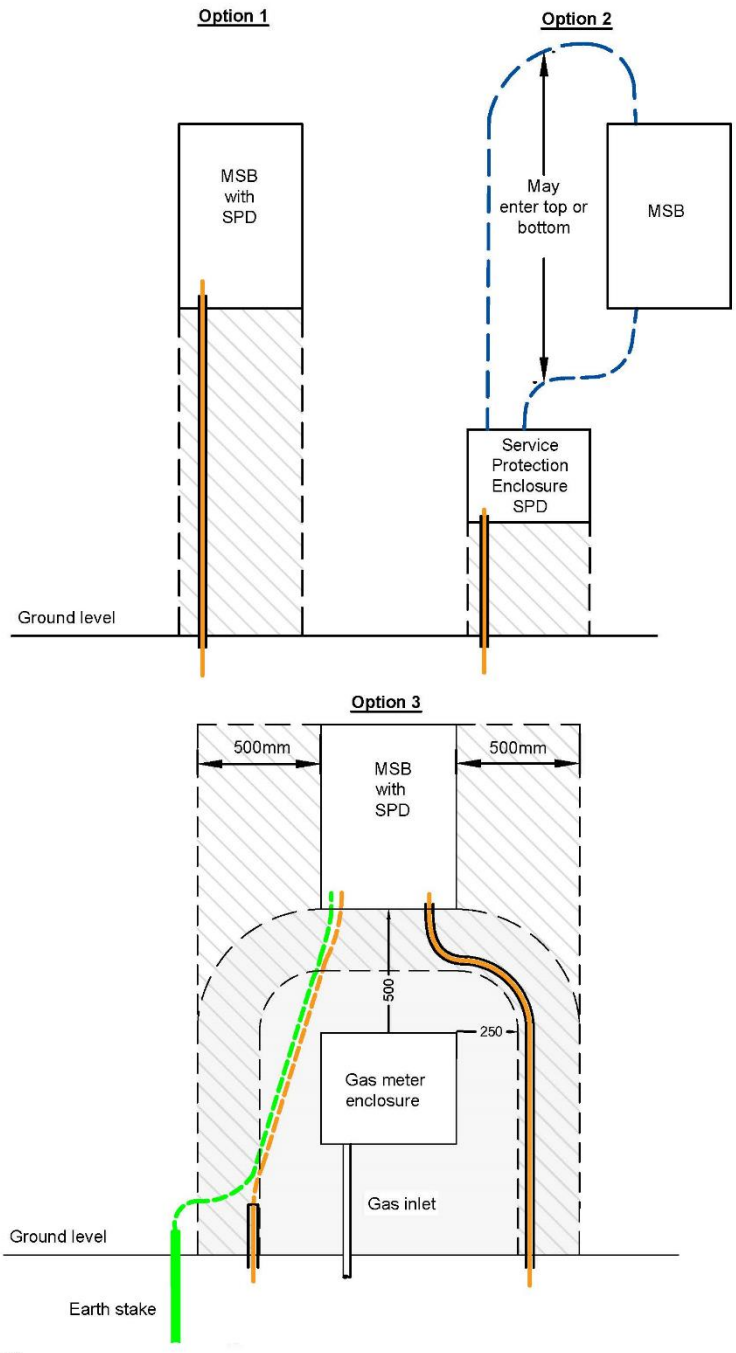
#### *7.5.1.2 Mechanical protection of consumer mains (TIR)*

For consumer mains mechanical protection attached to a SA Power Networks pole refer to (clause 7.6.3).

Mechanical protection at a minimum thickness of 1.6mm galvanised steel shall be installed over all exposed consumer mains HD wiring enclosures Up to a height of 2m. All other situations refer to AS/NZS 3000.

To provide a degree of flexibility, mechanical protection will not be required over HD UV stabilised flexible or corrugated conduit entering the bottom of the MSB.

The HD UV stabilised flexible or corrugated conduit shall not be more than 300mm in length and secured with glands and lock nuts into the MSB.




NOTES

1. Unprotected consumer mains must enter the wall cavity within 500mm of MSB
2. Electrical Ignition sources must be installed outside the gas exclusion zone R500 (ie earth stake)
3. Surface installed consumer mains not allowed to be installed in the gas exclusion zone R250.

- Earth wire
- Unprotected consumer mains (surface installed with HD Conduit example)
- Unprotected consumer mains (wall cavity installed example)
- Protected consumer mains (surface / wall cavity installed)
- Mechanical protection
- Gas Exclusion Zone
- Vertical plane entry zone for unprotected consumer mains

**Figure 11 - Underground unprotected consumer mains entry without and with gas meter box**

### 7.5.2 Size and Length (TIR)

Consumer mains shall be sized to meet the customer's load requirements, and the requirements of AS/NZS 3000. However, the size of consumer mains which can be terminated into the SA Power Networks connection terminals refer Table 9.

The length of the customers consumer mains shall be correctly sized;

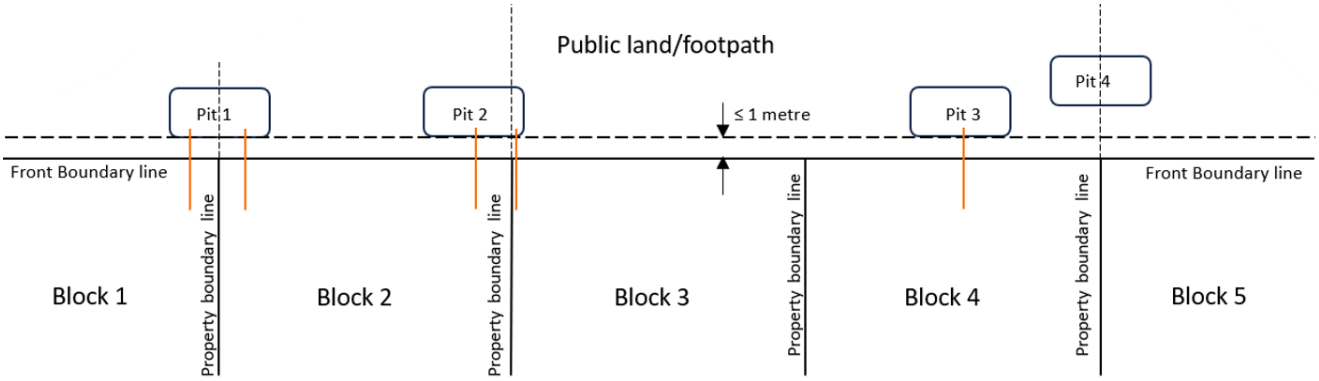
- to operate SPD or customer SPD under short circuit conditions, (protected situations only), and
- to limit the voltage drop on the consumer mains to no greater than 2% of the maximum demand of the installation. (This is from the connection point which shall include both un-protected and protected consumer mains). The rating of the meter isolator/ load control device circuit breaker as per clause 5.13.1 shall be considered the maximum demand for this calculation.

Additional requirements for unprotected consumer mains, (no short circuit protection at the connection point)

- Minimum cable size shall be 16mm$^2$, and
- Cables shall be double insulated, as per AS/NZS 3000 requirements, and
- Cables shall be installed,

For services supplied from SA Power Networks unfused connection points, – only on the customer's private property, and only extending to the SA Power Networks pit installed immediately adjacent the property boundary on road reserve/ public land, refer to

- Figure 12, and
- For service supplied from SA Power Networks padmount transformers and ground level transformers – the total cable route length shall not exceed 10 metres, without prior consultation with SA Power Networks Customer Solutions Manager.




| Pit | Is the pit "immediately adjacent" to: Block 1 | Block 2 | Block 3 | Block 4 | Block 5 | Note |
|---|---|---|---|---|---|---|
| 1 | Yes | Yes | No | No | No | |
| 2 | No | Yes | Yes | No | No | |
| 3 | No | No | No | Yes | No | |
| 4 | No | No | No | No | No | Pit is greater than 1 metre from the front boundary of the block |

**Figure 12 - Understanding immediately adjacent**

### 7.5.3 Identification and labelling

#### *7.5.3.1 Identification (TIR)*

All cables at connection terminals and metering facilities shall be clearly and permanently colour coded to identify each active and neutral conductor.

Sleeving required for identification should be 500mm long from the connection terminals within the connection point or MSB. In situations where the exposed length of the conductor is less than 500mm, sleeving shall be over the entire exposed conductor.

- Neutral Conductor - shall be a black conductor or a conductor with black sleeving.
- Active Conductor - shall be an active colour or a conductor sleeved with an active colour as permitted by AS/NZS 3000.
- Phase Identification - In the case of multiphase supplies, active conductors forming part of consumer mains shall be permanently identified red, white, and blue.

Electrical tape is not an acceptable means of identification.

#### *7.5.3.2 Labelling (TIR)*

Consumer mains labelling general requirements are;

- labels shall meet the requirements of clause 5.17, and
- the labels shall specify the correct street address of the installation it supplies, or for street lighting, the location, direction, and number of lights on the circuit.

Requirements when originating from pit/pillar/transformer;

- shall have labels attached a minimum of 400mm, and maximum of 600mm from the cable ends adjacent to the connection terminals, and
- all conductors shall be labelled including the neutral.

Requirements when originating from over/under services on a pole;

- shall have the top of the mechanical protection at the pole labelled only.

Consumer mains originating from an overhead connection point attached to the same building that the consumer mains supply, do not need to be labelled with the street address at the connection point.

### 7.5.4 Consumer mains on public lands including road reserve (TIR)

Where underground consumer mains are located within public land, the customer should obtain Council, Department of Infrastructure and Transport (DIT) or the relevant Authorities approval prior to the installation of underground electrical cables. SA Power Networks may request confirmation of this approval prior to making the connection.

The consumer mains should be installed on the same side of the road as the customer's installation. The route length of protected consumer mains installed on road reserve shall meet the requirements of Manual 18 and clause 7.5.2.

### 7.5.5 Consumer mains on a third-party property (TIR)

Consumer mains can enter a service pit/pillar on a third party's property in accordance with clause 5.7.

### 7.5.6 Consumer mains installed near gas services (TIR)

Consumer mains can only be installed externally on a building if they are greater than 250mm from the gas mains and/or gas meter box, (refer to Figure 11).

## 7.6 Consumer mains attached to SA Power Networks poles

Customer equipment attached to SA Power Networks poles shall meet the requirements of clause 0 and 7.6.2. In most cases the connection terminals are located between 3.0m and 3.7m above ground level; refer Figure 33. Other specific applications may have service points between 6m and 12m, refer Figure 34.

### 7.6.1 Attachment to SA Power Networks connection point on a pole (TIR)

Connection of conduits and ducting to SA Power Networks connection points shall;

- be UV stabilised flexible or corrugated conduit, and
- be supplied with adaptors that will allow for easy disconnection, and

- be labelled in accordance with clause 7.5.3.2.

Metal and non-flexible enclosures/conduit, sheathing or armouring of the consumer mains shall not be joined rigidly to SA Power Networks connection points.

### 7.6.2 Installation of customer equipment on a pole (TIR)

The customer is responsible for the installation of the consumer mains and associated equipment to maintain a minimum clearance to the overhead mains in accordance with clause 5.10.

Drilling into the concrete of Stobie poles is not permitted. Band strap, cable ties or similar systems are also not allowed.

Fasteners such as self-tapping screws and explosive power tool threaded studs that protrude through the face of the steel shall be treated to ensure no sharp edges.

Cables and equipment shall be installed so they;

- do not pose a risk to public safety, and
- are not susceptible to mechanical damage, and
- do not obscure pole identifications, and
- do not interfere with the operational aspects of the pole, and
- do not compromise the structural integrity of the pole footing, and
- do not restrict the access to fixings of other consumer mains, and
- are installed without interfering with other third-party infrastructure.

The relevant SA Power Networks Customer Solutions Manager will determine under what conditions other equipment may be attached to SA Power Networks poles or structures.

### 7.6.3 Mechanical protection (TIR)

For the purposes of these rules, the minimum requirement for mechanical protection systems attached to SA Power Networks poles:

- Installed on road reserve/public lands shall be a minimum of 3mm galvanised steel covering consumer mains installed in HD conduit.
- Installed on private property shall be a minimum of 1.6mm galvanised steel covering consumer mains installed in HD conduit.

Mechanical protection shall be a minimum height of 2.4m and a maximum height of 2.6m from ground level. The installation shall be in a manner that does not cause a hazard to pedestrians or animals.

Attachment method:

For mechanical protection without welded mounting tabs, saddles or clamps are acceptable methods of attachment. All mechanical protection shall have at least two attachment points using either;

- galvanised steel bolts, or
- explosive power tool (Ramset/Hilti Tool etc.) threaded studs, or
- self-tapping screws, or
- anti-tamper nuts and bolts, or
- screws/bolts suitable for treated pine . (Timber poles only)

The requirement for the use of a standard tool for removal is no longer required.

### 7.6.4 Earthing of mechanical protection (TIR)

The earth bonding of the mechanical protection to steel poles shall be;

- with steel mounting tags or studs welded to the mechanical protection and attached in at least two positions by means of a minimum M8 galvanised steel bolts with nuts, or by explosive power tool M8 threaded stud or M8 threaded studs with tapped holes, or

- by a minimum bonding conductor of 25mm$^2$ attached to both the steel of the pole and mechanical protection by means of at least M8 galvanised steel bolts with nuts, tapped holes or threaded studs.

Note: Self-tapping fixings are not permitted for the earth bonding connection.

All bonding contact surfaces shall be prepared to ensure electrical continuity and protection from corrosion.

### 7.6.5 Timber poles

The consumer mains shall be mechanically protected and earthed as per clause 7.6.3 and clause 7.6.4. SA Power Networks will provide an earth bonding point, as shown in Figure 39.

### 7.6.6 Protecting consumer mains at the base of a SA Power Networks pole (TIR)

Where the consumer mains transitions through a conduit bend to the vertical onto a pole, a polymeric slab shall be installed over the area of reduced cover, as shown in Figure 33.

## 7.7 Consumer mains installed into SA Power Networks pits and pillars (TIR)

Where excavating to a service pit/pillar to install consumer mains the requirements of NICC 404 Working in the Vicinity of SA Power Networks Infrastructure – Network Access Permit Procedure clause 5.10.1 shall be followed. Where the pits have been determined to contain asbestos refer to clause 5.12.

Where consumer mains enter a service pit/pillar, they shall;

- enter through the aperture or ducting/conduit system provided. If no ducting/conduit is available, please consult the SA Power Networks Customer Solutions Manager, and
- only be one cable per phase and neutral, and
- labelled and identified in accordance with clause 7.5.3, and
- have reinforced insulation on the end (electrical tape is not acceptable) to prevent inadvertent contact with live conductors within the service pit/pillar, and
- already be terminated at the switchboard or LOAD end, and
- be a minimum cable tail of 600mm to extend beyond the top of the pit/pillar at the farthest end from the entry point. This length is required for the connection (refer Figure 36 and Figure 37), and
- have a cable gland or non-flammable sealer installed in the conduit to prevent the transmission of liquids, termites and vermin.

Armoured cables, mineral insulated metal-sheathed cables, neutral screened cables and metallic piping shall not enter SA Power Networks service pit/pillar (refer to Clause 7.2.2).

## 7.8 Provisions for un-metered protected sub-mains (TIR)

Un-metered sub-mains supplying a separate group meter position, shall;

- have a lockable circuit breaker at the origin of the un-metered sub mains, and
- meet the same requirements for consumer mains, clause 7.5, and
- meet the sealing requirements clause 5.4, and
- be completely enclosed in conduit or ducting.

Exceptions to the requirements to be completely enclosed in conduit or ducting;

- metal armoured cables, or
- metal sheathed cables, or
- neutral screened cables, or
- other types of cables located in normally inaccessible locations or underground.

The combined voltage drop of the un-metered submains and the consumer mains shall not exceed 2%, as specified in Clause 7.5.2.

Enclosures and links within a MSB or metering facilities that contains un-metered terminations shall have provisions for an electrical industry security seal in accordance with clause 5.4.

## 7.9 Repairs and joints to consumer mains and un-metered sub-mains (TIR)

Joints in un-metered cables shall be made in such a manner to prevent unauthorised access, interference, or diversion of electricity.

Suitable methods include;

- crimp sleeves with heat shrink enclosed in conduit, or
- in accessible areas a junction box capable of being sealed with an electrical industry security seal, or
- in inaccessible areas a junction box with the lid glued shut with screws covered in a hard setting 2-part epoxy compound or similar to prevent removal. Encapsulation in epoxy resin may also be required to protect from moisture ingress depending on where the joint is.

The use of active and neutral links capable of being sealed is an approved method of joining consumer mains within the MSB or metering enclosure.

### 7.9.1 Repairs to consumer mains relating to size and capacity (less than 100A)

Where existing consumer mains are repaired by replacement with larger conductors, to meet modern standards, the work will be considered as a repair and not an upgrade. However, for safety reasons a load limiting device shall be installed in the customer's installation to the existing service capacity.

The load limiting device can be installed either before or after the revenue meter, as shown in Figure 13 and labelled as SAPN LOAD LIMITING DEVICE.

Where increase in authorised service capacity is required, the upgrade of consumer mains and/or load control device shall be through the alteration process.

Note: when changing the size of the consumer mains ensure the earthing requirements are complaint with the current Standards.

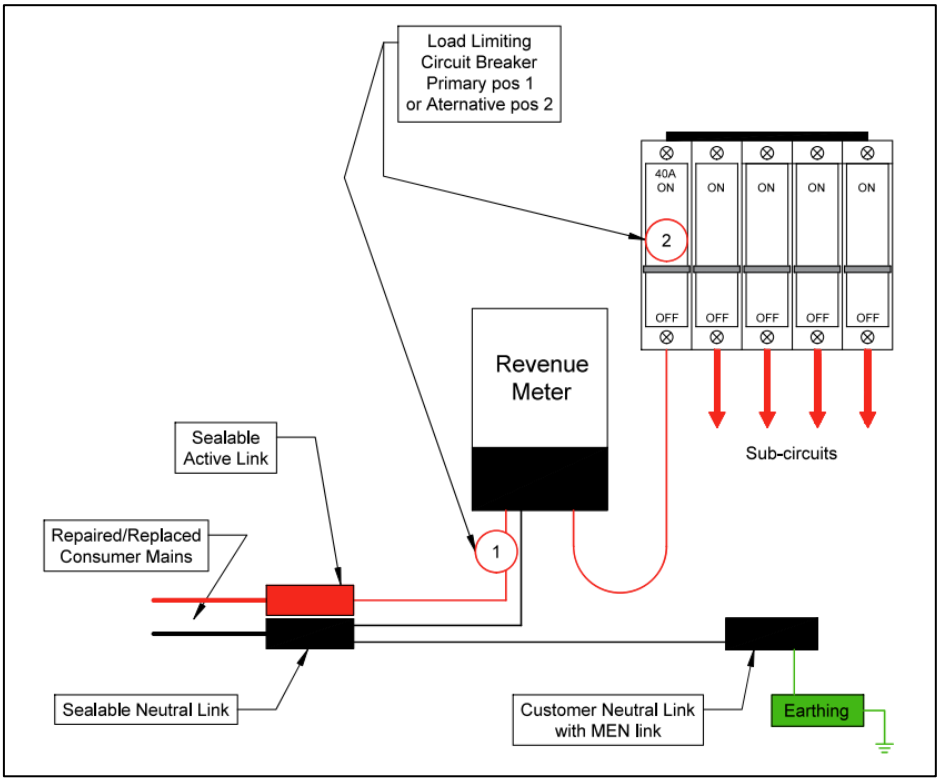



**Figure 13 - Options for installing a load limiting device**

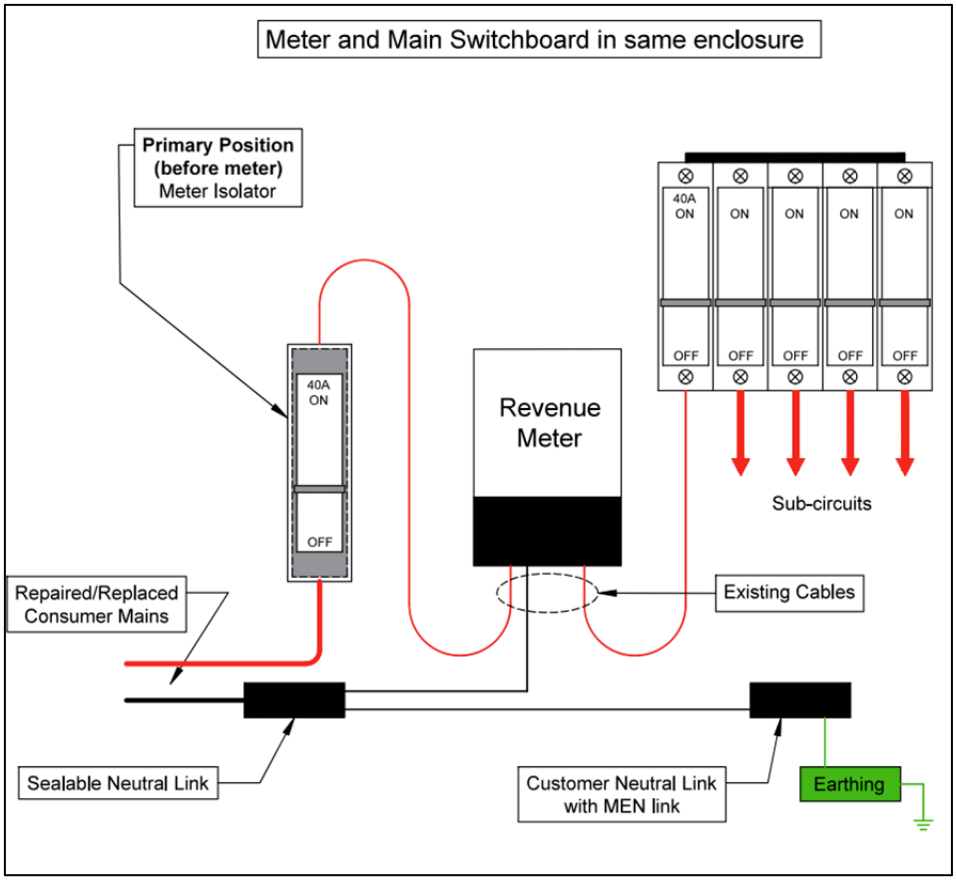



**Figure 14 - Wiring diagram for load limiter installed before the meter**

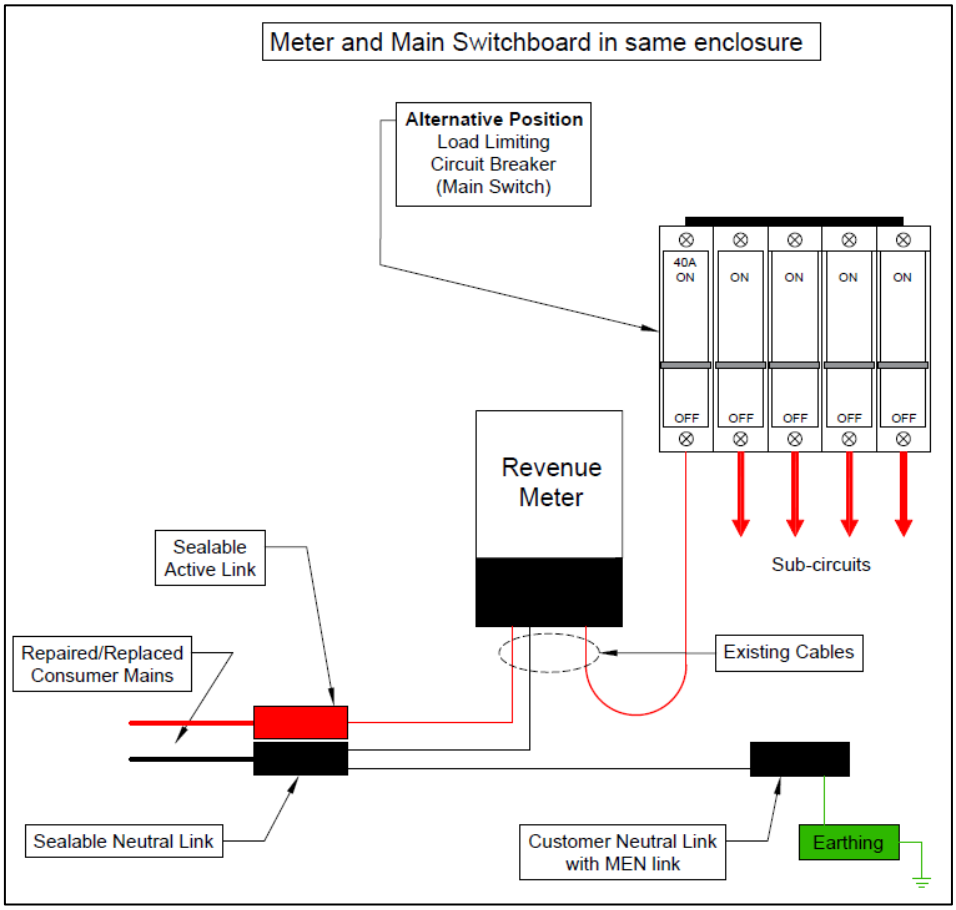



**Figure 15 - Wiring diagram for load limiter installed after the meter**

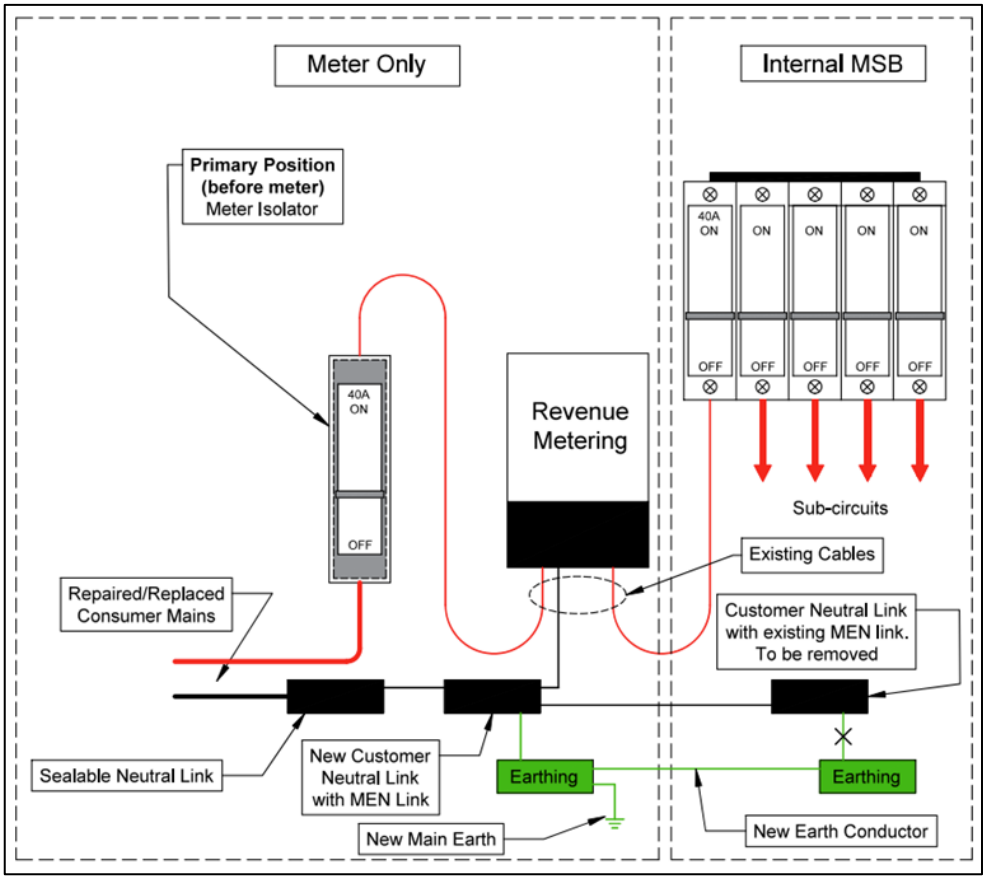



**Figure 16 - Wiring diagram for a load limiter installed in a meter only enclosure**

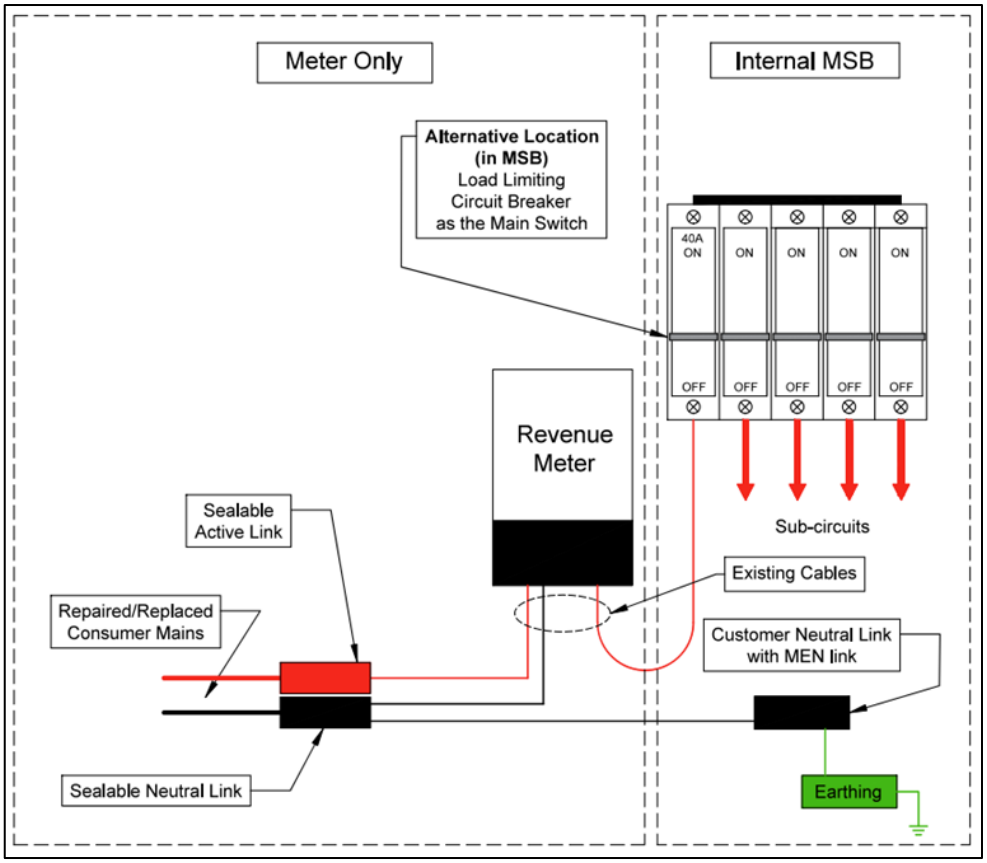



**Figure 17 - Wiring diagram for a load limiter installed in an internal MSB**

## 7.10 Pulling pits in consumer mains and un-metered sub-mains (TIR)

Pulling pits shall be either filled with sand or soil to meet the AS/NZS 3000 requirement for underground wiring systems or secured to prevent un-authorised access.

# 8. Low voltage main switchboards and metering

The purpose of this section is to provide details on low voltage main switchboards (MSBs) and group meter boards. Refer to clause 5.2.7 for metering responsibilities, including customer, retailer, and SA Power Networks. Refer to Section 10 for additional requirements applicable to high voltage metering.

The MSB/group meter board shall allow the Metering Provider to install whole current and CT metering without interfering with the facilities and wiring other than that required to connect, fix and maintain the metering and the associated communication equipment.

## 8.1 Location, access, and clearance requirements

The customer shall provide safe, convenient, and unhindered access and working clearances while ensuring adequate and reasonable protection for the environment installed in. This access is required for revenue metering activities, fault and quality of supply investigations, connection activities and commissioning and on-going maintenance of an NPU.

Special installations may require higher security or other specific requirements. In these cases, discuss with the SA Power Networks Customer Solutions Manager.

The MSB/group meter board shall be;

- located as close as practicable to the public entrance to the property or premises, and
- in an area which is safely accessible, and
- accessible during normal business hours, (unless the MSB includes the SPD refer clause 7.3.5), does not apply to single domestic properties, and
- accessible at any other time agreed by the customer and SA Power Networks or Metering Provider, and
- be located to eliminate the necessity to access secured or quarantine areas, and
- be in an area free from hazards such as chemicals and gases, and
- be protected by location or by barriers from vehicles, and
- have sufficient natural or artificial light for safe egress and operation, and
- where security is required for the switchboard, locked in accordance with clause 5.5, and
- not be located on SA Power Networks easements without approval, and
- not be located within 1.5m of an SA Power Networks stobie pole, which may restrict access to the connection point locations, and
- meet the earthing clearances as specified in clause 5.10.3, and
- installed on the property being supplied.

Where a perimeter fence, gate, roller door or door restricts access to the MSB/group meter board it should be;

- installed in a suitable vandal resistant lockable enclosure which is in an externally accessible part of the fence, which does not protrude outside the property line; or
- be provided with an access door or gate fitted with a lock in accordance with clause 5.5.

Where these requirements cannot be met consult with SA Power Networks Customer Solutions Manager.

In situations where access is not provided refer to clause5.6.

### 8.1.1 MSB/Group meter boards additional requirements for strata and community title installations

The MSB/group meter board shall;

- be in a position to allow all occupants to have right of access to their occupancy's revenue metering and circuit protection equipment, as per the Community Title Act 1996 and the Strata Title Act 1988, and

- the door(s) of rooms and enclosures housing revenue metering equipment shall be labelled 'Electricity Meters'. If the door is to be locked, it shall be locked in accordance with clause 5.5. For access requirements refer to clause 5.6.

### 8.1.2 Egress path (TIR)

In a single domestic installation, egress to the MSB of at least 600mm wide and 2m high shall be provided in at least one direction. If the egress path is via the MSB door side, the door shall be easily removable or be able to be secured in the fully open position (180°). For non-domestic and multiple installations, and installations with NPUs, the above applies but the egress shall be at least 900mm wide.

MSB/group meter boards and NPUs mounted on an elevated platform of any height, shall have barriers installed to prevent falls, and be accessed via stairs. Stairs shall be installed to comply with the National Construction Code (NBC).

The use of vertical ladders as a principal means of egress will not be accepted.

### 8.1.3 Single domestic installations clearance for a MSB (TIR)

**A minimum horizontal clearance of not less than 600mm shall be provided in front of the MSB as shown in the** Figure 18.

A minimum vertical clearance of 2m from ground level shall be maintained in this clearance zone.

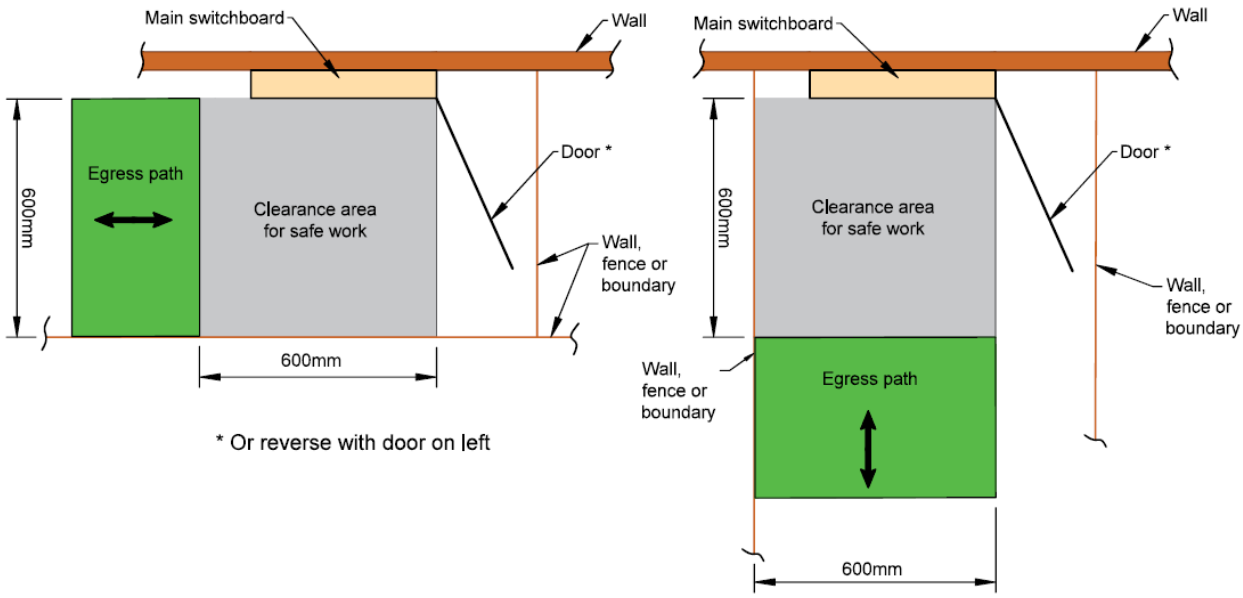



**Figure 18 – MSB clearances and egress paths for single domestic installations**

### 8.1.4 Non-domestic and multiple installation clearance for MSB/group meter board (TIR)

A minimum horizontal clearance of 600mm, from any part of the MSB/group meter board, including the doors, in any open position, shall be maintained as shown in the Figure 19. For MSB/group meter boards with removable lift off doors a minimum clearance of 1000mm shall be maintained from the MSB/group meter board.

A minimum vertical clearance of 2m from ground level shall be maintained in this clearance zone.

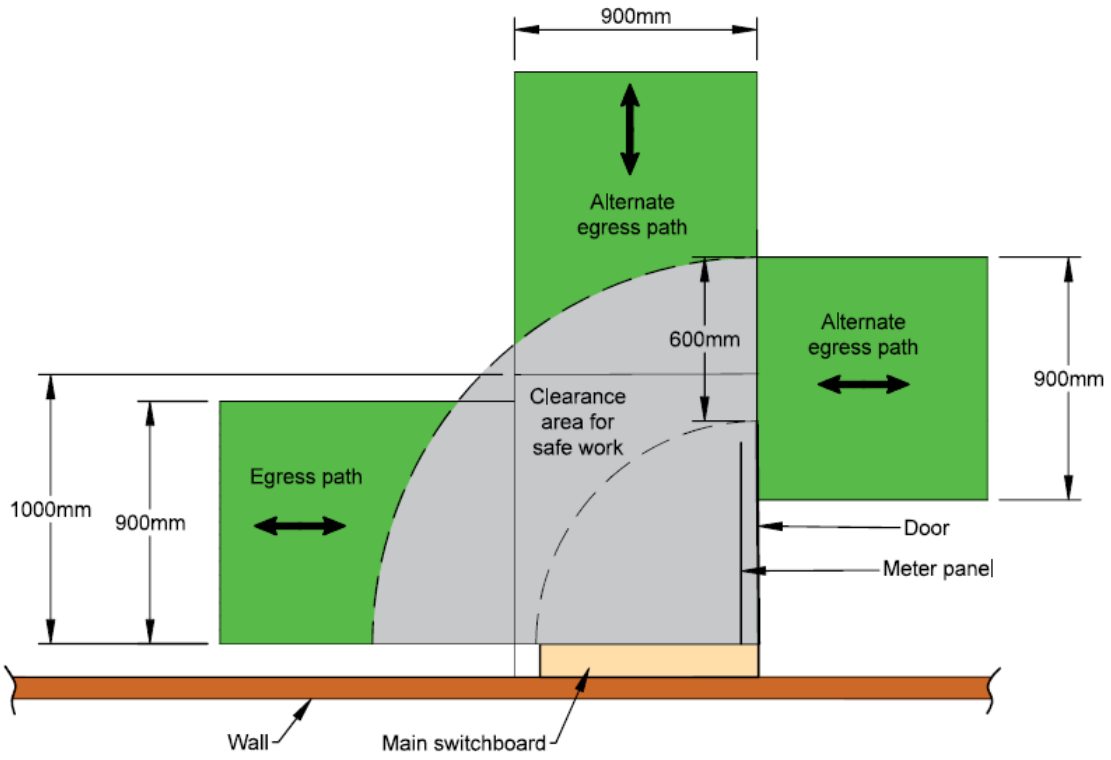



**Figure 19 – MSB/group meter board clearances and egress paths for non-domestic and multiple installations**

### 8.1.5 MSB/group meter board and metering panel mounting height (TIR)

For a single domestic application, the top of the MSB should not be mounted more than 2.0m in height and the bottom not less than 0.5m from the final standing surface level, i.e. ground level, pavement, decking, balcony etc.

For non-domestic and multiple applications, the metering panel height within the MSB/group meter board should not be mounted more than 2.0m in height and the bottom not less than 0.5m from the final standing surface level.

In all cases the main switch, panel and meter isolators, metering links and MEN link should not be designed to be at a height greater than 2.0m from the final standing surface level and meet the requirements of AS/NZS 3000.

## 8.2 Clearance between low voltage switchboards and gas enclosures

### 8.2.1 Gas meter enclosure clearances (TIR)

APA Networks National Standard for domestic gas meter installations requires that there is 500mm clearance between gas and electric meter boxes, gas regulator/gas boxes, main earth electrodes, communications cable terminations or any other source of ignition (refer Figure 11).

For enquiries regarding specific gas meter box clearances please call APA Group

Phone: 1300 001 001

Exception:

For existing switchboards adjacent to existing gas meter enclosures, an alteration or upgrade of the installation including replacement of the switchboard or consumer mains shall not impose the requirements of gas enclosure clearances provided the installation complied with the requirements of the original installation.

## 8.3 Suitable locations for MSB/group meter boards

The figures below indicate suitable metering positions. These locations may not all be suitable when considering the additional requirements for the SPD if installed in the MSB (refer to clause 7.3.5).

### 8.3.1 Single domestic

Single domestic installation, low voltage switchboard suitable locations are shown in Figure 20and Figure 21.

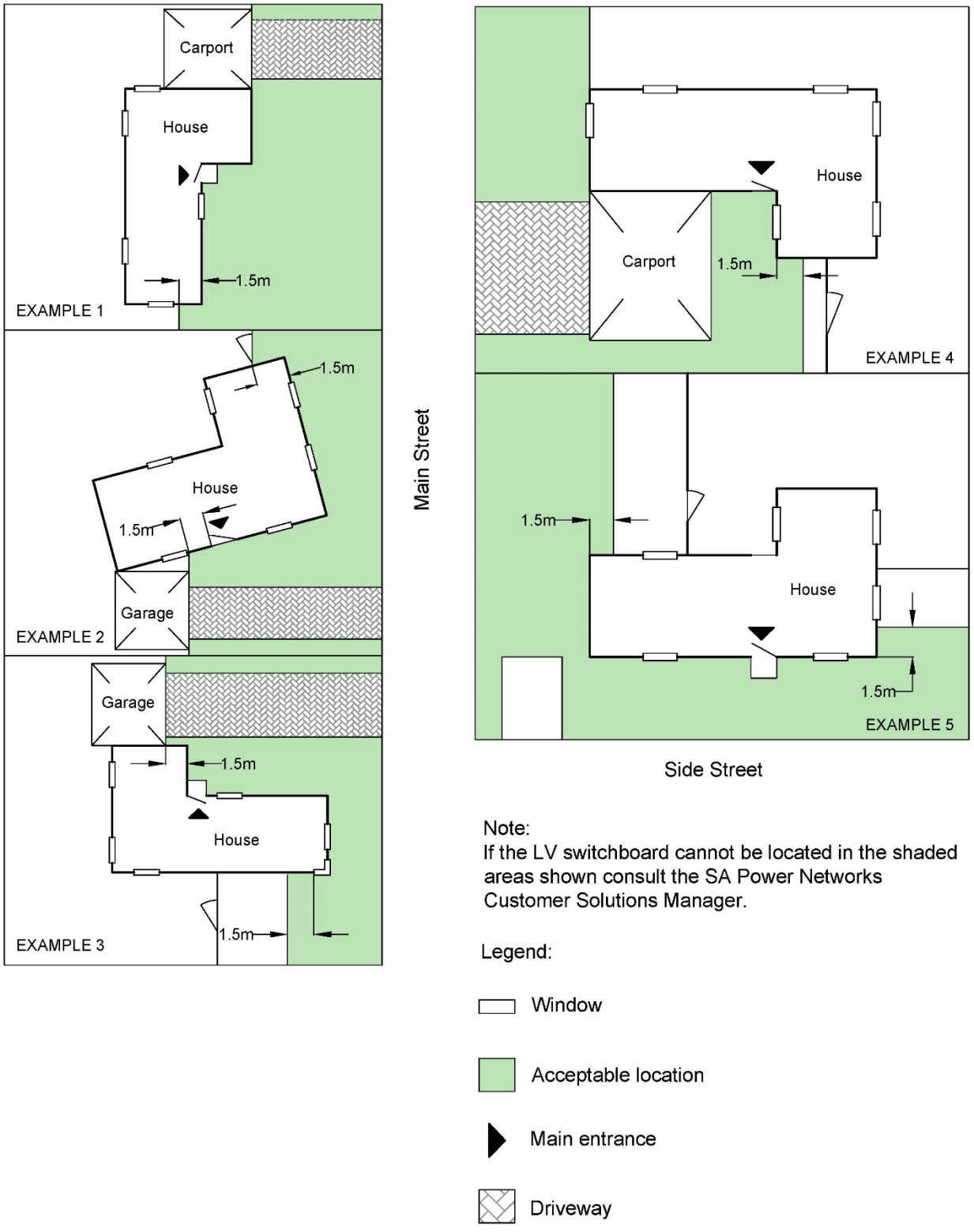



**Figure 20 - Suitable MSB locations for single domestic installation**

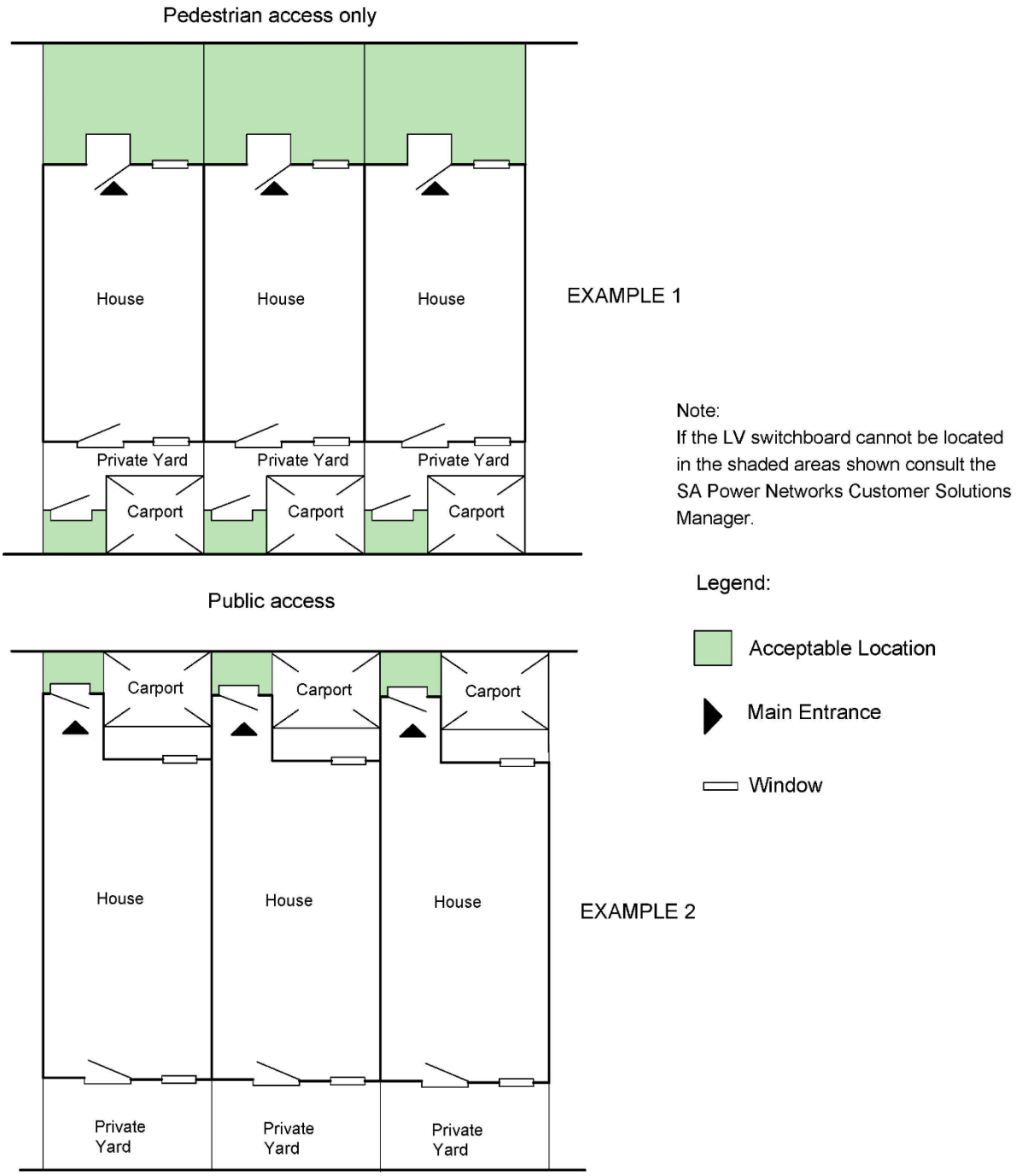



**Figure 21 - Suitable MSB locations for single high density domestic installations**

### 8.3.2 Single non-domestic installations

Single non-domestic, including commercial, industrial and primary production installations, MSB/group meter board suitable locations are shown in Figure 22.

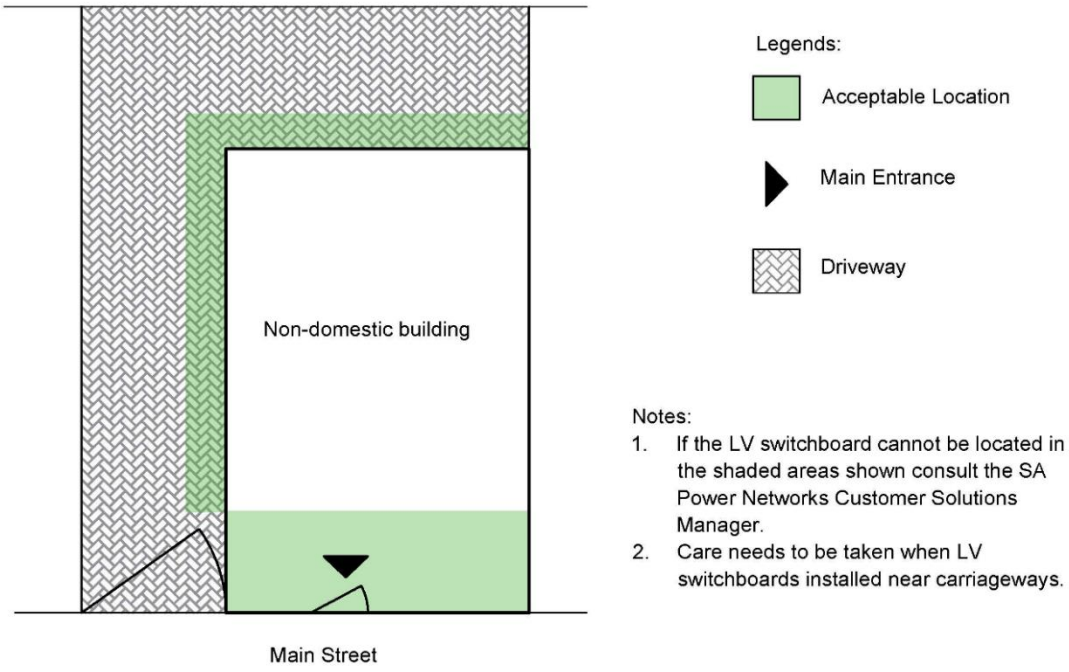



**Figure 22 - Suitable MSB/group meter board locations for single non-domestic installation**

### 8.3.3 Non-domestic and multiple installations

Non-domestic and multiple installations, MSB/group meter board suitable locations are shown in Figure 23.

Where the supply is from a distribution transformer installed inside the building in accordance with TS 108, the main switchboard should be in a room immediately adjacent to, or directly above or below the transformer room and accessible from the distribution transformer room.

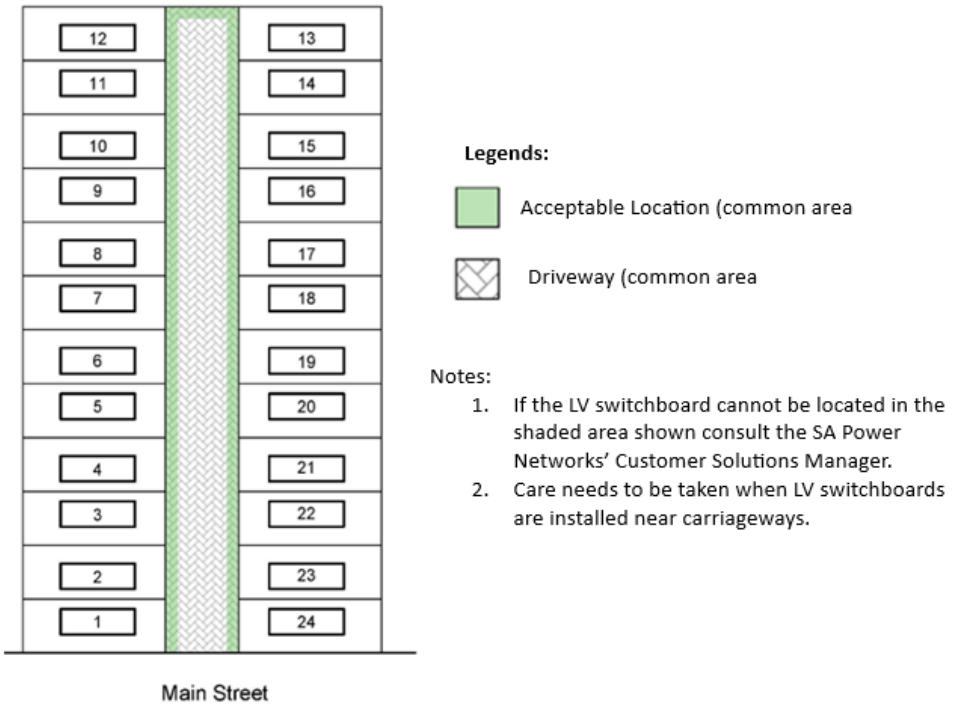



**Figure 23 – Suitable MSB/group meter positions for domestic and non-domestic installations**

### 8.3.4 Combined domestic and non-domestic installations

Where the installation is used for both domestic and non-domestic use, the respective portions of the installation need to be metered separately (refer clause 5.2.7.2).

### 8.3.5 Free standing MSB/group meter board installations

For free standing MSB applications, the MSB shall be;

- attached to at least 2 x 50mm x 50mm RHS galvanised steel posts, with caps and a minimum wall thickness of 2.0mm, concreted at least 600mm into the ground, or
- attached to a customer private pole, as per clause 7.2.7.1, or
- mounted on a concrete pad, with suitable structural integrity to withstand the weight of the MSB and the loading/forces applied by wind.

## 8.4 Metering equipment (TIR)

### 8.4.1 General (TIR)

Metering equipment shall not be exposed to weather, moisture, dust, vibration or mechanical damage and installed in a location which is not subject to varying high intensity magnetic fields (refer to AS 62052.21 and AS 62052.22) that may affect it.

Metering equipment shall be mounted on a panel;

- within the customer's switchboard/group meter board, or
- on a metering hinged switchboard frame.

For complex metering arrangements please contact the relevant Metering Provider.

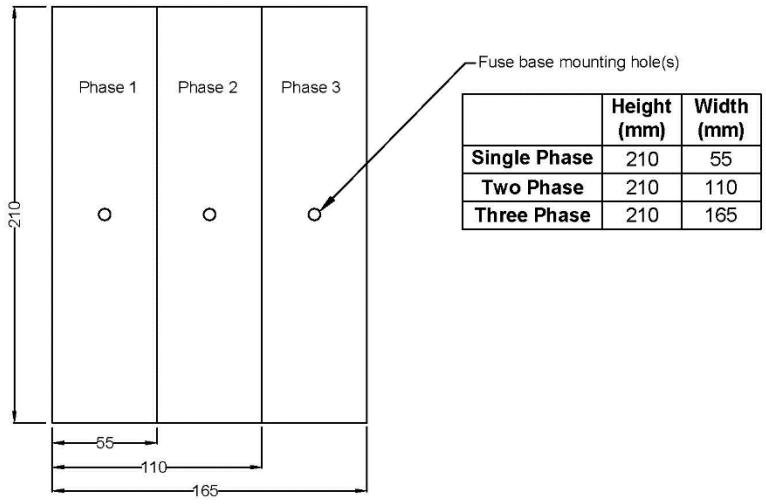
All metering installations shall comply with AS/NZS 3000, the relevant Acts, Regulations, NER, these Rules and be suitable for the service and environmental conditions.

### 8.4.2 Meter panels (TIR)

#### *8.4.2.1 Meter panel size (TIR)*

Meter panel(s) shall be provided with adequate space for the installation of revenue metering (considering the size of all Retailer's meters available in industry), metering communication equipment, panel and meter isolators (refer clause 7.4.1, 7.4.1.2 and 7.4.2) if appropriate and SA Power Networks SPD if required.

The customer may be requested to provide suitable pre-drilled meter panel(s) for fixing of metering equipment and SPD, where required (refer Figure 24).




| | Height (mm) | Width (mm) |
|---|---|---|
| Single Phase | 210 | 55 |
| Two Phase | 210 | 110 |
| Three Phase | 210 | 165 |

**Figure 24 - Meter panel SPD space allocation 100A and below**

#### *8.4.2.2 Meter panel materials (TIR)*

Meter panel(s) shall be constructed of a non-corroding insulating material;

- as per AS/NZS 3000, and
- suitable for environment, including exposure to ultraviolet light where exposed to daylight, and
- will maintain structural integrity.

#### *8.4.2.3 Meter panel fixing arrangements (TIR)*

The meter panel shall be;

- capable of being opened to an angle not less than 60 degrees from the closed position with all metering equipment installed, and
- equipped with hinges of adequate strength mounted on one vertical edge of the panel, and
- of a double off-set type for meter panels installed within enclosures, and
- secured in the closed position by a suitable fastener or fasteners which requires the use of a tool to release.

#### *8.4.2.4 Meter panel wiring (TIR)*

Meter panel wiring shall be wired in accordance with Metering Provider specifications and

AS/NZS 3000. Where other wiring passes behind the meter panel, it shall be located and secured in a manner which maintains the required clear metering panel space both front and rear (refer clause 8.4.5.1).

Where an existing meter box is located on a SA Power Networks high voltage pole, all wiring within the meter box must be maintained as double insulated.

### 8.4.3 Meter panel labelling (TIR)

All labels shall be in accordance with clauses 5.17, 8.4.3.1 and 8.4.3.2, and shall remain clearly visible after the installation of all equipment. The ongoing maintenance and correctness of these labels is the customer's responsibility.

#### *8.4.3.1 Single occupancy (TIR)*

Single occupancy meter panels shall have a label at the top of the meter panel displaying the correct street address of the installation.

#### *8.4.3.2 Multiple occupancy (TIR)*

Each multiple occupancy meter panel shall be labelled with the correct street address for each occupancy, and to indicate the relationship of meters, meter isolators, fuses, and other equipment.

A corresponding marking shall also be made on the conductors for each occupancy at the meter panel location to enable the correct identification of conductors.

The door of the MSB for the installation shall have a permanently marked diagram clearly showing the location of all sub-boards and the routes of all submains throughout the installation.

### 8.4.4 Meter Panel repairs, modifications, and replacement requirements (TIR)

Where an existing timber, Masonite or asbestos meter panel exists, it shall be replaced with a hinged insulated panel with appropriate clearances in accordance with these Rules.

An exception is applied for cases where a meter change occurs for additional tariff for Inverter Energy Systems, works initiated by a Meter Coordinator including the installation of a meter isolator (refer clause 7.4.2.4), or meter churn works for existing Masonite, timber, or asbestos meter panels, if they are in good serviceable condition. Refer clause 5.12 for further guidance regarding asbestos. In these scenarios a non-hinged panel can be maintained.

### 8.4.5 Meter enclosures and hinged switchboard frames (TIR)

Meter enclosures and hinged switchboard frames shall be selected to suit the application and environment it is to be installed in.

#### *8.4.5.1 General requirements (TIR)*

Shall be constructed;

- to accommodate a meter panel in accordance with these Rules, and
- have sufficient stability and strength to withstand distortion and contain any energy which might be caused in both normal and fault conditions, and
- sufficient strength to support the meter panel, and
- access doors if required shall have the hinges mounted on the vertical side or sliding access doors shall move horizontally, and
- with means for securing the meter panel shall be readily accessible using a tool.

Internal panel clearances;

- a minimum of 175 mm in front of the meter panel to the inner face of the door or any internal projection where the meter panel is enclosed, and
- a minimum of 75 mm behind the meter panel.

#### *8.4.5.2 Materials (TIR)*

Meter enclosures and hinged switchboard frames shall be constructed of;

- sheet steel is not less than 1.2 mm thick unless an acceptable strength is achieved with a thinner sheet which is reinforced by the manufacturing process, design or other material, and
- hot dipped galvanised with a coating weight of Z275 in accordance with AS 1397, or
- where painted, pre-treated in accordance with the paint supplier's recommendation and coated with a material such as power coating or baked enamel giving a hard, durable finish with a service life of not less than 20 years, and
- with characteristics equal to or better than steel where materials other than steel are used.

### 8.4.6 Equipment installed on meter panel or within enclosures (TIR)

Equipment installed on meter panels shall be mounted with minimum 20mm clearance to the edge, fixings or hinges or requirements of the Meter Provider. Equipment should be installed on the panel in a manner which enables connection, disconnection and reconnection of all wiring and access to all terminals without dismantling other equipment or creating a need to remove covers from equipment other than that being worked on.

Equipment shall be securely fixed to meter panels. Fixing screws and fasteners shall not protrude through the rear of the panel in a manner that could damage conductors or create un-earthed exposed metal.

Customer's equipment installed on the metering panel shall not compromise or affect the integrity, accuracy, or performance of the metering equipment.

### 8.4.7 Low voltage CT metering

#### *8.4.7.1 Metering enclosure internal panel clearances*

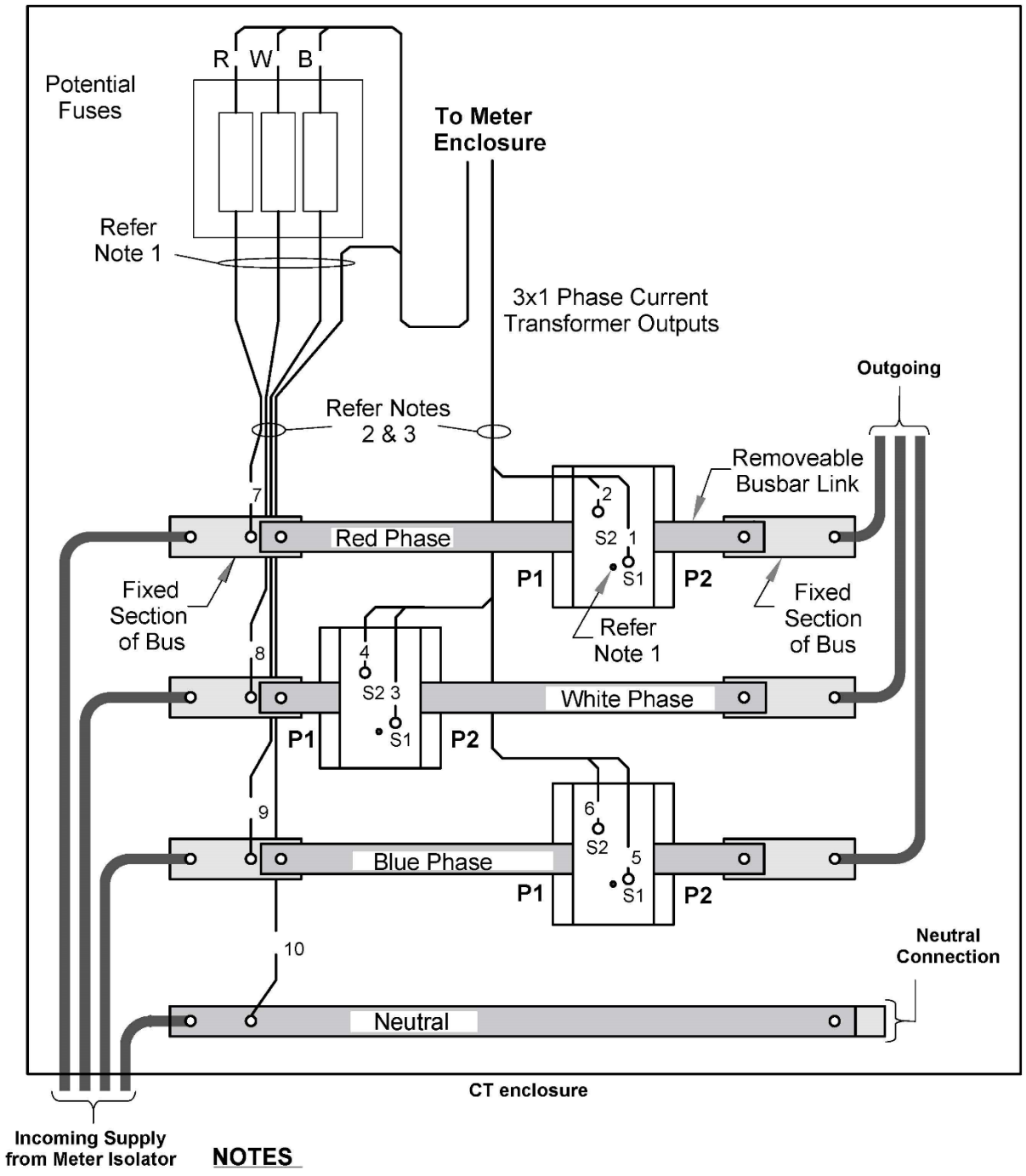
CT metering shall have a set of CTs in a separate enclosure or compartment with a hinged door which is separate from the meter isolator and all other wiring. The customer shall supply and install the CTs and associated wiring loom and provide adequate space, housing and facilities for the current transformers and metering equipment as detailed in these Rules.

#### *8.4.7.2 CT Wiring*

The meter panel shall be prepared with the CT metering wiring loom installed in corrugated conduit, terminated into the CT test block and wired in preparation for a Metering Provider to suitably install the appropriate metering. The CT Chamber shall only contain components as shown in Figure 25, with single incoming connection from the meter isolator and single outgoing connection to the next point of isolation.

#### *8.4.7.3 Testing*

NATA approved test results are to be provided for the revenue metering CTs.




**NOTES**

1. Current Transformer Polarity
   P1 & P2 − Bar Primary Terminals
   S1 & S2 − Secondary Winding Terminals
   S1 − Indicates the Start connection of the Secondary wiring.

2. Wiring in conduit

3. All Single Insulated wiring not protected by conduit must be sleeved.

**Figure 25 – Typical CT and busbar metering wiring diagram**

## 8.5 Existing MSB/metering arrangements on poles (excluding metered mains)

Any alterations/upgrades of MSB/meter enclosure shall require the MSB/meter enclosure to be relocated off the SA Power Networks pole.

For repairs to existing MSB/meter enclosures on SA Power Networks poles, these can be reinstalled on the same pole. Repairs are defined in clause 5.15.2.

Metering Providers are permitted to perform a meter change for maintenance or add a PV tariff only, in a one for one exchange. Meter Isolators and metering equipment on 460V systems shall be rated accordingly.

### 8.5.1 Existing MSB/Meter enclosures on high voltage poles

Locations where the existing metering enclosure is mounted on a high voltage distribution transformer pole, including SWER poles, specific installation requirements apply. This is due to the separate earthing systems used for the pole, both high voltage and low voltage. These earths may be physically and electrically separate and should have no interconnection other than through the general ground.

There are legacy meter boxes on poles that remain in service. These may be part of a metered mains installation or a hybrid/non-standard installation. The two main configurations were;

1. the meter box was bolted to the steel of the pole but not earthed (other than via the pole earth) and all the wiring within the meter box was double insulated, or
2. the meter box was supported off the pole by either insulators or timber supports and was provided with an independent (customer) main earth and customers switchgear.

The requirements below refer to the first configuration (meter box mounted directly in electrical contact with the pole). In the second case refer to SA Power Networks Customer Solutions Manager.

Where the meter box is mounted directly in electrical contact with the pole then all the wiring within the enclosure shall be double insulated.

At times, improper modifications may have been made to some of these installations including conversion from non-switchboard, to switchboard, additional circuits, or changes to the meter wiring, where many of the changes have been non-compliant. When encountered, this may result in supply being disconnected for safety or significant rectification works.

If an installation has prior modifications where the separation of the earthing or double insulation has not been maintained, we recommend that the safety and suitability of the installation be carefully assessed before proceeding. Refer to the relevant SA Power Networks Customer Solutions Manager.

Metering Providers shall ensure they maintain double insulation for all wiring in these cases, along with maintaining existing phasing and load balance.

All signage on high voltage and transformer poles shall not be interfered with and the signage directions followed.

### 8.5.2 Meter enclosures containing service fuses on asbestos panels (TIR)

In some areas such as the greater Elizabeth Area, the meter enclosure may contain a timber meter panel with service fuses in the lower section on an asbestos panel.

These shall not be converted into main switchboards by adding a meter isolator.

Only where a Metering Provider requires the old timber panel to be replaced, this shall be with a modern insulated hinged panel attached to the original panel frame and using appropriate asbestos management procedures.

## 8.6 Main switchboard supported in a permanent location for connection prior to building completion(TIR)

A MSB in a domestic application of less than 100A shall be located and secured as close as practical to its permanent position, refer Figure 26, Figure 27 and Figure 28.

As these locations are building sites, additional controls are required to help prevent injury to persons or damage to the MSB, consumer mains or earthing systems during construction. These installations shall

- Meet the requirements of these Rules, AS/NZS 3000 and AS/NZS 3012, and
- the IP rating of the MSB is appropriate for the location, and
- the MSB shall be fixed to the permanent framing, support or walling of the building, and
- shall only be connected to a protected connection point, and
- shall only be supplied from underground consumer mains only, and
- the consumer mains shall be installed in HD conduit along the entire length, and
- the consumer mains entering the MSB shall be installed in either a HD rigid and/or flexible / corrugated conduit properly secured to the MSB with adaptor/gland and locknut, and
- exposed HD conduit shall have additional protection, as per the note* and Figure 27and Figure 28 , and
- HD conduit shall be protected from UV exposure, and
- the main earth conductor shall be installed in conduit along its entire length and also have the same additional protection* as the consumer mains.

The MSB shall be properly installed in its permanent position within 12 months.

Notes:

* The additional protection for external walls can be timber ply, cement sheet, builders wrap or other non-conductive ridged weather-proof material. For internal walls, the additional protection can be the same as external walls or dry wall (Gyprock).

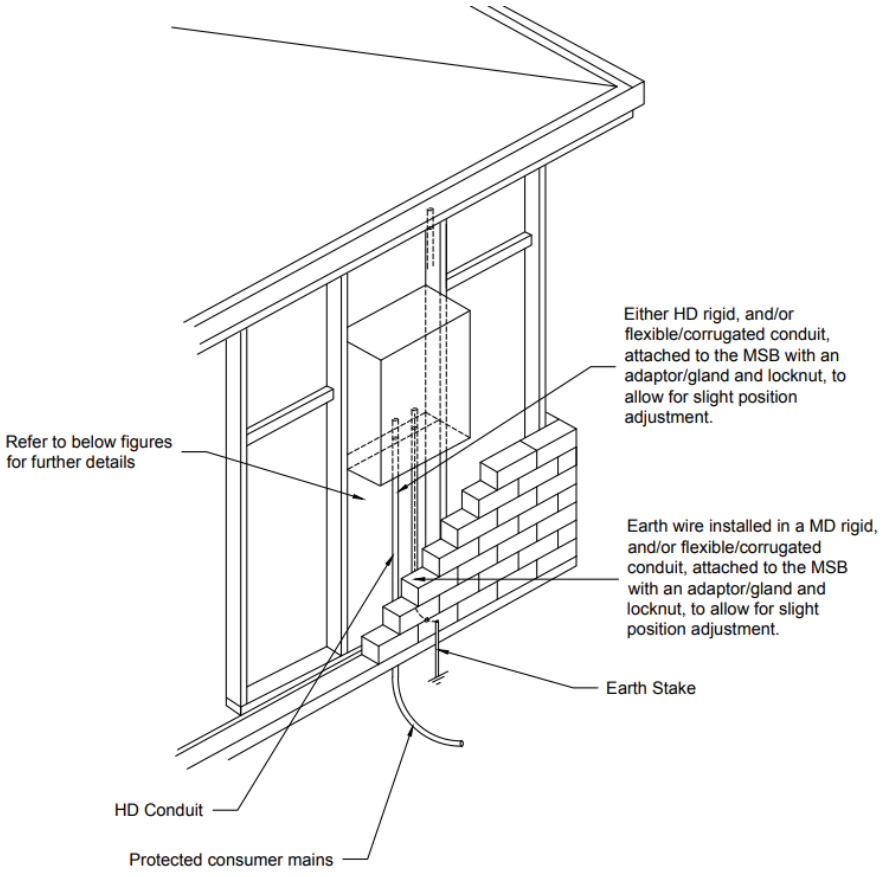
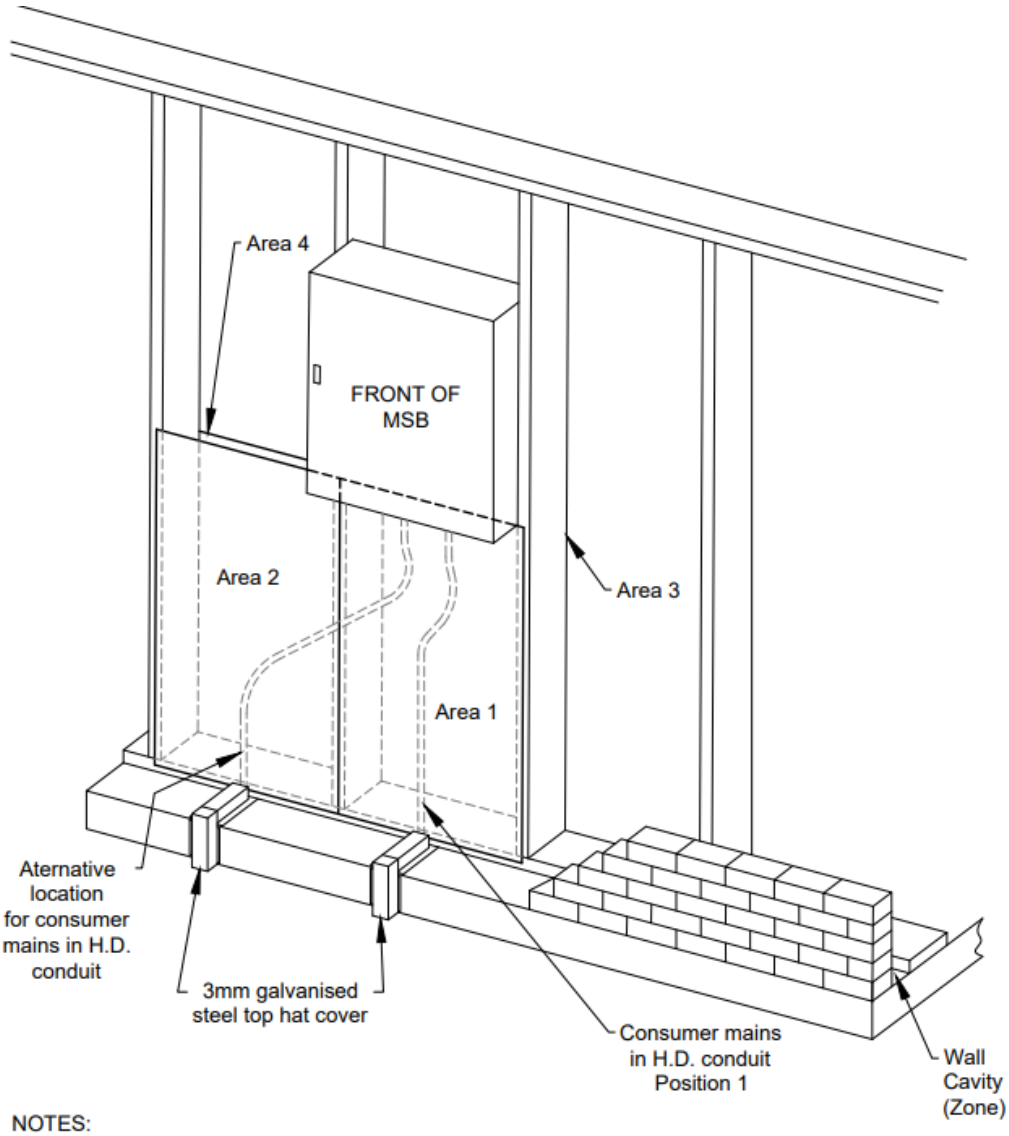


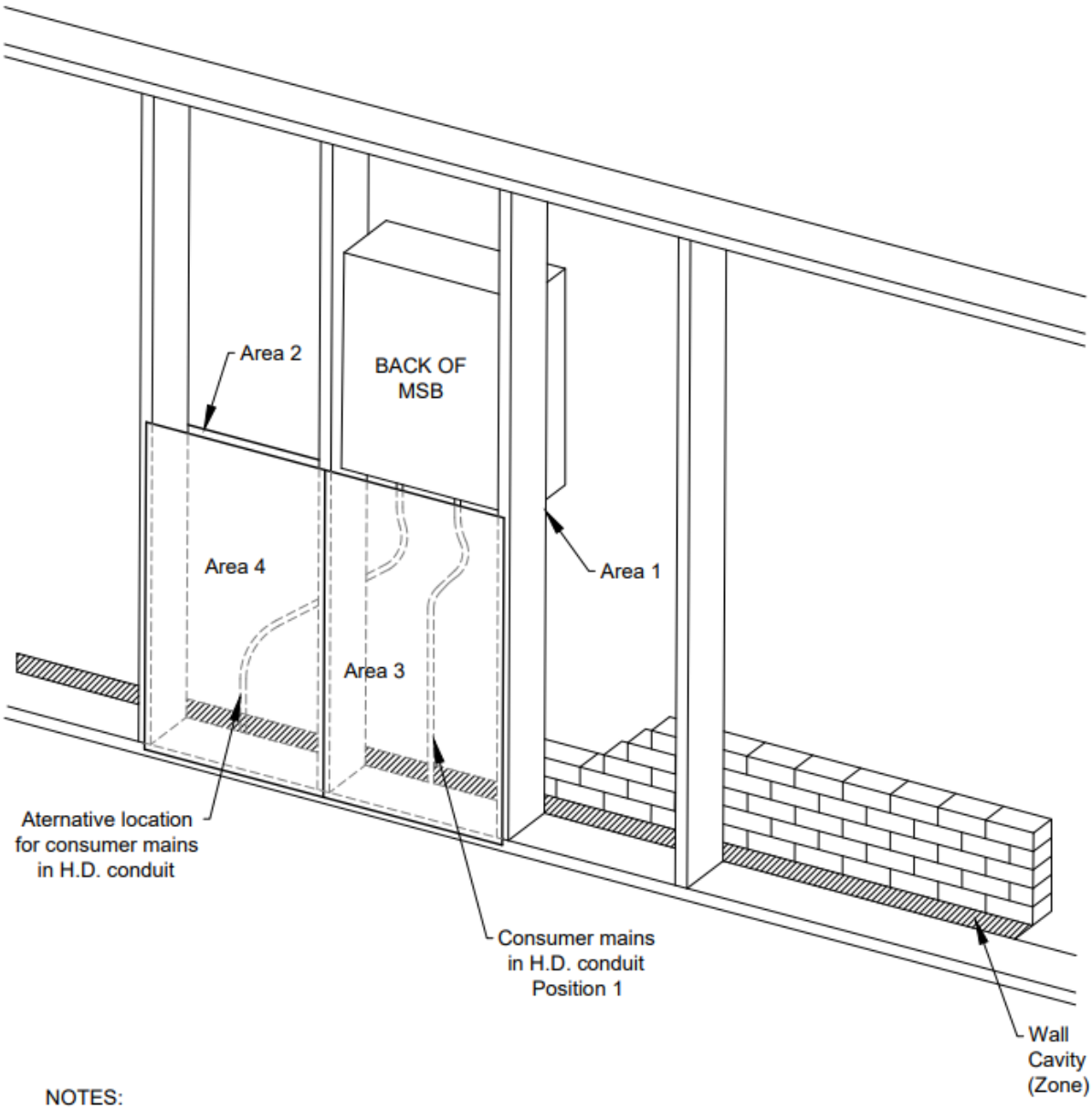

**Figure 26 - MSB supported in a permanent location for building construction**




NOTES:

1. Consumer mains installed in Position 1 shall have protection installed over Areas 1 & 3.
2. Consumer mains installed in the alternative location shall have protection installed over Areas 1, 2, 3 & 4.
3. All protection shall be properly secured on all sides.
4. The alternative locations may be on either side of the MSB.
5. The same protection arrangements shall apply to the main earth conductor.

**Figure 27 - Additional protection – External View**




NOTES:

1. Consumer mains installed in Position 1 shall have protection installed over Areas 3 & 1.
2. Consumer mains installed in the alternative location shall have protection installed over Areas 1, 2, 3 & 4.
3. All protection shall be properly secured on all sides.
4. The alternative locations may be on either side of the MSB.
5. The same protection arrangements shall apply to the main earth conductor.

**Figure 28 - Additional protection – Internal View**

# 9. Distributed Energy Resources (DER)

## 9.1 Introduction

Installers of embedded generation need to be suitably licensed and comply with these Rules and our Technical Standards.

### 9.1.1 Location, access, and clearance requirements of Network Protection Units

The customer shall provide safe, convenient, and unhindered access for the Network Protection Unit (NPU) as specified in Clause 8.1 and 8.1.2

## 9.2 Generating systems connected to the distribution network

No generating system, of any kind, is to be connected to the distribution network without SA Power Networks approval and a connection agreement exists between the customer and SA Power Networks for that generating unit.

SA Power Networks categorises Embedded Generation into the following categories, SEG – Small Embedded Generation, MEG – Medium Embedded Generation and LEG – Large Embedded Generation.

SA Power Networks' website has details on the application process:
https://www.sapowernetworks.com.au/connections/solar-and-other-generators/

### 9.2.1 Disconnection of DER (TIR)

SA Power Networks may facilitate the disconnection of a DER from the distribution network if;

- the equipment compromises the safety of SA Power Networks employees or the safety of others, or
- will cause undue interference with the network or adversely affect its integrity (refer clause 5.2.5), or
- requested by the Office of the Technical Regulator, or
- requested by ESCOSA for breach of the generation licence, or
- a breach of the contractual agreement with SA Power Networks, or
- any other circumstances for disconnection specified in your agreement with SA Power Networks or under the Terms and Conditions. (refer clauses 5.2.1).

### 9.2.2 Technical Standards (TIR)

Any generating system that is to be connected to the distribution network shall comply with the requirements outlined in these Rules and SA Power Networks' Technical Standards listed in table 10.

| Generation connection type | Connection voltage | Technology | Total nameplate rating | Relevant Technical Standard |
|---|---|---|---|---|
| Small EG Connection | up to 1kV | Inverter (including ESS) | ≤ 30 kVA | TS129 |
| Low voltage EG connection | up to 1kV | Inverter (Including ESS) & Non-inverter | > 30kVA to ≤ 1.5MVA | TS132 |
| High voltage EG connection | 1kV to 66kV | Any | Any size | TS133 |
| Communication Systems (inc. SCADA) for EG | All | NA | NA | TS134 |

**Table 10 - Generation connection type relevant Technical Standards**

### 9.2.3 Alterations to existing installations (TIR)

Embedded generation installation alterations are described below;

- alteration or modification of an embedded generation system, and/or
- increased output or capacity, and/or
- configuration modification, and/or
- component upgrade (this may include firmware and software upgrades), and/or
- operational modification, control system and/or philosophy.

shall first be approved by SA Power Networks before the proposed alterations are implemented.

### 9.2.4 Repairs to existing embedded generation installations (TIR)

Embedded generation component replacements shall first be approved by SA Power Networks before the proposed repairs are implemented (refer to relevant Technical Standards, clause 9.2.2).

### 9.2.5 Testing, commissioning, and ongoing compliance (TIR)

All DER installations require testing, commissioning, and maintenance as per the Technical Standards and these Rules.

### 9.2.6 Backup energy systems

Where the installation has a soft loading transfer switch (SLTS), which can synchronise between the distribution network supply and the backup energy source, refer to TS132 and TS133 (clause 9.2.2).

### 9.2.7 Closed transition transfer switch (CTTS) (TIR)

For installations where an AS/NZS 3010 compliant backup energy source is connected to operate only in the event of a loss of distribution network supply, a closed transition transfer switch may be used to transfer supply from the network connection to those back-up generators and vice-versa upon restoration of distribution network supply.

The transfer switch shall be a proprietary device, provided, tested and certified as a packaged unit by an industry recognised manufacturer. The auto changeover shall not be assembled from individual components within the switchboard.

The maximum parallel time (transfer time) permitted is 100ms.

The transfer switch shall be backed up with a 1 second delay backup timer which will operate to disconnect the generating system if the transfer has not been successfully completed within this time.

This equipment shall not cause interference to the quality of supply, refer clause 6.2 and 10.3.

The arrangement shall be such that the metering, distribution network and service equipment cannot be energised in any form from the back up source of supply.

A prominent label (refer clause 5.17) shall be fixed at the consumer terminals, the main switchboard, and any points of control to show that such facilities are installed.

### 9.2.8 Energy Storage Systems

Energy Storage Systems (ESS), such as batteries, shall be installed in accordance with the requirements in the appropriate Technical Standards (refer to clause 9.2.2) for the connection type, as well as the relevant Australian Standards.

### 9.2.9 Virtual Power Plant (VPP)(TIR)

VPPs are where an aggregator controls multiple domestic or non-domestic ESSs to charge and discharge for market activities and in some instances network support.

VPP operators shall consult SA Power Networks before designing and beginning work.

### 9.2.10 Embedded Generation installations supplying multiple metered occupancies (TIR)

Any Embedded Generation (EG) installation that supplies multiple occupancies shall be approved by SA Power Networks Customer Solutions Manager. The arrangement shall be such that the EG system can be isolated together with the supply from the distribution network for each of the occupancies though the use of a linked circuit breaker under a SA Power Networks security seal (refer clause 5.5).

# 10. High voltage supply arrangements

## 10.1 Connection Point

SA Power Networks will negotiate the type of connection point to the distribution network.

The type of connection provided shall be determined by the;

- requested service capacity, and
- type of load or/and generation, and
- configuration and limitations of the local distribution network, and
- reliability required for the connection and the distribution network.

Connection equipment supplied by SA Power Networks (e.g. switching cubicles) shall remain the property of and be maintained by SA Power Networks.

Refer to clause 5.2.6 regarding progressing expenditure prior to confirmation of connection point and technical requirements.

The customer is responsible for the supply and installation of all equipment beyond the connection point.

Customers shall provide and maintain safe and unrestricted access to the connection point at all hours.

Delays may be experienced with connection or restoration of supply where access to the connection point is not safely accessible at all hours (refer clause 5.6).

## 10.2 High voltage supply characteristics and responsibilities

### 10.2.1 Distribution network supply configurations (TIR)

SA Power Networks may make available one of the following nominal supply voltages; 7.6kV, 11kV, 33kV or 66kV, maintained at steady state of +10 % and -10 % in accordance with AS 60038 and NER (for 66kV), with a nominal frequency of 50Hz and having an appropriate alternating current sinusoidal wave shape. Where 7.6kV installations are installed, they shall be designed for future conversion to 11kV at the customer's expense. High voltage supply at 3.3kV, or 6.6kV is no longer available for new connections.

### 10.2.2 Protective (Earthing) systems (TIR)

The distribution network employs either;

- the multiple earth neutral (MEN), or
- a common multiple earth neutral (CMEN) earthing system.

Where a CMEN system is employed, the installation's high voltage and low voltage earthing systems shall;

- be installed separately, and
- have a single bonding point between the high voltage and low voltage earthing system at each transformer, and
- be connected to the distribution network's common neutral conductor via the customer's neutral conductor.

Where a MEN system is employed, the customer's high voltage and low voltage earthing systems shall be kept separate.

Earthed primary neutral windings are not permitted on any transformer of the supply nominal voltage. It is recommended that the customer use Delta-Star transformers to comply with this requirement.

### 10.2.3 Earthing of installations (TIR)

The earthing system of the installation shall comply with AS 2067, AS/NZS 3000 and these Rules.

### 10.2.4 Earth Potential Rise (TIR)

The earthing system shall be designed to withstand the maximum distribution network design fault level in accordance with AS 2067 and to prevent hazardous step and touch potentials under earth fault conditions.

### 10.2.5 Earthing of metering equipment (TIR)

The enclosure of the meter, metering transformers and any metal supporting structure/s shall be connected to the same earth grid as the CTs and VTs secondaries.

The customer is responsible for providing earthing for the metering enclosure to the requirements of AS 2067. A suitable earth grid is required for all metering installations.

### 10.2.6 Supply disturbances (TIR)

SA Power Networks will endeavour to ensure voltage disturbances meets the requirements of AS/NZS 61000.3.6 and harmonic distortion meet the requirements of AS/NZS 61000.3.7. However, due to the nature of transient voltages, currents, and the uncontrollability of their source, SA Power Networks cannot provide any limitation on these types of supply disturbances.

Customers are advised to provide protection devices to protect equipment within their installation.

### 10.2.7 Voltage unbalance protection (TIR)

Customers with sensitive equipment on multi-phase installations should provide appropriate phase failure, over voltage and under voltage protection against the loss or unbalance of one or more phases.

### 10.2.8 Prospective fault current (TIR)

The installation shall be designed to perform under fault conditions. The short-circuit which may occur in the customer's installation is dependent on.

- the prospective fault level at the connection point, and
- contributions made by rotating electrical plant or other connected systems connected to the installation, and
- impedances within the installation.

The fault level generally given will be higher than that which initially exists to provide for system development. The maximum fault level rating will be used to determine the minimum equipment fault ratings of the installation. The ultimate fault level rating will allow the determination of the protection relay settings and anticipated voltage fluctuations. Indicative information is provided in Table 11 below. Refer to SA Power Networks Customer Solutions Manager for the actual fault level ratings at the connection point.

| Voltage | Ultimate fault level rating |
|---|---|
| 11kV | 20kA/380MVA/1s |
| 33kV | 20kA/1428MVA/1s |
| 66kV | 31.5kA/3597MVA/1s |

**Table 11 - High voltage fault and short circuit ratings**

## 10.3 Customer responsibilities (TIR)

The customer is responsible to ensure that load/generation stays within specified limits. For additional generation requirements, refer to the Distributed Energy Resources section 9. In all cases the requirements in the SA Power Networks Connection Agreement and the SA Power Networks Engineering Report (if applicable) shall be met, which may be different to those below.

### 10.3.1 Obligations (TIR)

Customers shall ensure;

- protection equipment in the installation is effectively coordinated with the electrical characteristics of the distribution network, and
- changes to any primary protection or protection control of DER systems must only be where agreed with SA Power Networks, and
- the distribution network and the reliability and quality of supply to other customers are not adversely affected by the customer's actions or equipment, and
- the maximum current drawn by the installation does not exceed the authorised service capacity (refer 5.13).

### 10.3.2 Power Factor (TIR)

The customer shall take all reasonable steps to maintain power factor at all times of monthly maximum demand within the relevant range set out in Table 12 - below.

| Supply voltage | Maximum demand of installation | | | | | |
|---|---|---|---|---|---|---|
| | Up to 100kVA | | 100kVA to 2MVA | | Exceeding 2MVA | |
| | Minimum lagging | Minimum leading | Minimum lagging | Minimum leading | Minimum lagging | Minimum leading |
| < 6.6 kV | 0.80 | 0.80 | 0.85 | 0.80 | 0.90 | 0.85 |
| 6.6 kV to 66 kV | 0.80 | 0.80 | 0.85 | 0.85 | 0.90 | 0.90 |

**Table 12 - High voltage power factor**

### 10.3.3 Harmonic distortion (TIR)

The customer shall ensure that harmonic distortion caused by the installation or by any equipment is not in excess of the limits prescribed in AS/NZS 61000.3.6. Contact SA Power Networks Customer Solutions Manager to request allocation of contribution limits specific to each customer. Note the allocation limits are to be maintained at the supply connection point.

### 10.3.4 Balanced load or source (TIR)

The connected load or generation of an installation, which is connected, shall be balanced as near as practicable over all phases.

### 10.3.5 Voltage disturbances (TIR)

The customer shall ensure the installation does not result in voltage disturbances to other customers greater than the limits prescribed in AS/NZS 61000.3.7.

### 10.3.6 Voltage unbalance factor (TIR)

The customer shall ensure the installation does not result in a voltage unbalance to other customers greater than the limits in Table 13 below.

| High voltage unbalance factor (%) | |
|---|---|
| Time period | Voltage unbalance factor (%) |
| 30-minute average | 1.3 |
| 10-minute average | 2.0 |
| 1 minute average | 2.5 |

**Table 13 - High voltage unbalance factor (%)**

### 10.3.7 Switched loads (TIR)

The customer shall ensure that switching loads within an installation does not cause distortion of the voltage at the connection point outside limits in clause 10.3.5.

### 10.3.8 Restart delay (TIR)

Restart delays or staging of installation load reconnection should be considered after a supply outage of the distribution network to ensure the installation meets the requirements of clause 10.3.1.

### 10.3.9 Starting current of motors (TIR)

The starting current shall not cause a voltage disturbance as per clause 10.3.5. High voltage motors should be discussed with the SA Power Networks Customer Solution Manager to ensure that there are no negative impacts on the distribution network.

### 10.3.10 Power quality measurement data

SA Power Networks may require power quality measurement data (voltage level, harmonic flicker and voltage balance at a 10-minute average) for a minimum of 7 days to be provided in a format suitable to SA Power Networks. Data logging shall be undertaken as close as possible to the customer's connection point. In some cases, the most practical location is the low voltage switchboard and the results for the connection point may be inferred from the low voltage test results.

### 10.3.11 Customer high voltage assets installed on third-party property and public lands (TIR)

The customer should consider the ongoing responsibilities of high voltage assets installed on third party property and public lands. High voltage asset shall be;

- designed to meet AS/NZS 3000, AS 2067 and AS/NZS 7000, and
- meet the requirements of the council, DIT, private property owners or other authority who controls the third-party property including public lands, and
- consult other utilities where the installation is in close proximity to their infrastructure, and
- have all approvals and registered easements in place, and
- meet the requirements of any ESCOSA licensing, and
- identified to prevent confusion with SA Power Networks infrastructure, and
- be registered in 'Before You Dig Australia' (www.1100.com.au) for underground construction.

## 10.4 Connecting to SA Power Networks high voltage network

### 10.4.1 Information to be provided during the planning process

Significant planning is required for a high voltage connection. The following preliminary information shall be provided;

- location(s), time frames, indicative budgets, and
- reliability requirements (i.e. need for backup supply), and
- if multiple connection points, need to parallel, and
- single line diagrams of the proposed installation, and
- relevant equipment details and protection settings, and
- overall site plan showing the locations of the high voltage equipment, and
- preferred connection point (new installation), and
- anticipated maximum demand (MVA) required for the installation, and
- any proposed DER, CTTS, or SLTS, and
- any disturbing loads and type (e.g. large motors, arc furnaces, etc.), and
- high voltage metering design arrangements (contact your Retailer to ensure the Metering Coordinator / Meter Provider are part of the design approval process), and
- operating philosophy (e.g. load profile).

Additional information may be required by SA Power Networks during the planning process.

### 10.4.2 Connection Point(s) (TIR)

#### *10.4.2.1 Number of Connection Points (TIR)*

The number of connections points will be determined during the planning process to meet the customer's requirements.

The normal supply arrangement for loads up to 4MVA is via a single connection point. For loads 4MVA or greater, multiple connection points are required for reliability purposes unless agreed otherwise.

Paralleling of connection points may be permitted subject to conditions. Paralleling of connection points to provide a no break supply may also be considered if technically viable and will be subject to the installation of additional protection at the zone substation at the customer's expense. Paralleling may result in a loss of security, i.e. both supplies may trip for a fault instead of one.

Paralleling of connection points may increase fault levels beyond allowable limits.

Non paralleling of connection points may be permitted where the main incoming circuit breakers are interlocked so that paralleling of the connection points is not possible. Approved interlocking methods are;

- hard wired electrical interlocking, and/or
- mechanical interlocking.

In any case, the customer shall notify the SA Power Networks Operation Centre (NOC) prior to transferring load.

The above also includes transferring significant loads at any stepped down voltage behind the connection points, which may also require similar approved interlocking schemes.

### 10.4.3 Distribution feeder / line protection (TIR)

For customers connecting using dedicated supplies, appropriate protection will need to be installed at the SA Power Networks zone substation. In some cases, e.g. taking parallel supplies or when connecting large generators, the use of a differential protection may be required.

For connections points at 33kV or 66kV, a line differential protection scheme shall be installed also.

These protection schemes require the customer to provide a suitable space within their control room for SA Power Networks to install its protection panel and any associated telecommunication and SCADA equipment.

In some cases, the consumer mains should have the same protection to protect the consumer mains and ensure consumer mains faults do not cause upstream trips of the distribution network.

For a connection point from a shared distribution feeder, SA Power Networks shall specify an upgrade of the existing feeder protection scheme if the connection reduces the safety and /or reliability of the feeder with existing feeder protection.

Connecting DER system(s) may also require protection scheme upgrades for improved functionality associated with reverse power flows and fault recording abilities etc.

These protection scheme(s), installation and / or upgrade will be at the customer's expense.

### 10.4.4 Insulation Coordination (TIR)

The customer shall ensure that the insulation level of their equipment is appropriate for the normal and expected voltage range in accordance with the provisions of AS 2067.

It is recommended that all equipment shall be capable of withstanding, without damage, power frequency voltage and impulse levels as nominated in Table 14. The lightning impulse withstand voltage level is under full-wave dry conditions using the standard 1.2/50µs wave shape.

The customer shall provide adequate lightning protection on their equipment in accordance with AS 2067, such that the effect of a lightning strike anywhere within the installation is not transferred to the distribution network.

Precautions should be taken to prevent transient voltages generated by any connecting loads, reactive plant (e.g. capacitor banks, reactors), switching and/or the SA Power Networks distribution network from causing damage to the installation.

| Voltage level kV | Application | Minimum power frequency withstand voltage | Minimum lightning impulse withstand voltage (see Note) |
|---|---|---|---|
| 3.3kV | All applications | 16kV rms | 40kV peak |
| 6.6kV | All applications | 20kV rms | 60kV peak |
| 7.6kV | Underground<br>Overhead | 28kV rms | 75kV peak<br>95kV peak |
| 11kV | Underground<br>Overhead | 28kV rms | 75kV peak<br>95kV peak |
| 33kV | Underground<br>Overhead | 70kV rms | 170kV peak<br>200kV peak |
| 66kV | All applications | 140kV rms | 325kV peak |
| | Equipment connected to neutrals | 70kV rm. | 170kV peak |

**Table 14 – Insulation coordination requirements**

Note: Where equipment meeting these impulse levels is not available, the use of surge arresters should be considered.

### 10.4.5 Customer incomer circuit breaker (TIR)

Each connection point shall have a SPD, load control and isolating device facilitated by a single incomer circuit breaker equipped with earth fault and over current protection capable of making and breaking the maximum prospective fault currents on all three phases.

The incomer circuit breaker shall;

- be the installation's main switch and be labelled "XXkV Main Switch", and
- be sized in accordance with the agreed service capacity, and
- be capable of protection settings being sealed to the requirements of clause 5.4, and
- ensure grading with the upstream distribution network protection devices, and
- be located at ground level/floor level and readily accessible, and
- be located as near as possible to the customer's connection point, and
- be located with and prior to the metering transformers, and
- be readily accessible to authorised persons only, and
- operate simultaneously in all active conductors, and
- be capable of local manual operation for closing (remote trip/open is permissible), and
- be able to be locked in the open position. The locking device shall be capable of accepting a SA Power Networks padlock fitted with a 10mm shackle (refer to clause 5.5), and
- be provided with adequate means of isolation for maintenance purposes (This may be achieved by rack-out circuit breaker. Remote operation shall be able to be conveniently disabled or deactivated and locked off for maintenance purposes), and
- not be utilised as a means of control for generation purposes.

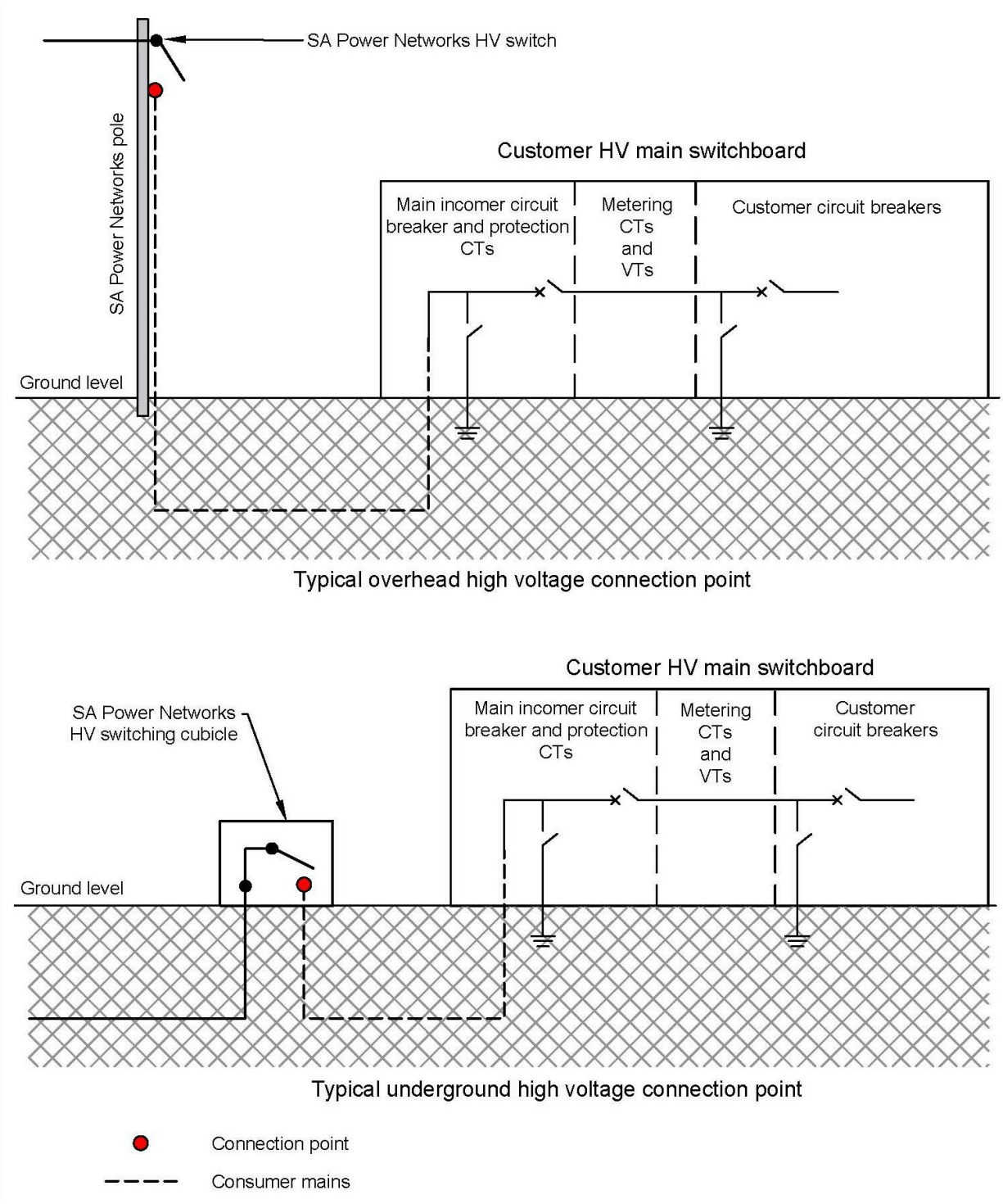



**Figure 29 – Typical high voltage connection point arrangements**

### 10.4.6 Switchgear (TIR)

Switchgear includes all devices, but is not limited to circuit breakers, disconnectors and earth switches. Equipment shall comply with AS 2067.

### 10.4.7 Meter Equipment (TIR)

Metering equipment is required to be installed downstream of the incomer circuit breaker. All customer equipment is to be installed on the customer (load) side of the metering equipment, with the exception of the main incomer earth switch.

The switchgear shall allow the Metering Provider to install the metering without interfering with the facilities and wiring other than that required to connect, fix, and maintain the metering equipment and the communication equipment.

### 10.4.8 Main incomer earth switch (TIR)

An approved earthing device is required to provide earthing of the consumer mains upstream of the customer incoming circuit breaker. A mechanism which is capable of securing the earthing device in both the open and closed position shall be fitted. This shall be suitable for a SA Power Networks padlock with a 10mm shackle, refer clause 5.5 and may have additional padlocks for customer. The earthing device shall be marked “XXkV Earth Switch”.

### 10.4.9 Protection (TIR)

All protection settings for the customer incoming circuit breaker shall be approved by SA Power Networks prior to connection. No changes to approved settings are permitted without prior approval of SA Power Networks. If alterations are made to the incoming circuit breaker or associated protection, the installation shall be recommissioned with SA Power Networks. Supporting documentation is required if the customer utilises relays that have not been previously assessed by SA Power Networks.

#### *10.4.9.1 Customer incoming circuit breaker protection requirements (TIR)*

The customer’s installation shall have protection relays comprising of over-current protection that is capable of clearing all credible faults and achieving coordination as per clause 10.4.9.3.

The incoming relay shall be IEC 60255 compliant.

More complex protection arrangements may be required in particular cases to meet acceptable protection performance criteria depending on the installation arrangement, the distribution network arrangement and the required protection performance levels.

The design shall ensure access for primary and secondary injection during relay testing.

Wherever possible, the CTs for the customer protection are to be located on the upstream side of their incoming circuit breaker.

#### *10.4.9.2 Customer incoming circuit breaker protection settings (TIR)*

The customer is required to provide full documentation of protection settings used as per Table 15. The settings of the protection relay shall be fixed by the SA Power Networks security seal as per clause 5.4 and shall include a label “Settings only to be changed with prior approval from Distributor”.

| Required information | Phase over current | Earth over current |
|---|---|---|
| Relay type | X | X |
| Current pick-up value in A | X | X |
| Time multiplier setting in % | X | X |
| Characteristic description or equation | X | X |
| Instantaneous pick-up value in A | X | X |

**Table 15 - Typical customer incoming circuit breaker protection relay settings**

A separate earth fault relay is only required where coordination with SA Power Networks earth protection cannot be achieved using phase over current protection.

#### *10.4.9.3 Protection coordination (TIR)*

The customer's protection systems should be designed to coordinate with the distribution networks feeder protection. The settings applied to the customer's protection relays shall discriminate with distribution network protection equipment to ensure that, for faults in the installation, the customer's incomer circuit breaker will operate before the distribution networks protection equipment. A current grading margin between the SA Power Networks upstream protection pickup and the customers incoming circuit breaker protection settings of at least 20% is required for both earth and phase overcurrent protection.

In general, the customer's primary phase fault protection device for faults at the voltage level of the supply shall detect and clear all bolted short faults in a time not greater than 100 milliseconds at the fault level nominated at the connection point. Any proposed operating time greater than 100 milliseconds shall be discussed with SA Power Networks at an early stage.

Where the installation downstream of the incomer circuit breaker includes any length of overhead line, Sensitive Earth Fault (SEF) protection shall be fitted which grades with the distribution networks SEF protection. The customer shall notify SA Power Networks of any customer equipment connected between any phase and neutral.

If SA Power Networks needs to modify its protection and control functionality as a result of the customer connection, this will be at the customer's expense.

Feeder protection settings may change from time to time. It is the customer's responsibility to ensure that the correct coordination with the feeder protection is maintained after being advised of the change by SA Power Networks. SA Power Networks will not be responsible for any costs incurred in making such a change (refer clause 5.2.5).

### 10.4.10 Power Transformers (TIR)

For compatibility with the distribution network, transformers shall;

- be from an approved manufacturer, and
- comply with AS 60076, AS 2067, and
- have either unearthed star or delta, high voltage winding configuration, and
- vector group as per below.

| Voltage | Vector group |
|---|---|
| 11kV/0.4kV | Dyn11 |
| 33kV/11kV | Dyn5 |
| 66kV/11kV | Dyn5 |

**Table 16 – Transformer vector groups**

There is no limitation on the secondary (or tertiary) winding configurations and standard distribution network transformers can be purchased from SA Power Networks.

### 10.4.11 Metering (TIR)

The following metering requirements are applicable to single connection point installations and are consistent with clause 5.2.7.

Other installations such as multiple connection points and / or DER installations will require additional provisions and the Metering Coordinator shall be consulted.

In all situations final approval of metering installations is by the Metering Coordinator (refer clause 5.2.7.4).

#### *10.4.11.1 General Requirements (TIR)*

Metering equipment shall be installed with the applicable requirements of Section 8.

#### *10.4.11.2 Panel (TIR)*

The customer shall provide the enclosure or hinged switchboard frame for mounting a lift-off hinged panel on which to mount the metering equipment.

A minimum clear space of 2.0m high by 1.2m wide is required to provide personnel access for mounting metering equipment.

The minimum size meter panel for a single high voltage metering installation shall be in accordance with clause 8.4.2.1.

#### *10.4.11.3 Enclosure (TIR)*

The customer shall install and maintain a metering instrument enclosure complying with the requirements of clause 8.4.

Meter enclosures shall comply with clause 8.4.5. The door on meter enclosures shall be labelled "**Electricity Meters**".

#### *10.4.11.4 Metering Transformers compliance (TIR)*

Metering transformers shall comply with AS 61869.1 and additionally VTs with AS 61869.3, and the CTs shall comply with AS 61869.2.

The transformers shall meet the electrical characteristics performance requirements clause 10.4.10.

The metering transformers shall comply with the requirements of the NER. The metering transformers are to be mounted within the customer's ground level/floor level and readily accessible switchgear and shall be acceptable to the Meter Provider and SA Power Networks. Dual secondary metering transformers may be permitted, when provided in compliance with the NER. Dual purpose CTs will not be permitted.

The CT and VT nameplate data is to be duplicated and displayed in the CT/VT marshalling compartment.

Test certificates from a NATA accredited laboratory shall be provided to the relevant Metering Provider prior to installation.

The test certificate shall show conclusive evidence that the transformers comply with the relevant Australian Standard specification. A copy shall be retained inside the metering enclosure.

The following minimum information shall be written in English and be included on the test certificate:

- Serial No.
- Make
- Rating
- Burden
- Class
- Specification
- Date of test
- Proof of compliance with high voltage insulation requirements
- Test ratio(s), Burden(s), Current(s), Voltages, absolute values of Magnitude and Phase.
- Errors at each test point
- Statement of uncertainty in determination of errors.

#### *10.4.11.5 Metering voltage and current transformer layout (TIR)*

The following requirements apply to transformers and their enclosure:

- The metering transformers shall be mounted within the high voltage chamber which is able to be placed under the SA Power Networks or the Metering Provider electricity industry security seals refer clause 5.4.
- The layout of the transformers shall be such that identification of transformer polarities can be readily established, and such that there is ready access to the secondary terminals of all transformers.
- No other devices apart from metering equipment (with the exception of anti-condensate heaters) shall be located within the high voltage chamber.
- The VTs shall be permanently mounted within the metering high voltage chamber.
- The secondary windings of the VTs shall be protected with 32 Amp HRC off set tag fuse bases fitted with 6 Amp fuse links located at the test marshalling point.
- To permit the required maintenance and inspection by the Metering Provider, the CTs and VTs shall be located immediately after the main incoming circuit breaker.
- Provision shall be made within the high voltage chamber for the bonding of all high voltage conductors to earth to facilitate disconnection of supply and work to be carried out on the metering transformers.
- The CTs and VTs shall be completely encapsulated with the secondary terminal box part of the resin body of the transformer.

#### *10.4.11.6 Metering secondary wiring (TIR)*

The customer shall provide suitable wiring facilities for the interconnection of the marshalling terminals and the metering instrument terminals.

The following requirements apply in addition to the requirements of AS/NZS 3000:

- The secondary terminals of the metering transformer shall be connected to the metering loom via a terminal strip at the marshalling point.
- The marshalling point shall be readily accessible for safe access and inspection to the same extent as required for a metering enclosure.
- The marshalling point shall also contain a suitable earthing bar to allow for the earthing of secondary wiring circuits.
- A security cover shall be provided for the terminals at the marshalling point. The cover shall be capable of being sealed in position with SA Power Networks or the Metering Provider's electrical industry security seal so as to prevent unauthorised access (refer clause 5.4).
- Secondary wiring from the marshalling point to the meter position shall be wired, supplied and installed by the customer; The wiring loom shall be a maximum of 15 m in length with standard 10 core 2.5mm$^2$ wiring loom and appropriately labelled, (refer to Figure 30) Other wiring loom sizes and lengths shall be approved by the Meter Provider.
- A test block shall be provided on the same panel as intended to be used for the metering instrument.
- The test block shall have capabilities for bridging the CT secondary circuits and opening of secondary VT circuits in order to facilitate meter testing and replacement.
- The test block shall have a security cover and facilities for SA Power Networks or the Metering Providers electricity industry security seal.
- All metering secondary circuit terminals shall be of a screw type as specified in AS/NZS 3000.
- A schematic of the metering circuitry is to be supplied to the Metering Provider prior to connection and a permanent copy shall be retained in the metering instrument enclosure.
- Supplementary marshalling terminals and associated fuses shall be separately accessible, (split covers) and not under SA Power Networks or Metering Providers security seal.

### *10.4.11.7 Access to Meters installed in SA Power Networks Substations (TIR)*

Where other Metering Providers have legacy metering installed in SA Power Networks Substations and require access to their metering (refer clause 5.10.1).

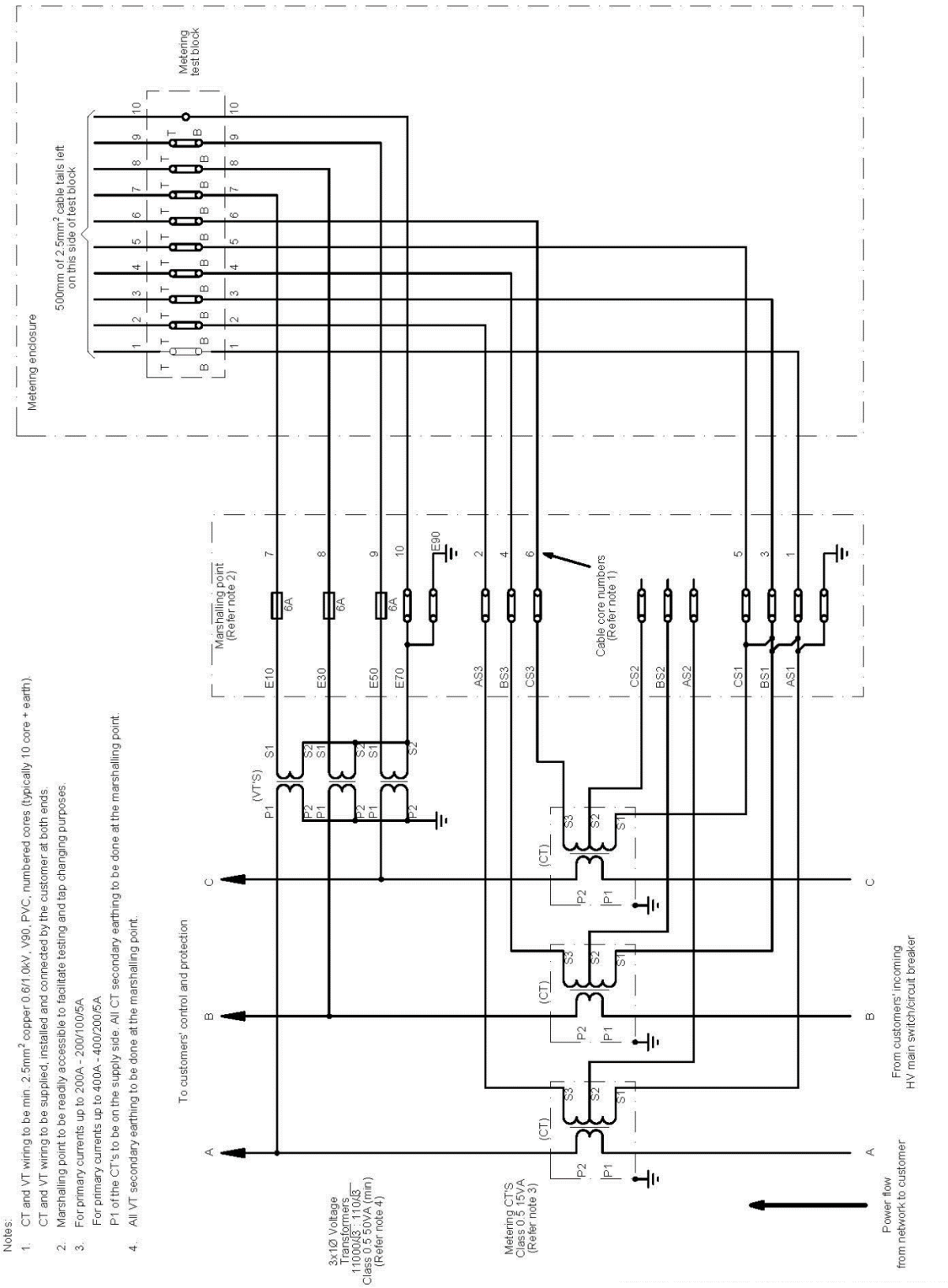



**Figure 30 - Typical high voltage VT and CT metering wiring diagram**

### 10.4.12 SA Power Networks connection assets (TIR)

Where the connection point is within a metering cubicle and SA Power Network is no longer designated as the Metering Provider in AEMO's Market Settlement and Transfer Solutions (MSATS), then this cubicle will be the connection point.

The designated Metering Coordinator is responsible for the testing and calibration of the CTs and voltage VTs within the cubicle.

If SA Power Networks believes there is any risk to the reliability of supply from this connection point, SA Power Networks may require that the metering CTs and VTs be relocated to an alternative position.

## 10.5 Preparing for your connection (TIR)

Prior to testing, commissioning and connection in accordance with clause 10.6, the customer shall submit the following details (SA Power Networks will assess only some aspects of the design for acceptance, however this assessment and/or acceptance in no way infers or implies compliance in entirety with this document, Australian Standard or any other contractual or regulatory requirements);

- the final single line diagram, and
- the agreed maximum demand, and
- the main circuit breaker specification, and
- protection settings for main circuit breaker as per clause 10.4.9, and
- compliance to Distribution Code, e.g. systems study etc., and
- arrangements for SA Power Networks pre-inspection if required, and
- any other requirements determined during the planning process.

The below shall be provided to the Metering Coordinator;

- a schematic of the metering circuitry, and
- metering VT and CT test certificates (refer clause 10.4.11.4).

The works shall be prepared ready for the Responsible Officer to commence the connection on arrival. For any questions around work readiness call Customer Service on 13 12 61.

## 10.6 Testing, commissioning and connection (TIR)

For all new or altered installations, SA Power Networks requires that all inspections and commissioning tests be carried out to ensure that installation complies with AS/NZS 3000 and AS 2067 and these Rules.

Where any testing is carried out by SA Power Networks, the customer will be required to contribute to the cost of the services provided. SA Power Networks may, on application from the customer, carry out other specific testing of equipment at the customer's expense.

Testing by SA Power Networks will only be done under conditions that allow SA Power Networks personnel to use standard isolation and safe working procedures laid down for the operation of similar SA Power Networks equipment.

This may involve completely de-energising the installation if proper provision has not been made for safe operation or isolation.

Before final connection is made the customer shall provide/ensure;

- proof of equipment insulation testing conducted after installation, and
- proof of earthing system testing conducted after installation of equipment on site, and
- proof of correct earthing arrangement, and
- operation requirements information as per clause 10.7.1, and
- maintenance requirements information as per clause 10.7.2, and

- commissioning and test certificates as determined by AS/NZS 3000, which shall include trip tests on the incoming circuit breaker via primary and secondary injection witnessed by SA Power Networks Officer, and
- proof of testing witnessed by SA Power Networks officer to verify phase and circuit identification, and
- required labels and signs are installed, and
- Certificate of Compliance(s) (eCoC) (refer clause 5.2.2), and
- a padlock installed as per clause 5.5 on the customer incomer circuit breaker and earth switch, and
- where SA Power Networks switching equipment is installed inside the installation, it is readily accessible including SA Power Networks locking systems (refer clause 5.5), and
- the connection will only be energised up to the open customer incomer circuit breaker, and
- clearance to energise the installation to the open customer incomer circuit breaker.

SA Power Networks will not connect the whole or any part of the installation unless these are all provided. The Metering Provider is required to have installed revenue metering prior to the connection.

## 10.7 Customer's high voltage installation operation and maintenance (TIR)

Customers are required to safely maintain and operate their installation. If their installation requires an ESCOSA licence, a Safety, Reliability, Maintenance, and Technical Management Plan (SRMTMP) may be required.

### 10.7.1 Operation requirements (TIR)

The customer shall provide SA Power Networks with;

- availability of an authorised high voltage operator(s) to undertake switching operations on the installation, and
- single line diagram showing all aspects of the installation in a suitable enclosure adjacent to all control and isolating switches within the installation, and
- safe and unimpeded access to the main switch and metering equipment, and
- 24-hour contact phone number to SA Power Networks' Network Operation Centre, and
- as required 24-hour access to SA Power Networks,

for the purpose of inspection of metering equipment, load shedding, routine maintenance and emergency repair of the distribution network.

Unless specifically contracted, SA Power Networks will not provide personnel or equipment for any of the customer's operational purposes.

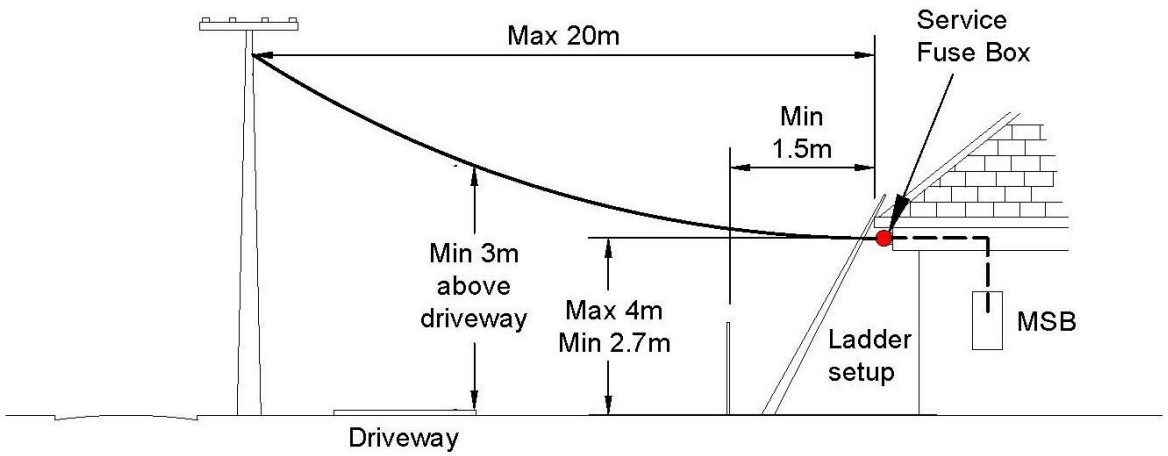
### 10.7.2 Maintenance requirements (TIR)

The installation shall be maintained in good order to ensure that any malfunction will not create a hazard or cause interference (clause 10.3) to the SA Power Network's distribution network.
SA Power Networks may take appropriate action as per clause 5.2.4 if such instances are found.

The installation's main incoming circuit breaker and protection system shall have a documented maintenance schedule.

# Appendices

## Appendix A – Reference drawings




Overhead Service Line

Consumer Mains

Connection point

NOTES:

1. Overhead mains shall maintain a clearance of 600mm to communications cable and equipment.
2. Connection point shall have 600mm clearance for safe ladder access each side.

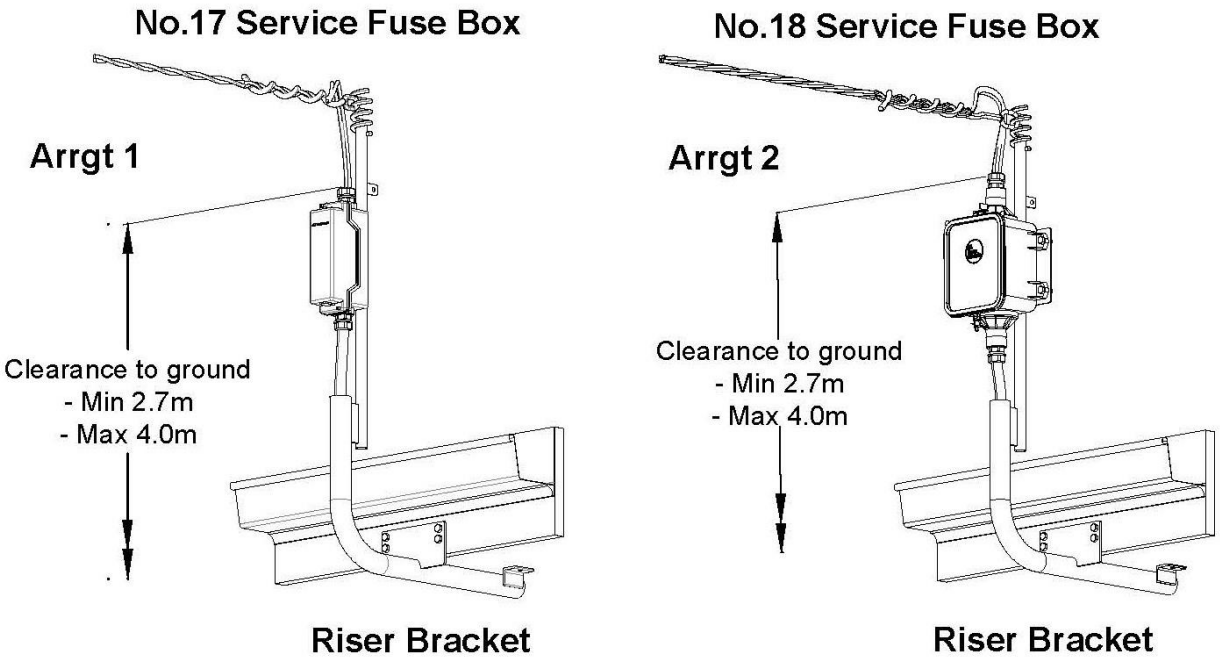
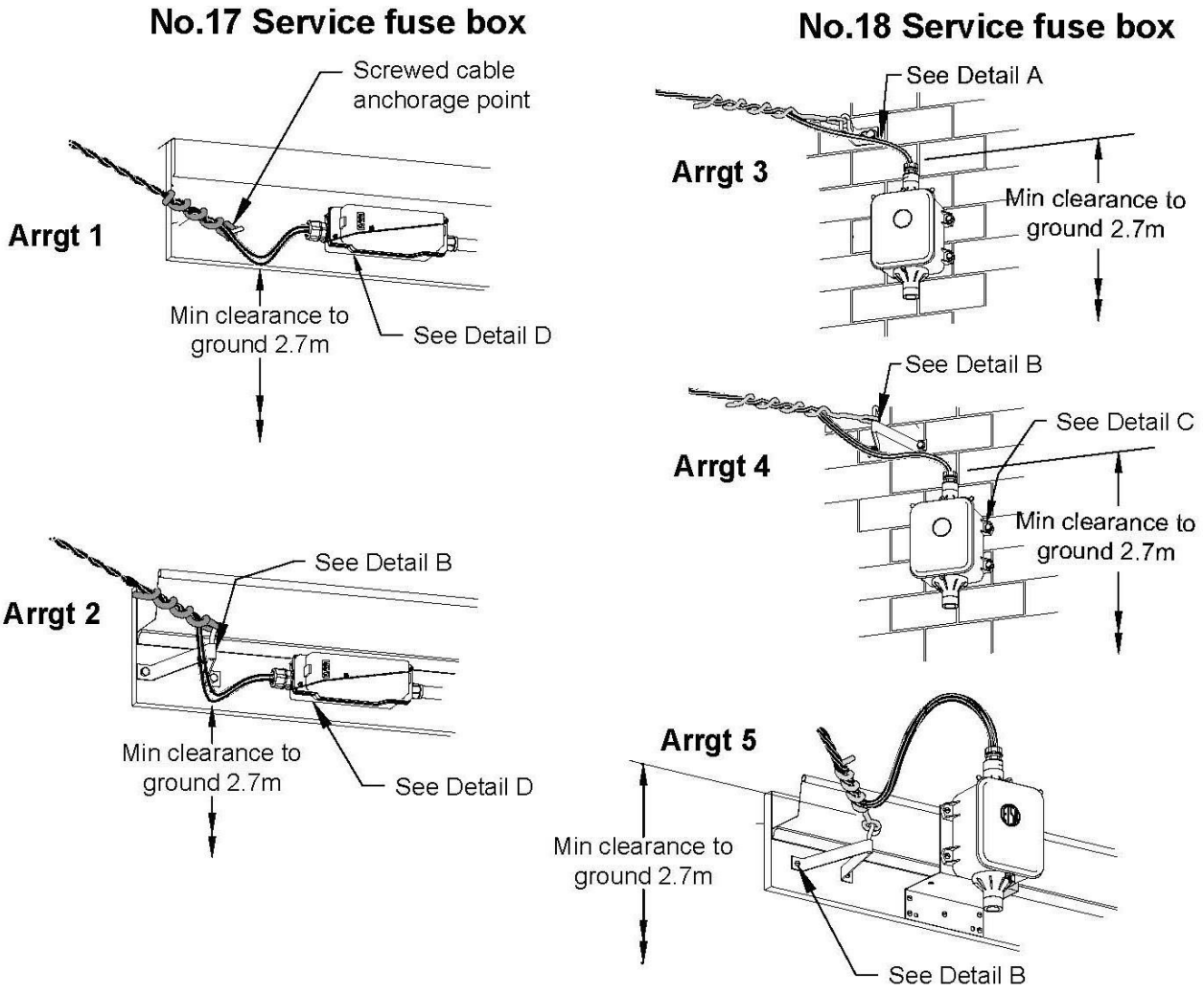
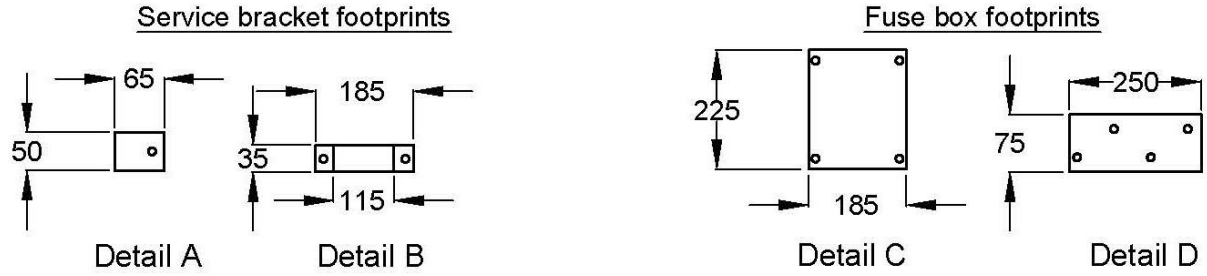



**Figure 31 – Typical overhead service and fuse boxes on riser brackets**




Detail A & B
Anchorage typically fixed to timber or wall using M10 galvanised hex coach screws or M10 masonry anchors or other suitable fasteners of equivalent strength. Where masonry fastners are used, a minimum of 25mm thread must remain exposed for attachment of bracket.

Detail C & D
Anchorage typically fixed to timber or wall using M6 galvanised hex coach screws or M6 masonry anchors. Where masonry anchors are used, a minimum of 25mm thread must remain exposed for attachment of fuse box.

Note:
Ensure suitable strength for mounting location and space provided for SA Power Networks to attach brackets and fuse box.

+

**Figure 32 – Typical overhead service and fuse boxes**

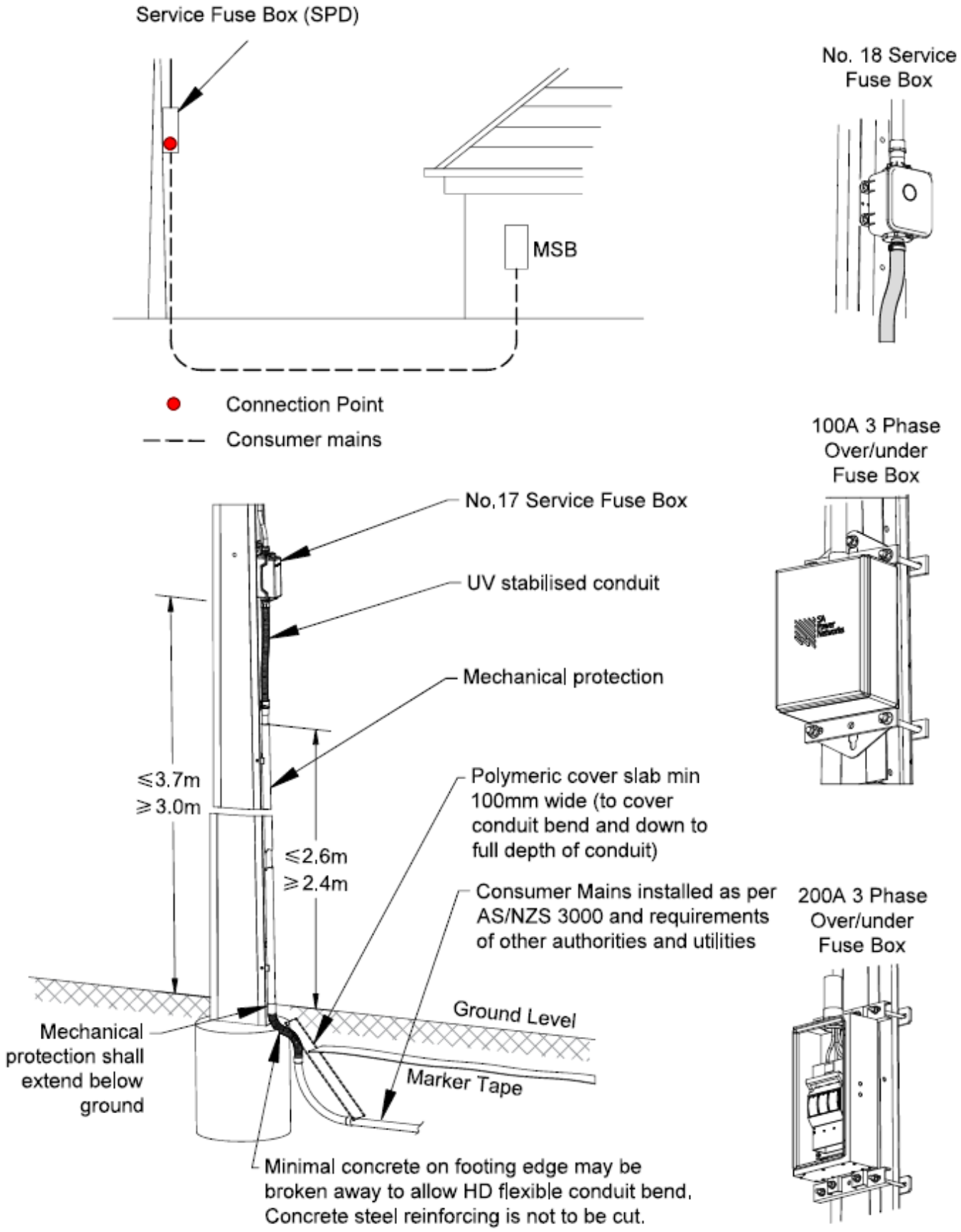



**Figure 33 – Typical Over / Under service and fuse boxes**

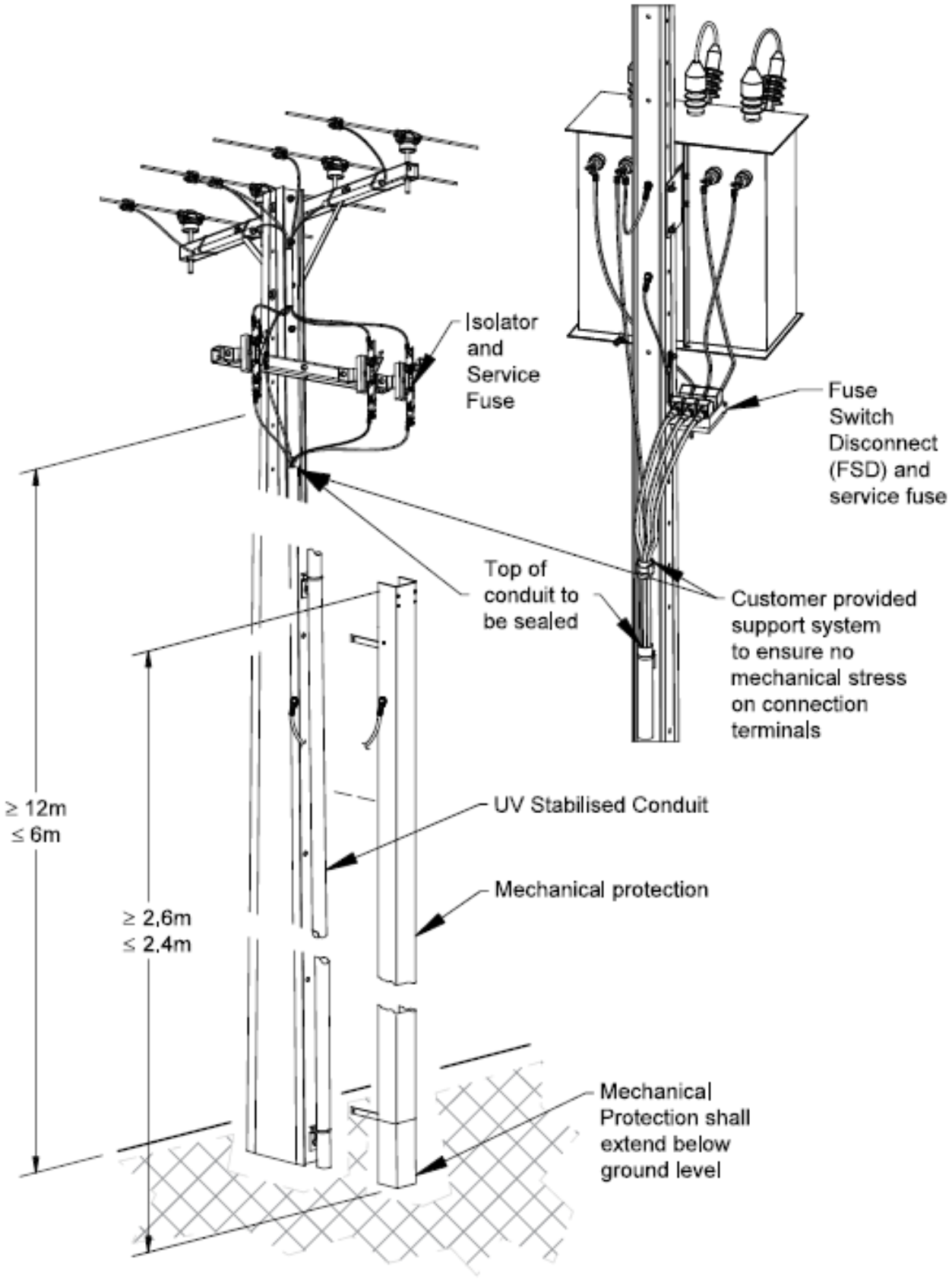



**Figure 34 – Typical Over / Under service - Isolators and service fuses**

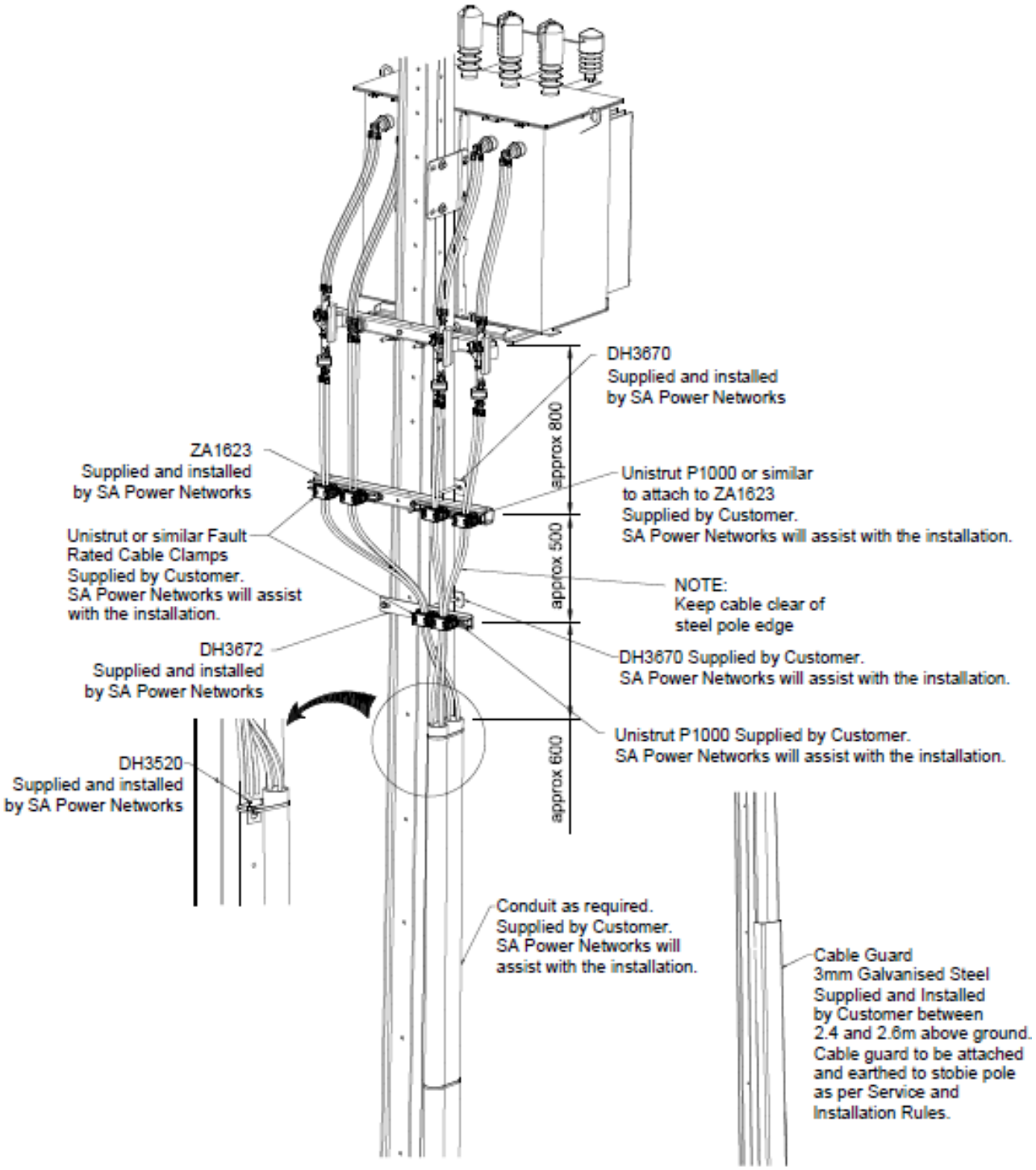
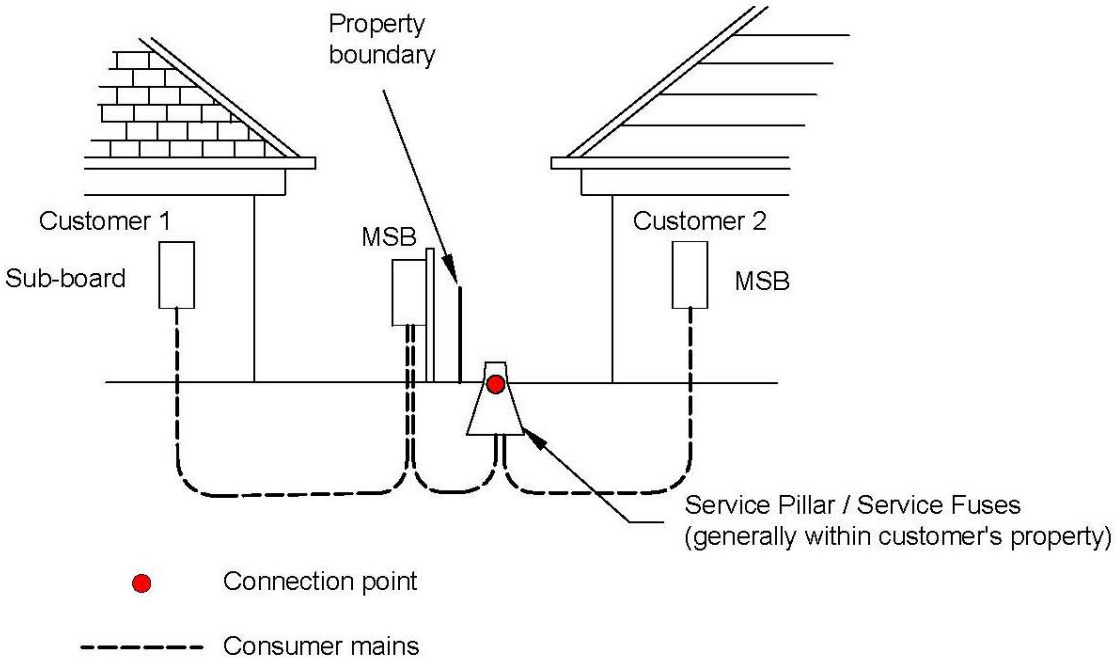



**Figure 35 - Greater than 200A service on a pole**



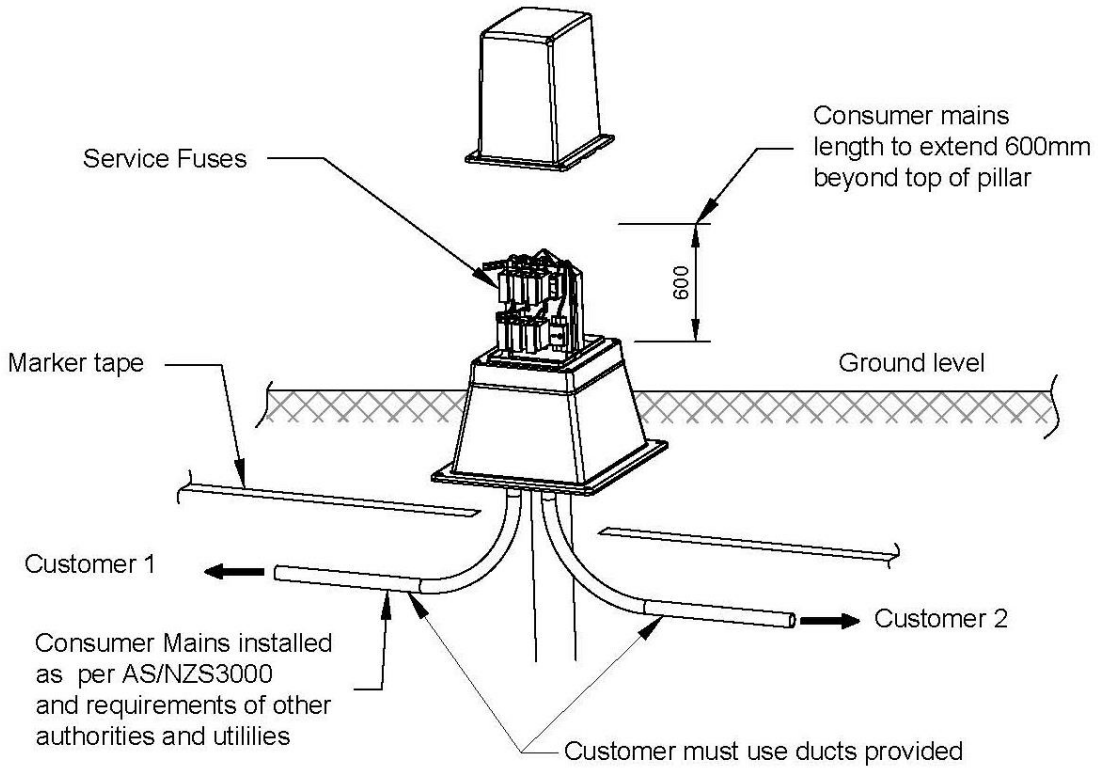
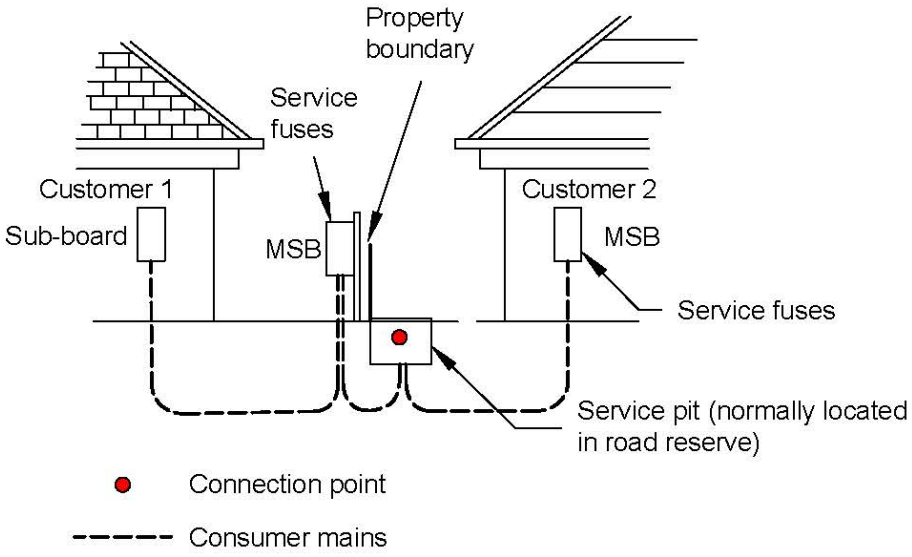




**Figure 36 – Typical fused service pillar - underground service**



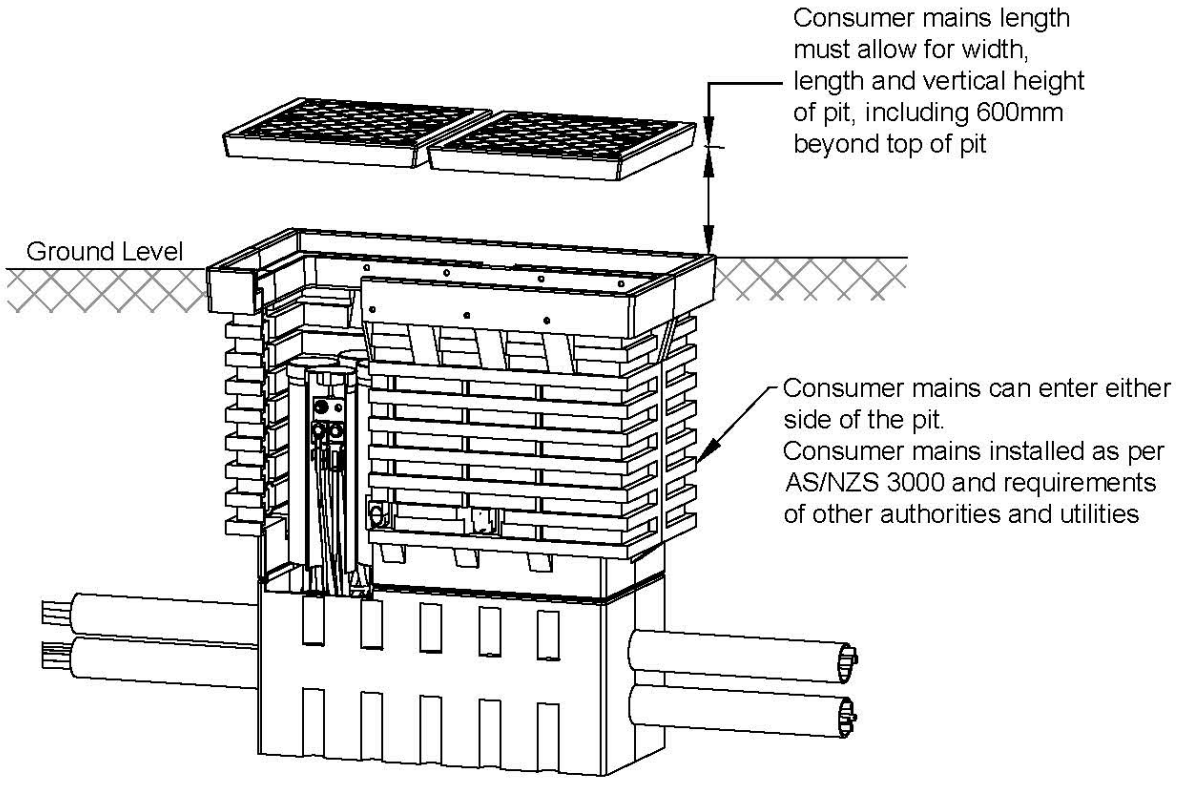
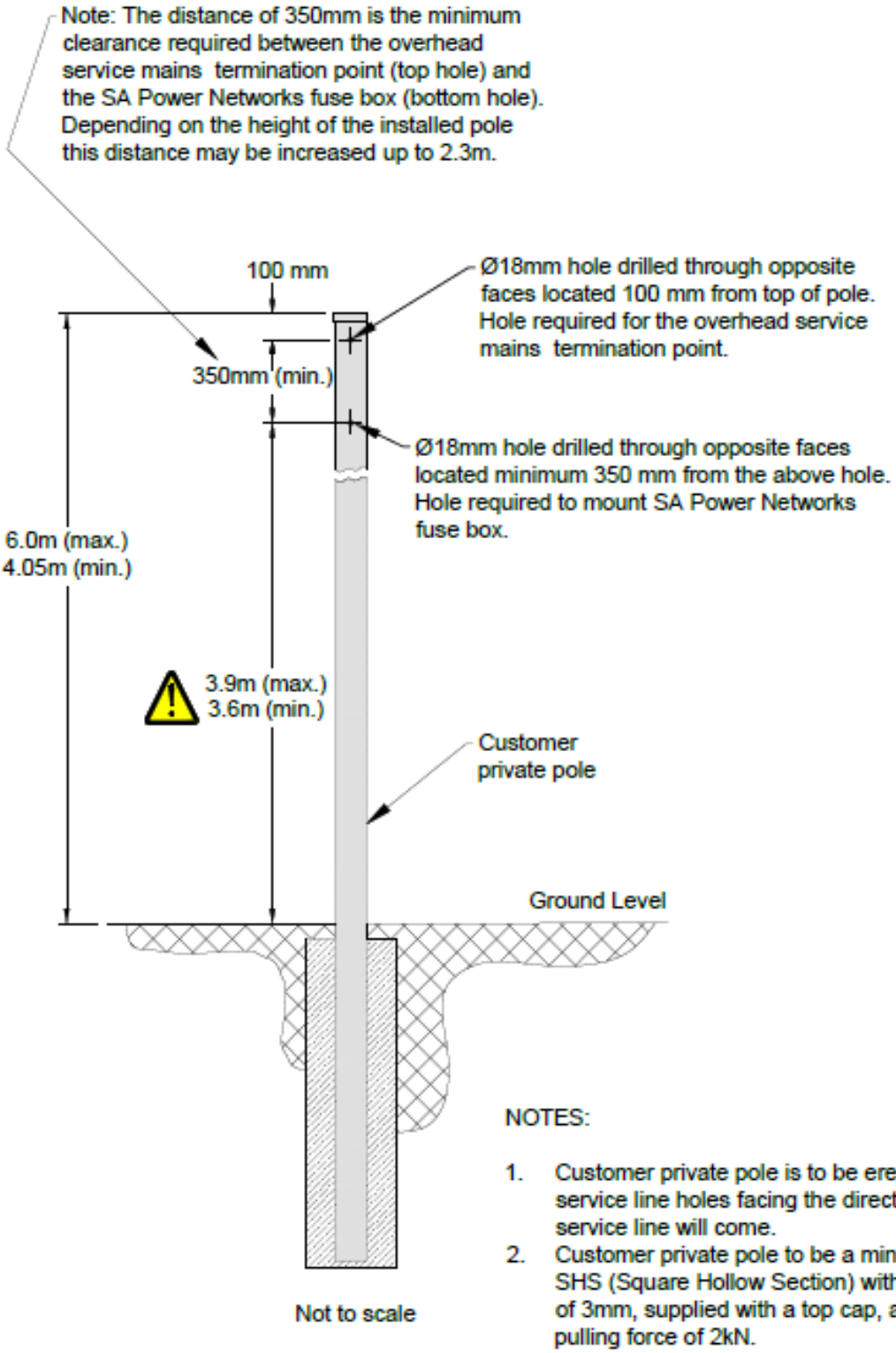




**Figure 37 – Typical unfused service pit - underground service**




NOTES:

1. Customer private pole is to be erected with the overhead service line holes facing the direction from which the overhead service line will come.
2. Customer private pole to be a minimum of 100mm galvanized SHS (Square Hollow Section) with a minimum wall thickness of 3mm, supplied with a top cap, and able to withstand a pulling force of 2kN.
3. Customer to drill the 2 x Ø18mm holes as detailed above.
4. Refer AS/NZS 3000 for the pole footing or any other requirements.
5. Customer private pole application and location to be approved with SA Power Networks.

**Figure 38 – Typical customer private pole**

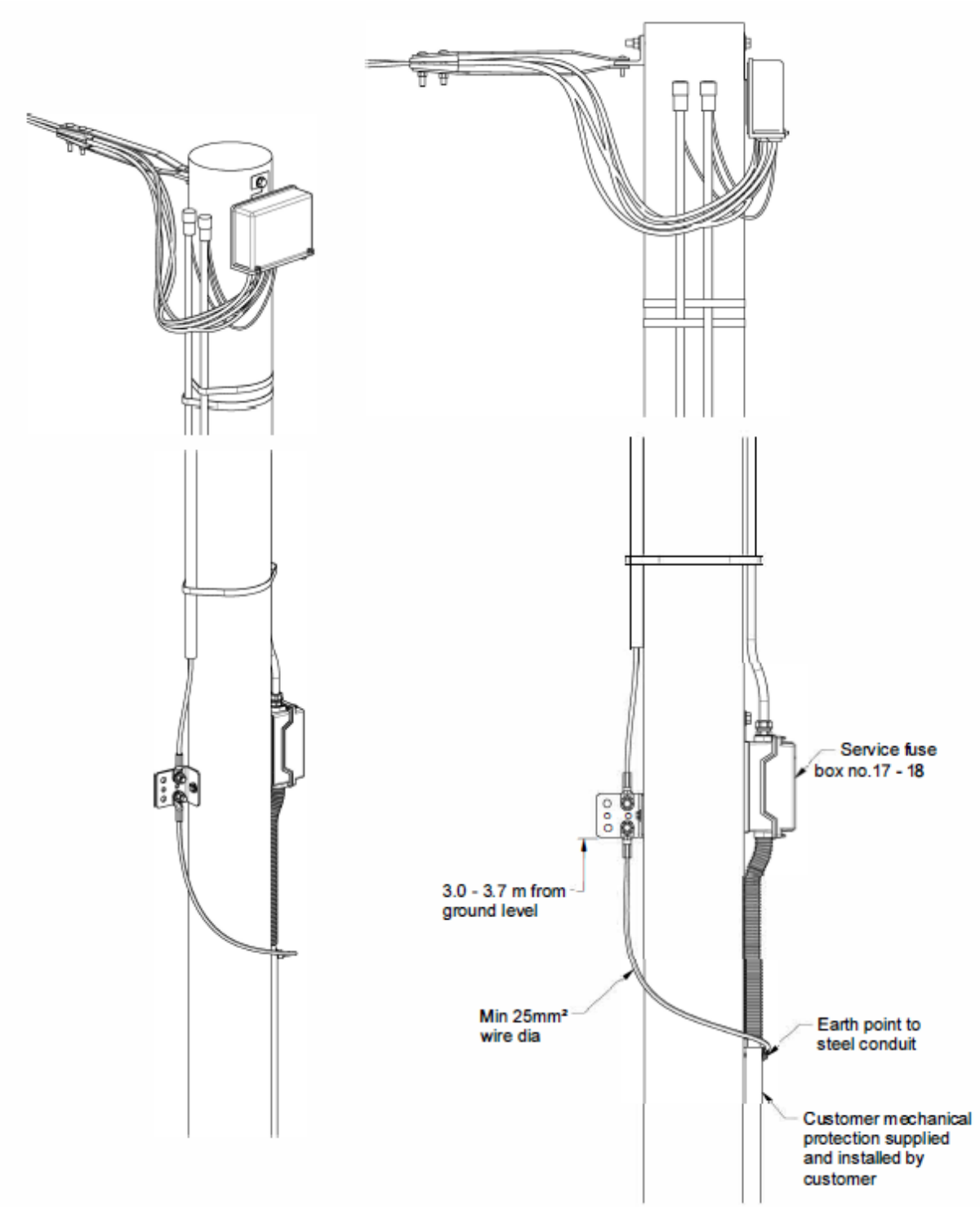



**Figure 39 - Timber service pole – earthing arrangement**

## Appendix B – Customer's connection prompt sheet

| **Low Voltage Installation** | |
|---|---|
| Exemptions | Agreed with SA Power Networks before connection |
| Compliance | eCoC – onsite |
| | Authority to Connect form- with correct eCoC number |
| Access / clearances | Connection point |
| | Main Switchboard/Group meter board |
| | SPD enclosure |
| Labelling | Consumer mains in pit/pillar |
| | Mechanical protection on SA Power Networks pole |
| | Meter panel |
| | Main earth electrode |
| LV Consumer mains | Size to limit voltage drop to <2% |
| | Voltage rise and loop impedance |
| | Installed for connection in accordance with Table 9 |
| Main switchboard | Installed at correct height/location/clearance to gas service |
| | Neutralised/earthed |
| | MEN established and metering neutral link |
| | Provisions for electrical industry security seals as required |
| | Locking facilities |
| | Adequate meter panel size |
| | Clearance to HV earthing |
| | Consideration for multi-installations/submains/revenue metering |
| LV Isolators/load control | Rated for the maximum demand of the installation and the fault current. |
| | Panel Isolator – required for more than 2 x NMI's |
| | Meter Isolator-for each NMI |
| Mechanical Protection | Mechanical protection of consumer mains at stobie pole |
| | Mechanical protection of consumer mains below MSB |
| | Protection of MSB/group meter board and SPD enclosures |
| Alternative supplies | Requirements for PV, batteries, generator etc. |
| **High Voltage Installation** | |
| Design documentation | Protection settings of main circuit breaker |
| | Single line diagram |
| | SA Power Networks acceptance |
| Pre-connection site visits | If required |
| Witnessing | Requirements ready to be witnessed |
| | Meter provider |
| Locking facilities | Incoming breaker |
| | Earth switch |
| | Gates and doors |
| Signage and Labelling | |