

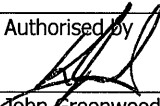

NP010 Meter Manual

This document should be read in conjunction with the following documents:

- NP007 Service Rules
- NP003 Installation Rules

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Authorised by:  16/12/14	Prepared by: 	Issue Date:	Status: Final
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2. Scope

This Manual documents the procedures and policies to be followed in the installation and maintenance of customer revenue metering equipment connected or intended to be connected to any power system owned and operated by Power and Water Corporation.

3. Definitions

Act is the *Electricity Reform Act 2000*, and includes Regulations made under the Act.

Customer Connection Officer is the Power and Water officer responsible for arranging for the installation and removal of service equipment (refer Policy NP 002 Connection Procedures). Contact details of those officers are given in the Installation Rules.

Electricity Officer refers to a person appointed by Power and Water who is authorised under the Electricity Reform Act to do work such as connecting or disconnecting supply, reading meters, inspecting installations or other duties as defined in the Act.

Safety Regulator is the person so appointed under the Act.

Service refers to the low voltage overhead or underground line running from a pole or pillar owned by Power and Water, which crosses the property boundary of the block, and runs to the Point of Supply located on the block.

Service equipment refers to meters and related equipment, current transformers, test links, service fuses, seals and related equipment owned by Power and Water, used for the provision of electricity supply, and located on the customer's installation.

4. Introduction

4.1 Basic Metering Requirements

To ensure that an electricity supply is metered correctly it is essential that:

- 4.1.1 The metering equipment installed is appropriate for the customer's load and tariff, and the electricity metres shall be of a type that is approved by the National Measurement Institute for use in revenue metering installations.
- 4.1.2 All equipment shall be adequately protected from damage and interference, and **Shall Remain Readily Accessible** to authorised Power and Water staff, who require convenient and unhindered access to all meters and metering equipment located on customers' premises for Meter installation, meter reading, planned maintenance, supply and metering equipment fault rectification.
- 4.1.3 The wiring connections shall be made correctly and safely, and in accordance with the Wiring Rules.
- 4.1.4 The metering installation shall be properly inspected and tested, and accurate records shall be kept of all equipment installed and removed.

4.2 Metering Manual

This Metering Manual has been prepared for use by Power and Water staff, customers, contractors and consultants. The manual describes in detail, Power and Water requirements in regard to all electricity metering installations where those installations are used for revenue collection purposes.

This manual is to be read in conjunction with the Service and Installation Rules and the Network Connection Technical Code.

4.3 Metering Organisation

For administrative purposes Power and Water has commercial offices in Darwin, Katherine, Tennant Creek and Alice Springs. The Metering Services Branch is located in Darwin.

4.4 Metering Policy

Power and Water's metering policy as set out in this manual is determined by Power and Water Power Networks Division, and is applicable in all regions throughout the Territory.

In exceptional circumstances individual rules may be waived or varied. Applications to do so shall be in writing to the Power and Water Customer Connection Officer in Darwin or Alice Springs.

The Metering Services Branches in Darwin supply meters, metering current transformers and colour-coded wiring looms. All other components of a new installation are to be supplied by the customer or their agent.

Specialist technical advice on metering problems is available through Power and Water's Manager Metering Services in Darwin.

4.5 Customer Responsibility

The customer or his agent shall ensure that each new electrical installation and every alteration is carried out in accordance with this Manual. Early discussion with a Customer Connection Officer is advised for major customers to establish building and installation requirements, and to give adequate lead time for the acquisition of specialised equipment.

4.6 Low Voltage Metering Approval

Low voltage CT metering installations shall be approved by a Power and Water Customer Connection Officer.

4.7 High Voltage Metering Approval

All high voltage metering installations should be referred to the Manager Network Engineering in Darwin.

4.8 Maintenance of Metering Installations

Power and Water is responsible for the routine maintenance of metering installations and the replacement of any faulty meters. Property owners are responsible for the maintenance and upkeep of meter rooms, boxes and panels (including lids, doors and locking mechanisms).

4.9 Prepayment Metering

Where modifications to existing meter boxes or panels are required to enable the installation of prepayment meters, those modifications are to be carried out at the customer's cost.

4.10 Meter Panels Containing Asbestos

Where metering panels containing asbestos are installed at a property, their removal and replacement by an accredited contractor will be required before any maintenance or any modification on metering panel based on customer request is carried out on the installation. The cost of this panel removal and replacement will be the responsibility of the customer.

Where a panel containing asbestos cannot be economically replaced because of its size, any cutting, drilling or other work likely to create dust and the cleaning of the site is to be done by an accredited contractor. All freshly exposed surfaces are to be sealed in an approved manner.

4.11 Manual Amendments

Power and Water may at any time vary, amend, or add to these rules.

5. General Requirements

5.1 Incorporation of Standard Rules

The Australian/New Zealand Standard AS/NZS 3000, known as the Wiring Rules, applies to all electrical installations throughout the Northern Territory.

Metering equipment is considered to be "switchgear" as defined in those rules and all standard provisions relating to switchboards and switch rooms shall apply to metering installations.

5.2 Meter Terminal configurations:

Power and Water current standard on new installations is the direct connected bottom connect kilowatt hour meters as standard equipment for all new direct current metering installations throughout the Northern Territory.

The existing plug-in meter installations will be retained until there are changes which require the meter to be changed, for instance, an installation upgrade, in which case, the plug-in meter would be replaced by a direct connect meter.

Exception:

Single phase Plug-in metering may be specified by PWC for single phase customers in remote communities or town camps where single phase prepayment meters are used.

But a direct connected polyphase meter would be used for any new three phase connection in remote communities or town communities.

5.3 Connection to Customer's Premises

5.3.1 Service Equipment

The customer shall provide installation and mounting facilities for Power and Water service equipment in accordance with this Manual. "Service Equipment" as referred to in this manual comprises service lines and cables, circuit breakers, meters and current transformers.

5.3.2 Connections to Service Equipment

Only persons who are authorised employees of Power and Water or contractors authorised and appointed in a similar capacity shall make

any connection to, or disconnection from, any conductor directly connected to the Power and Water supply system. It is not permissible for any person to interfere with a seal, or insert a conductor into any item of the service equipment, except as authorised under the provisions of this manual. The Electricity Reform Act prescribes penalties for such interferences.

5.4 Standard Metering Equipment

5.4.1 Schedule of Standard Equipment:

All metering panels, enclosures, and supplementary equipment shall comply with the relevant Australian standard/s applicable and the relevant Electricity regulations, Metering Codes and the PWC Rules applicable at the time of connection to the electricity supply network

5.4.2 Metering Panels /Enclosures requirements:

Meter Panels Size: Meter panels/Enclosures shall be of a size to adequately accommodate the metering equipment to be installed upon it, which is sufficient to maintain the clearances as specified in the following PWC Standard drawings:

S11-2-7-1, S11-2-7-2 for one single phase meter

S11-2-7-4 for three phase meter,

For multimetering arrangement:

S11-2-7-45 for single phase meters

S11-2-7-46 for three phase meters

5.4.3 Service Protection device/ Isolating Devices - Circuit breakers for direct current metering installations:

The existing arrangement for isolation and protection of the direct current metering service is by the provision of service fuse.

This is located as follows:

In underground services, the service fuse is on the supply side of the meter at the service meter box. In overhead service areas, the service fuses are installed external to the customer's premises on the overhead pole.

Revision of the service fuse arrangement:

This service fuse arrangement has been revised to the provision of a Padlockable circuit breaker serving as the main point of isolation and protection of the service. The circuit breaker would be located in the meter box on the supply side of the meter.

Thus all new direct current metered services would have the Padlockable circuit breaker in the meter box, as the service protection device.

In addition to the above arrangement, the new overhead service areas would still have the service fuses as supplied by Power and Water and installed external to the customer's premises and new underground services would still be fed from the stripe fuse distribution pillars off isolators with fuses.

Application of circuit breaker:

The requirement to install a Padlockable circuit breaker as meter isolator applies

- To all new direct current metering installations
- Where the meter enclosure is replaced
- Where the meter location is changed
- To existing installations where the Consumers mains (or submains in multiple customer installations) are upgraded for increased current or phase requirements
- Where there has been failures associated with the service fuse which requires replacement of the entire fuse unit with holder

Purpose of the circuit breaker:

The requirement for the circuit breaker as the meter isolator is included to provide a safe and convenient isolation point for

- PWC Metering Section staff – to service and maintain their metering installation
- Electrical Contractors - to safely work on the customers' switchboard etc
- PWC officers or agents – to perform disconnections as requested by Retail
- Restoration of power supply by switching ON a tripped isolator by the customer or by PWC personnel.

The circuit breaker also provides graded electrical overcurrent protection for the customer's installation.

The circuit breaker is required to isolate the metering for a customer's installation.

Circuit breaker requirements:

The meter isolator shall be a circuit breaker with its operational status clearly visible at all times and operating mechanism accessible for local operation.

Meter isolators are to be lockable circuit breakers that have the terminals and load settings if any, under PWC security seal.

The means of locking of circuit breaker is required to be of adequate construction and permanently attached to either the circuit breaker or its enclosure.

The circuit breaker shall be enclosed in a sealable non-metallic enclosure with provisions for the attachment of security seal for the terminal covers.

Enclosures which have provisions for PWC sealing arrangement are only acceptable.

The meter isolator shall be located as per the layouts shown in the metering drawings S11-2-7-1, S11-2-7-2, S11-2-7-4, S11-2-7-45 and S11-2-7-46.

Each meter isolator shall be capable of being individually locked in the off (open) position only except for lift and fire protection feeders which shall be capable of being padlocked both in the OFF and ON position.

The circuit breaker should be suitable to be installed in climatic conditions in the Northern Territory, like high ambient temperature and high humidity, which could affect circuit breaker performance.

The rating of the metering isolation circuit breaker must be sized as a backup overload protection of the consumer's mains and as close as practical to the maximum demand as specified by the connection agreement of the tenancy related to the meter.

The meter isolator shall be a "C" curve type circuit breaker connected on the supply incoming side of the metering, and, shall be installed on the front of the meter panel.

The customer shall supply and install the required arrangement of approved sealable circuit breakers on the meter panel and shall complete all electrical connections excluding the connection to the de-energised service cable.

The customer is responsible for the maintenance of the circuit breaker and for replacement of the circuit breaker if needed.

Details and layout arrangement of Circuit breakers are given in the Metering Standard drawing.

5.4.4 Use of Circuit breaker as Main switch in multimetering Installations:

A circuit breaker, which is rated for total overload protection of the consumer's mains in accordance with AS/NZS 3000, shall be connected as the Main Switch, on the incoming side of the metering. Also suitable Circuit breakers are required for the individual meters.

5.4.5 Active and Neutral Meter Links:

Active links are required when multiple meters are to be connected to the same phase or where conductor size needs to be reduced to a size compatible with the metering. Alternately an approved in-line crimp connection with heat shrink insulation is also acceptable for downsizing of cables as above.

In multimetering installations, meter active and neutral links mounted on the rear of the meter panel shall be used. They may be installed in a position which provides access to meter links without any obstruction by any structure or wiring within the switchboard and it is safe to work on the links without isolating supply.

It is also important that these links do not impede the installation of meters or any other equipment in the meter panel.

Active and neutral meter links shall be sealable and if this is not possible, for instance, for larger sized consumer's mains, the links are to be provided within a suitable enclosure fitted with a sealable cover.

Meter links shall be of sufficient current carrying capacity equal to or greater than the current to be carried by the link; all single service meter wiring neutral links shall be a minimum rating of 100 Amp and 500 Volt

Meter links are to have separate terminals for each conductor terminated in the link.

Two screws shall be provided for each terminal of the meter links.

Phase identification of active links shall be permanently marked.

Active and neutral meter links shall be identified and marked to identify each outgoing circuit of the meter link.

5.5 Standard Meter Ratings

5.5.1 Meter Current Ratings

Meters are marked with two current values (eg. "15-100"). The lower value is the basic current I_b rating and is required for testing purposes within the laboratory. The higher value is the Rated Maximum Current (I_{max}) of the meter and is the only relevant value for installation purposes. A meter is suitable for any load that is less than its I_{max} . For example, a 15-100 meter is suitable for any load up to a maximum of 100 Amps.

In current transformer operated meters Rated Current (I_n) is specified in place of the basic current (I_b).

5.5.2 Direct connected Metering

Single-phase direct connect meters shall be provided for new installations with demands up to 100 Amps (except in remote communities where plug-in meters are used as discussed in section 5.2) and polyphase direct connect meters shall be provided for three phase installations with demands up to 100 Amps per phase.

5.5.3 Current Transformer Metering

Three-phase installations with demands over 100 Amps are to be metered with the aid of instrument class current transformers of an appropriate ratio with a secondary current of 5 Amps at the current transformers primary rated load. The CT's shall be supplied by PWC. Polyphase electronic meters are to be used on all new CT metering installations. (Refer to S11-2-7-42).

5.5.4 Temporary Supply Metering

All temporary supply metering shall comply with the requirements above for single-phase, polyphase, or current transformer installations.

5.6 Testing of Meters

5.6.1 Accuracy Requirements

Electro-mechanical meters, single-phase electronic meters and prepayment meters shall be Class 2M ($\pm 2\%$). Polyphase electronic meters are required to be Class 0.5M or 1M ($\pm 0.5\%$ or $\pm 1\%$) depending on type.

5.6.2 Manufacturer Meter Testing

All meters purchased by Power and Water are verified for accuracy by the supplier, or by an accredited calibration facility approved by the supplier. In either case, the verifying facility shall have National Association of Testing Authorities' (NATA) accreditation for the verification of kWhr meters. All new meters are also to be of a type that is approved for use for revenue metering purposes by the National Measurement Institute.

5.6.3 In-Service Testing

Inspection, testing, or maintenance of metering installations may be carried out by Power and Water technicians at any time.

5.6.4 Customers' Test Requests

Where a meter test has been requested and paid for by a customer and the meter's error is found to be outside the accuracy for that class of meter, any fees paid for the test will be refunded.

5.6.5 Special Tests

Meter tests of a special or unusual nature will be referred by Power and Water Retail Offices to the Power and Water Metering Services Section in Darwin.

5.7 Installation of Metering Equipment

The method of construction of any metering installation shall be as directed or approved by Power and Water Customer Connection Officers in Darwin or Alice Springs.

5.7.1 Metering Panels and Enclosures requirements:

Meter panels and enclosures are to fully comply with the switchboard requirements of the Wiring Rules.

Meter Panels and Enclosure boxes shall satisfy the following requirements:

- **Meter Panels Size:** Meter panels shall be of a size to adequately accommodate the metering equipment to be installed upon it, which is sufficient to maintain the clearances as specified in the following PWC Standard drawings :
 - S11-2-7-1, S11-2-7-2 for one - single phase meter
 - S11-2-7-4 for one - three phase meter
 - For multimetering arrangement:
 - S11-2-7-45 for single phase meters
 - S11-2-7-46 for three phase meters
- Consideration should be given to a larger size meter panel to accommodate extra metering equipment for possible future tariff changes and extra PWC equipment such as circuit breakers.
- Meter panels shall be constructed of insulating material to an equal or better standard than that required by the AS/NZS 3000 Wiring Rules for switchboards; and suitable for its intended use and environment, including UV exposure to where exposed to daylight. Any alteration work requiring a new meter panel shall comply with the above.

- The door opening and interior of the box shall be unobstructed.
- The box shall be constructed of galvanised steel sheet or other approved metal sheet and shall be not less than 0.75mm in thickness.
- The box shall be fully weatherproof and shall be provided with suitable drain holes in the bottom.
- The top of the box may be horizontal but preferably should slope from rear to front.
- The door of the meter box shall be either top hinged or side hinged in single domestic installations. However, only side hinged doors shall be used on multi-metered installations (both domestic and general purpose) for panels larger than 600 mm x 600 mm.
- The door(s) shall be capable of opening to 100 degrees, and it is preferable that they be secured to prevent the door opening beyond that point. Hinges shall be of a non-corroding loose fitting type. Glazed doors are not acceptable.
- Suitable provision shall be made so that the door may be opened easily by hand. If a handle is used it shall be firmly attached by screws or bolts. A suitable catch shall be fitted to hold the door in the closed position.
- The outside surface of the box shall be adequately treated for corrosion prevention.
- Suitable means of entry for cables shall be provided into the box. These entries shall be bushed or shaped to comply with the Wiring Rules. Top entry will only be permitted where approved measures are taken to control moisture ingress.
- Metal boxes shall be provided with an approved earthing terminal.

5.7.2 Minimum clearances

The following MINIMUM clearances based on the wiring rules shall be maintained on all hinged and removable switchboard panels:

Minimum Hinged Panel Area	Minimum Clearance Behind Panel	Conductor Size
Up to 0.4 m ²	75 mm	16 mm ²
From 0.4 m ² & Up to 0.8 m ²	150 mm	35 mm ²
From 0.8 m ² & Up to 1.2 m ²	230 mm	50 mm ²

For larger installations, the metering equipment may be incorporated into any standard form of switchboard construction, or be located in a separate meter room. In either case the Wiring Rules apply and all installations are subject to approval by a Power and Water Customer Connection Officer.

5.7.3 Fixing of Meter Boxes

Boxes, surrounds and enclosures shall be securely fixed to a wall or rigid supporting structure in accordance with the requirements of the Wiring Rules. The standard meter box may be recessed and tied into a surrounding wall with at least four steel bolts or equivalent straps. Alternatively, the box shall have at least four well-spaced and secure fixings consisting of steel screws or bolts. If wall plugs are used they

shall be of a durable (preferably metallic expansion) type. Wooden plugs are not acceptable.

The metering equipment shall be mounted on a hinged meter panel which is vertically hinged to ensure that the metering equipment is fixed in the vertical plane.

It should be noted that metering panels when opened to 100 degrees shall be able to support the weight of all the equipment fixed to the panel without sag or distortion of the hinge assembly or meter box.

See NP003 PWC Network Policy Installation Rules Clause 5.50 for details of meter boxes to be used in Aboriginal Communities.

5.7.4 Construction and Wiring of Meter Panels

Meter boxes, panels, enclosures and rooms are considered to be switchboards, and their construction, layout, and wiring shall be in accordance with the AS/NZS 3000 Wiring Rules.

Meter mounting facilities shall be of adequate size to accommodate the metering equipment to be installed upon it and shall be provided in the metering enclosure.

The customer/contractor shall arrange the metering equipment in a clear and logical manner, with meters and circuit breakers being located in corresponding order from left to right and top to bottom. The line connection to circuit breakers or switches shall, whenever practical, be on the top or right hand side.

Mounting of metering equipment:

All bolts/nuts/screws used to mount metering equipment on insulated meter panels shall be correctly sized for the purpose and shall be installed in a manner to prevent contact/ damage to cables.

Alternatively UV rated non-conducting mounting accessories (e.g. nylon or plastic) can be used.

Wiring of panels:

The customer is responsible for the provision of the interconnection wiring of the customers' installation and meter. All conductors shall be suitably installed such that there is no undue stress at terminals of electrical equipment when the panel is moved or in open/closed position.

Conductors connected to the electrical equipment on the switchboard panel shall be provided with sufficient free length to allow the panel to be moved, where the panel has provision to be moved/removed.

Wiring other than consumer's mains and meter wiring shall not be located behind the meter panel with the exception of the following:

- (a) *Installations of public lighting and power control apparatus whereby the wiring shall be separately loomed and double insulated into an individually enclosed switchboard.*
- (b) *Where a single customer's switchboard is an integral part of the meter panel, the wiring shall be separately loomed.*

5.7.4.1 Wiring cable material and connection to meter terminals:

Compressed (compacted) or hard drawn conductors shall not be used for meter wiring and only soft drawn Copper conductors are to be used since the conductors must be flexible enough to bend into the meter terminals.

The conductors shall be identified (labelled and coloured coded) and sized to the load they are to carry in accordance with the relevant Australian Standards (AS 3000 and AS 3008).

Contractors shall provide metering conductor minimum tails of 150 mm of cable extending through the meter panel for connection of meters. Meter terminals are designed for the connection of stranded copper conductors. Flexible copper conductors shall be terminated with suitable ferrules to allow adequate connection into the meter terminal. 16mm² and 25mm² insulated flexible cables are to be used, with un-insulated bootlace ferrules securely crimped onto the cable tails by the electrical contractor with an appropriate crimping tool. The electrical contractor shall provide the right size ferrules for the work.

The meter wiring for direct connected metering shall be PVC insulated copper cable from these standard sizes:

4mm², 6mm², 10mm², 16mm², and 25mm² size cable.

Direct connected metering neutral conductors shall not be less than 4mm² or not greater than 6mm² PVC insulated cable.

5.7.4.2 Large Conductors

If the conductor is too large for the terminal it should be terminated in an approved sealable active link and connected to the meter by a suitable copper conductor. An approved in-line crimp connection covered with approved heat-shrink insulation is acceptable.

5.7.4.3 MIMS and other High Temperature Conductors

Mineral insulated metal sheathed (MIMS) cables and cables rated at 110 °C or higher shall not be terminated directly in metering equipment because of their high temperature rise and the possible distortion of equipment by solid conductors. The contractor shall provide a suitable stranded conductor using a suitable connector.

5.7.4.4 Aluminium Conductors

Aluminium conductors shall not be terminated directly in metering equipment. A suitable length (at least 600 mm) of copper conductor shall be provided within the meter box or enclosure to facilitate installation and removal of the meter panel. At least 300 mm of the aluminium conductor should be left accessible to allow for possible future re-termination. Copper-clad aluminium conductors shall be treated in the same manner as aluminium. An approved aluminium-to-copper connector shall be used for this purpose.

5.7.4.5 Looping of Conductors

The connections to the supply and neutral terminals of any meter shall not be looped to or from any other meter. Individual wiring to each meter shall be provided from sealable active and neutral links, junction boxes or other approved arrangements. Meter neutrals shall be connected via a sealable link. Looping of neutral conductors through meters is no longer permitted.

5.7.4.6 Meter Neutral Conductor

The metering neutral shall be connected to the main neutral using a sealable meter neutral link.

5.8 Location of Metering Equipment

5.8.1 Protection from Damage

The customer shall take whatever action is considered necessary by Power and Water's Customer Connections Officers and the customer shall provide adequate and reasonable protection to protect Power and Water metering equipment from mechanical damage, or damage from exposure to the environment. The metering installation shall be reasonably protected as far as practicable, against mechanical damage, vibration, weather, corrosion, spread of fire, vehicles impact, vandalism etc.

External Location of metering equipment:

Where metering equipment is installed on the outside of a building, they shall be enclosed in a suitable meter enclosure mounted on, or recessed into the outside wall of the building. Meter enclosures shall not be installed where they protrude or open across a property boundary.

Meter location on Temporary structures:

Where a meter enclosure is installed on a temporary structure, the supporting structure shall be mechanically sound. Where the temporary structure is used for building purposes it shall comply with the requirements of AS/NZS 3012 .

5.8.2 Unsuitable Mounting Locations

In general, the following locations are considered unsuitable for the mounting of metering equipment:

5.8.2.1 Stairways, ramps, narrow passageways or other confined spaces.

5.8.2.2 Vehicle docks, driveways and factory passageways where the equipment or the person working on it would not be effectively protected.

- 5.8.2.3** Positions in close proximity to or over or under machinery or open type switchgear.
- 5.8.2.4** Locations where the atmosphere is liable to be affected by fumes, dampness or dust of a nature that may cause deterioration of equipment or unsafe working conditions.
- 5.8.2.5** Hazardous locations as defined in the Wiring Rules.
- 5.8.2.6** Where the normal ambient temperature exceeds 45°C.
- 5.8.2.7** Where there is insufficient light.
- 5.8.2.8** In areas subject to high intensity magnetic fields.
- 5.8.2.9** In multiple installations, the meter position is not to be situated within any lockable portion of an individual tenancy (i.e. shall only be located in a common area).

Any other location considered unsuitable or unsafe by Power and Water's Customer Connection Officers.

5.8.3 Location on Domestic Premises

The location of the metering equipment on domestic premises shall be as follows, or if there is any doubt, as determined by Power and Water's Customer Connections Officer.

- 5.8.3.1** On any clear space on the front or on either side of the building within 1.5 metres of the front or front corner window.
- 5.8.3.2** If a clear space is not available as in 5.8.3.1 above, on the main entrance side as near to the front of the building as practicable.
- 5.8.3.3** If any other wall faces the service point of entry, on any clear space on that wall.
- 5.8.3.4** In elevated domestic premises having no lower ground floor external walls, the meter position shall be located on one of the external supporting pillars as in 5.8.3.1 above.

The position shall be such that any future building alterations do not enclose the meter position or make it inaccessible. (See also Clause 5.10.3.1).

5.8.4 Location on Commercial Premises

In any public building or multiple customer installation the metering equipment shall be located in an approved position in a common use area or near a public entrance to the building. The standard arrangement is to provide a meter or switch room in which all meters for the premises are located. Consideration may be given by Power and Water's Customer Connections Officer to requests for metering positions in other areas where there are a number of separate customers and the meters may be grouped in convenient locations.

5.8.5 Elevated Locations

Any elevated floor, platform or stairway used to provide access to metering equipment shall be fitted with a substantial and permanent safety railing and the access to elevated positions shall be

provided by an approved fixed stairway or ramp protected by safety handrail.

Where the customer is required to provide a platform to access a meter installation, it shall be designed to AS 1657 "Fixed platforms, walkways, stairways and ladders — Design, construction and installation".

5.8.6 Clearances around Metering Locations

Adequate unimpeded space is required in front of the meter panel for Power and Water employees to read meters and to work safely. An unimpeded space of at least **600mm** is required between any wall/obstruction to the meter panel with **door opened** in any position (as per AS 3000). The top of any meter shall not be higher than **2000 mm** and the bottom of any meter terminal cover shall not be less than **750 mm** above the adjacent ground, platform or floor. In the case of multiple customer installations, direct current meters may be installed such that the bottom of the meters terminal cover is down to **600 mm** above ground or floor level provided that they are mechanically protected by a suitable door. In such cases the door opening shall be large enough to ensure ready access to the meters for reading and maintenance.

5.9 Protection from Magnetic Interference

5.9.1 Requirements for Protection

The presence of external magnetic fields from nearby heavy conductors can cause errors in the meter registration, and the meter reading may be either lesser or greater than the true consumption. To ensure maximum accuracy of the metering installation it is necessary to take adequate precautions against the effects of external magnetic fields.

5.9.2 Grouped Conductors

Where all conductors of a circuit are spaced close together as in a multi-core cable or a group of single-core cables in flat or bunched formation, the magnetic fields effectively cancel and there is no special requirements for spacing or shielding.

5.9.3 Separated Conductors

Where conductors of a circuit are physically separated, as in spaced single core cables, busways, or busbars, the minimum spacing between any point on the meter and any point on the nearest conductor of the circuit shall be in accordance with the following table. Intermediate points may be obtained by interpolation.

Current in Nearest Conductor (A)	Minimum Distance from Meter (mm)
150	Nil
400	500
600	700
1000	900
1500	1200
2000	1400
3000	1700
4000	2000

5.9.4 Magnetic Shielding

Magnetic shielding may be used to reduce the minimum clearance given above by enclosing the conductors in a mild steel container of suitable thickness. Multiplying factors are given in the table following:

Thickness of Mild Steel Plate (mm)	Multiplying Factor
5.0	0.25
2.5	0.5
1.5	0.75

5.10 Access to Metering Installations

5.10.1 Requirements for Access

Power and Water requires convenient and unhindered access to all meters and metering equipment located on customers' premises for Meter installation, Planned maintenance and meter reading during normal business hours (See Clause 5.10.3) and at all times for supply and metering equipment fault rectification and also at any other time agreed by the customer.

The access shall be via the closest and most convenient pedestrian route within the property.

5.10.2 Locking of Metering Installations

Any locking of meter rooms and boxes shall be compatible with the Power and Water master key meter lock system.

Standard Power and Water locks are:

- (a) Standard meter panel locks, L&F (Low and Fletcher) system, as supplied with B & R meter boxes and cubicles comply with Power and Water locking of metering installations. The keys for these boxes are stamped with the number 92268.
- (b) Lockwood cylinder door lock 201 SC with Power and Water master-key barrel for meter room doors and gates.
- (c) Lockwood 234 Padlock with Power and Water master-key barrel.
- (d) Any mortice lock assembly which accepts the Lockwood 570 SGL series cylinder.

Padlocks are available from the Customer Service counters at Power and Water commercial offices in Darwin, Katherine, Tennant Creek and Alice Springs.

Where the metering equipment has to be within a restricted area of a business for reasons of security (eg. banks), approval for this may be given by the Power and Water Customer Connections Officer provided that suitable arrangements can be made to access the equipment during normal business hours.

5.10.3 Locking of Customer's Premises

- 5.10.3.1** In domestic installations where the meters are behind a locked gate or door the customer shall provide a locking arrangement that will enable one of the locks described in Clause 5.10.2 above to be installed to allow access to Power and Water Electricity Officers.
- 5.10.3.2** In public buildings or multiple customer installations the metering equipment or enclosure shall be accessible to Power and Water Electricity Officers during normal business hours without having to obtain a key to the premises.

5.11 Labelling of Metering Installations

5.11.1 Identification of Premises

All metering panels and equipment shall be labelled in accordance with these rules in addition to the labelling requirements of AS/NZS 3000. For exterior applications, UV and moisture resistant material is to be used for labelling.

The numbers shall be permanent type Labels, clearly visible and of a raised type such that the figures protrude above the plane of the surface they are fixed to.

The number shall be screwed to, or adjacent to, the door. Stickers and painted numbers are not acceptable.

Domestic metering:

In rural areas, meter boxes shall be equipped with a label indicating the relevant Lot number.

For Commercial installations, a permanent fixed label on the tenancy main switchboard is acceptable.

In multi-metered installations circuit breakers and meters are to be labelled to identify tenancy numbers.

The multi-meter panel shall be labelled with the tenancy number for each meter and shall indicate the relationship of meters, circuit breakers and other equipment supplied from the meter panel.

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

5.12 Sealing of Metering Equipment

5.12.1 Requirements for Sealing

Adequate sealing points shall be provided by the customer on all meter covers, fuses, circuit breakers, links, CT chambers, inspection doors or other equipment where sealing is a requirement.

Sealing of all metering equipment shall be carried out by Power and Water staff as soon as supply is made available to the customer.

Interference with Power and Water seals or metering equipment is an offence under the Electricity Reform Act.

5.12.2 Sealing Equipment

The sealing system used by Power and Water is the "Maun" high security sealing system and approved sealing tools with unique markings are registered and issued to Power and Water employees on an individual basis. Also the Harcor type security seals and sealing tools are being used for metering sealing purpose.

Two seal formats are used, flagged and barrel, and it is imperative that these be fixed using only approved sealing tools and sealing wire issued by Power and Water Metering Services in Darwin and Alice Springs. The sealing wire should be kept as short as practicable.

5.12.3 Meter Case Seals

All meter cases shall be sealed with at least one high security seal. The seals shall be fitted by Power and Water metering technicians or, in the case of new meters, by the meter manufacturer. In either case the seal is to be embossed or stamped so as to identify the organisation and individual who fitted the seal. The meter case seals shall not be broken by any person other than an authorised Power and Water employee in the performance of their duties. If any meter case seal is found to be missing or broken, a temporary seal shall be fitted immediately and the circumstances reported to the Power and Water Manager Metering Services in Darwin.

5.12.4 General Service Seals

Meter cases shall be sealed with a verification seal and/or verification sticker from an approved meter verification authority. Other metering sealing points are to be sealed with PWC approved seals and sealing equipment.

Security seals may only be removed by authorised Power and Water employees / authorised contractors in the performance of their duties. If a verification sticker or any security seals is found to be removed or damaged, the circumstances are to be reported to customer connections officers in Darwin and Alice Springs.

5.13 Earthing of Metering Equipment

5.13.1 Requirements for Earthing

All metal meter boxes, enclosures, supports or surrounds; and all metal-cased equipment located on the meter panel shall be earthed in accordance with the Wiring Rules.

5.13.2 Location of Earthing Connections

If the main switch is located on the meter panel (as in all multi-customer installations) the main earth and MEN connections for the whole installation shall be made at the metering location and not at any individual customer's switchboard.

If the main switch is remote from the metering location a separate earthing conductor shall be run from the main switchboard to the metering equipment.

Earthing connections may be soldered or made at an approved earthing bar or link in accordance with the Wiring Rules.

5.13.3 Double Insulation

In single customer installations where the metering point is physically remote from the remainder of the installation (eg. at the property boundary) Power and Water's Customer Connection Officers may approve the use of double insulation for the metering equipment and the consumer's mains as an alternative to the requirements set out above. (Refer to Installation Rule 5.25).

6. Direct Current Metering

6.1 Introduction

Direct current metering refers to a method of metering where the kilowatt hour meter is connected into the customer's load circuit, so that the load current passes through the meter's current coil/s. The existing direct current meters may be of the direct connected or socket base type, although only bottom connected meters are permitted by Power and Water for new service connections.

6.2 Application of Direct Current Metering

Direct current metering is the most common method of metering for domestic and small commercial installations. It is applicable to single-phase and polyphase services up to 100 Amps per phase. Refer to the Power and Water Installation Rules for approved service sizes.

6.3 General Requirements

The customer shall observe all of the General Requirements of this manual insofar as they relate to direct current metering in domestic or commercial premises. The customer shall also comply with all directions and instructions from Power and Water's Customer Connections Officers in regard to each specific installation.

6.4 Single Customer Installations

For single customer installations requiring one or more phases, the customer shall provide the appropriate size metering panel and box to house the metering equipment with recommended clearances as per the Metering standard drawings S11-2-7-1 and S11-2-7-2.

6.5 Multiple Installations using Meter Boxes

Where the metering for multiple installations is installed on a single panel, the layout of the equipment shall conform to the metering standard requirements. (Refer to Section 7.7 – Multi-metering Installations Involving CT Metering.)

6.6 Fitting of direct current bottom connect meters

Power and Water Corporation staff shall install the meters and seal as required.

6.7 Installations in Meter Rooms

Where the metering for any number of customers is not contained in meter boxes, the customer shall provide a suitable Meter Room for the purpose.

Meter rooms shall be kept clean, tidy and provide unrestricted access to metering equipment. The room shall also be of an adequate size as approved by Power and Water's Customer Connections Officer, and shall have approved lighting installed. A light switch is to be located on the inside wall of the meter room adjacent to the unhinged vertical edge of the door.

The room shall be located in a position that affords ready access to Power and Water employees. The access door need not have a lock, but if one is fitted it shall be of the standard type as used and provided by Power and Water.

The layout of equipment in meter rooms shall conform where applicable to this manual and be approved by Power and Water's Customer Connections Officer.

7. Low Voltage Current Transformer Metering

7.1 Introduction

Where an installation's maximum demand exceeds the permissible amount for direct current metering (100A), the installation shall be metered with the aid of current transformers (CT metering). In this type of installation the CT reduces the load current to a value that can be read by a suitable meter. It is therefore necessary to apply a multiplication factor to the meter's reading to determine the total consumption for the site. This multiplication factor may be applied internally in the meter's gearing (commonly referred to as primary rated metering) or externally by the Power and Water computerised billing systems (commonly referred to as secondary rated metering).

7.2 Application of Current Transformer Metering

Where CT metering is used it is to be wired as a four wire system with a current transformer in each phase of the supply.

7.3 General Requirements

The customer will observe all relevant requirements as set out in this manual and comply with all directions and instructions from Power and Water's Customer Connections Officer in regard to each installation.

Current transformers, meters and secondary wiring looms will be supplied by Power and Water and will remain its property.

Current Transformers

Current transformers shall meet the requirements for measuring current transformers in accordance with AS/NZS 60044.1-“Instrument transformers Part 1: Current Transformers”

The type of current transformer shall be selected from the following mentioned types for the load current range which would be suitable for the maximum demand applicable to the metering installations:

ESAA Type S 200/5 Class 0.5S Extended Range

ESAA Type T 800/5 Class 0.5S Extended Range

ESAA Type W 1500/5 Class 0.5S Extended Range

(Based on Energy Supply Association of Australia Limited)

Where a current transformer chamber and meter panel are part of a main switchboard assembly but are not adjacent to each other, provision shall be made for a dedicated steel enclosed cableway, duct or conduit to contain the secondary wiring in order to maintain its integrity.

Where the meter and test link panel is not an integral part of the customer's main switchboard assembly or cubicle, a separate meter box and panel shall be supplied with the interconnecting wiring enclosed in steel conduit. Plastic coated flexible steel products such as 'Anaconda' or 'Liquitite' are acceptable provided the correct fittings are used and sufficient fixings are used to support the weight of the conduit.

Whichever method is used the conduit shall;

- (a) Contain only metering installation wiring.
- (b) Have a minimum of 32 mm diameter.
- (c) Contain no elbows and have no more than three 90 degree bends or equivalent sets.
- (d) Contain no inspection points.

All secondary meter cables shall be:

- (a) Trace coloured to ESAA S(b)14-1980
- (b) Be no less than 2.5 mm² in cross-sectional area for runs up to 10 metres, and no less than 4 mm² for runs up to 20 metres. Where a requirement exists for runs in excess of 20 metres the matter shall be discussed with the Power and Water Manager Metering Services at the planning stage.

7.3.1 Installation of Current Transformers

Where current transformers are fitted, a 100 mm minimum free length of accessible insulated cable or bus shall be provided for the safe measurement of primary currents using clip-on type tong ammeters. Where the respective bar primaries or bus are used for this purpose the insulation is to be at least 0.6/1.0 kV grade.

The primary busbars passing through the current transformers are to be removable. Mains cables within current transformer chambers or enclosures shall be installed and connected in a manner that allows

direct frontal access to the current transformers for testing and replacement.

The current transformers shall be mounted in a manner that allows for the easy changing of ratios on multi-tapped transformers. Current transformers are to be installed so that the P1 side of the CT is facing the incoming supply and the P2 side is facing the load side.

WARNING

Current transformers can generate dangerously high voltages on the secondary terminals if left open-circuited under load condition. Their S1 and S2 terminal should always be shorted at the test link where the meter is to be installed.

7.3.2 Potential Metering Circuitry

The potential wiring shall originate on the line side of the current transformers and shall be protected by fuses in each phase. Three 32A, 440 V HRC fuse units with 10A staggered offset tag cartridge fuse to AS 60269 form part of the active metering voltage supply circuit; The fuses are to be mounted in the top right hand front corner of the CT enclosure. The fuse board is to be mounted on a suitable mounting plate. The fuse board is to be located inside the CT chamber and is to be mounted in such a manner that when the fuse holders are removed, they are pulled directly outwards away from the chamber. Sideways removal of fuse holders within the chamber is not permitted.

Cables used to connect the fuse units to the active conductors shall be minimum size of 6.0 mm² SDI cable arranged to minimise the likelihood of a short circuit developing over the life of the electrical installation, ie, no potential to contact a busbar or conductor of the opposite phase, or exposed metal.

7.3.3 Wiring and Layout of Equipment

The contractor shall mount the current transformers, metering test link, potential fuses. The contractor shall also install and terminate the secondary wiring loom between the current transformer chamber and lower side of the test link.

Power and Water metering technicians will install the meter and terminate the wiring between the meter and the test link and program all electronic meters.

Surface wiring of meter panels is not permitted.

The colour code of the current and voltage circuitry wiring shall comply with all aspects of this manual and any additional requirements that may be requested by Power and Water's Customer Connection Officer. Wiring looms are supplied by Power and Water Metering Services in Darwin and Alice Springs.

CT Meter Voltage and Current Wiring shall be connected in accordance with Standard drawing S11-2-7-42.

7.3.4 CT metering - Neutral Connections

The arrangement must allow the main neutral and MEN connections to be safely connected or disconnected without isolating the supply to the switchboard or moving other cables. The Main neutral and MEN connection shall not be behind any sealed section.

A meter neutral label shall be attached to the meter neutral conductor adjacent to its connection to the main neutral.

LVCT meter neutral shall connect in the CT chamber.

7.4 Requirements for Metering Cubicles

All cubicles or enclosures are to comply with the following basic requirements of this manual:

- (a) CT chambers shall have at least two diagonally opposite sealing points and be positioned so that the removal of the enclosure's cover cannot be achieved without the removal of all seals.
- (b) The metering panel shall not be less than 500 mm x 500 mm and is to be easily removable.
- (c) Where locks are used for the securing of cabinet doors, they shall be of a standard type as used by Power and Water (Refer to Clause 5.10.2).
- (d) Access to any of the metering circuitry terminations shall not be possible without the removal of a Power and Water security seal.
- (e) Where metering cubicles and boxes are exposed to weather, the enclosure shall have a protection not inferior to IP53.
- (f) In single CT metering installations both the incoming neutral and main earth conductors shall pass through the chamber in which the current transformers are mounted. (Refer to Clause 7.7 (d) for multi-metered installations.)
- (g) Provision within that chamber shall be made for connection of the metering neutral to the mains neutral via a link or bus bar. Connection of the metering earth to the main earth is to be done in a similar manner, or by soldered connection.
- (h) The current transformers shall be fixed in the CT chamber using tapped holes or stud bolts and the method of fixing shall be such that the busbar passes through the CT's toroidal centre. There should be sufficient spacing between the CTs to allow for the removal of any one CT without having to remove adjacent CTs or equipment.
- (i) The metering cubicle is only to be used for the housing and connection of metering equipment and shall NOT contain any other cable or switchboard apparatus that is not directly related to the metering installation.

7.5 Metering Incorporated In Switchboards

Where the metering and test link panel is enclosed within a switchboard, the metering panel shall be not less than 500 mm x 500 mm. All associated wiring shall comply with this manual, and particular reference is made to the proximity of metering equipment to other installation wiring (Refer to Clause 5.9).

7.6 Accessibility of Metering Equipment

(Refer to Clause 5.10).

7.7 Multi-metering Installations Involving CT Metering

Where multi-metering installations employ a combination of direct current and current transformer metering supplied from a common switchboard, the following shall apply:

- (a) Drawings of the metering switchboard arrangements shall be submitted to Power and Water's Customer Connection Officer in Darwin or Alice Springs for prior approval.
- (b) The customer shall observe all relevant requirements of this manual, and comply with all directions and instructions from Power and Water's Customer Connection Officer in regard to each installation.
- (c) Each separately metered supply shall be equipped with a circuit breaker that is capable of being sealed or locked in the off position. This point of isolation shall be on the supply side of the installed Power and Water metering equipment. The sole exception is where the Wiring Rules require lifts and fire protection equipment to be directly supplied from the line side of the main switch.

Note: Refer to Standard Drawing S11-2-7-37 for examples of possible combinations.

- (d) If it is not practicable for the main earth and neutral to pass through the CT chamber, then a continuous extension of bus bar from the main earth and neutral bar shall protrude into the CT chamber to provide a secure connection point for the secondary meter wiring earth and neutral. (Refer to Standard Drawing S11-2-7-42).

8. High Voltage Metering

8.1 Introduction

Where a customer takes supply at high voltage, the metering will be carried out using both current and voltage transformers (commonly referred to as HV metering). The metering transformer units which can either be pole-top or indoor metering units shall be in accordance to the PWC specifications and standard drawings.

8.2 Application of HV Metering

HV metering will be installed as directed by Power and Water's Manager Network Engineering.

8.3 General Requirements

Insofar as they relate to HV metering, all of the requirements of this manual and any additional directions given by Power and Water's Manager Network Engineering are to be observed. The cost of purchase and installation of HV metering equipment will form part of the negotiations for provision of power supply. The installation will be metered using a four-wire metering system with a current and voltage transformer in each phase of the supply.

The metering transformers shall comply with the following:

Current Transformers

Class 0.5M

Rated burden 15 VA

To AS 60044.1

Voltage Transformers

Class 0.5M

Rated burden 100 VA

To AS 60044.2

Rated Voltage factor of 1.9

Standard Current Transformer Ratios

25/50/100/5 Amps

100/200/400/5 Amps

400/800/1200/5 Amps

Indoor high voltage metering installations shall be equipped with a secondary termination chamber containing links for the secondary wiring from the current and voltage transformers, and for the housing of secondary voltage fuses. The secondary termination chamber shall be sealable/lockable and is to be located external to the high voltage metering chamber. Metering panels used for the purposes of HV metering shall be a minimum size of 500 mm x 500 mm.

9. Interval Metering

9.1 Introduction

Interval metering involves the use of electronic meters with in-built time clocks and a data storage capability. They may also include equipment that allows the meter to be remotely read via communications systems.

9.2 General Requirements

Insofar as they relate to interval metering, all of the requirements of this manual and any additional directions given by Power and Water's Manager Metering services are to be observed.

10.0 SMALL SCALE PARALLEL CUSTOMER GENERATION (VIA INVERTERS)

10.1 Introduction

This clause outlines requirements for the installation of metering for private generation facilities on a customer's premises that are connected to the distribution system (grid) via an inverter. The generation source is most commonly solar photovoltaic (PV) arrays, but other sources are applicable.

10.2 Metering Requirements

Power and Water will outline its metering requirements for the installation. The metering arrangements for customers selling excess energy back to Power and Water are as below:

10.2.1: **Type-1 scenario:** Type 1 scenario is no longer available for new installations.

10.2.2: **Type-2 scenario:** The condition where the inverter generation cable is connected to the customer switchboard.

a) Single phase customers: The customer must make provisions for replacing the existing single phase meter (at the main meter box) with a Bi-directional single phase bottom connect meter.

b) Three phase customers: The customer must make provisions for replacing the existing three phase metering arrangement with a bi-directional three phase bottom connect meter.

10.3 Connection Point

The generation source shall be connected at the box where the meters are located. This can be the main switchboard however it is typically within a separate meter box. This is in exception to AS4777.1 Clause 5.3.1, which states that the inverter must be connected to a switchboard.

The generation system must be connected to a dedicated circuit. The rating of the inverter circuit cables and all the cables which carry inverter output must be rated for at least the full output of the inverter, refer to the AS/NZS 3000.

10.4 Switching Requirements

The switching requirements for the two scenarios are as follows:

10.4.1 Type 1 Scenario- Type 1 scenario is no longer available.

10.4.2 Type 2 Scenario- Consumer Switchboard (or Distribution Board)

The following isolation switches in the consumer switchboard (or distribution board) that is connected directly to the *PV source* must be of the lockable or sealable form for safe isolation:

- (a) The supply main switch from the main meter box.
- (b) The generator supply switch from the *PV source* (Note: In accordance with AS3000 this will be a lockable circuit breaker)

10.5 Generator Supply Isolating Switch

The generator supply isolating switch must be located within the box at which the generation source is connected.

Appendix

Metering Drawings

Serial No	Title	Drawing No
1	Metering Panel for 1 meter	S11-2-7-1
2	Metering Panel for 1 meter and consumers switchboard	S11-2-7-2
3	Metering panel for 1 X 3 phase consumer up to 100 A	S11-2-7-4
4	Component Drilling details-Meters –Single phase and three phase	S11-2-7-23
5	Standard C.T. metering cubicle Hinged	S11-2-7-29
6	Standard C.T. metering cubicle Fixed	S11-2-7-30
7	Multi metering Installations	S11-2-7-37
8	CT metering- Wiring Diagram for one 3 phase meter	S11-2-7-42
9	Extended Range of CTs	S11-2-7-44
10	Hinged Meter Panel Arrangement Single Phase	S11-2-7-45
11	Hinged Meter Panel Arrangement Poly Phase	S11-2-7-46
12	PV metering- Type -1 -Single phase (Not for new connections)	S11-2-7-47
13	PV metering- Type -1 -Three phase (Not for new connections)	S11-2-7-48
14	PV metering- Type -2 -Single phase	S11-2-7-49
15	PV metering- Type -2 -Three phase	S11-2-7-50
16	Remote communities multimetering for upto 12 consumers	S11-2-7-51
17	Indigenous Duplex Housing Prepayment Metering arrangement	S11-2-7-52
18	Wiring Schematic for Multimetering panels-Example with 9 single phase meters	S11-2-7-53

Please refer to the Power Water website for the current version of the meter manual drawings:

Meter manual drawings