SA Water

Engineering

Technical Standard

TS 0302 – The design of stand-alone solar power supply systems

Version: 3.0
Date: 25 September 2024
Status: Final
Document ID: SAWS-ENG-0302
Confidentiality: OFFICIAL

Government of South Australia

Issue and version number

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Documents superseded by this standard

The following documents are superseded by TS 0302:

a. TS 0302, Version 2.0.

Significant/major changes incorporated in this edition

Updates in this version of the Technical Standard include:

a. Updated in accordance with the SA Water Technical Standard Template Version 8.1 and the SA Water Style and Writing Standard Version 2.0.

b. Internal references updated.

Updates throughout this document have been highlighted in yellow.

Document controls

Version history

Version	Date	Author	Comments
1.0	30-06-2018	Justin Hamra	New document TS0302
2.0	10-03-2022	Justin Hamra	Periodic review and update
2.1	25-09-2024	Justin Hamra	Technical Standard Template changed to 8.0. Internal references updated.
2.2	07-01-2025	Neil Smith	Technical Standard Template changed to 8.1. Internal references updated.
3.0	22-01-2024	Justin Hamra	Issued for use

Template: Technical Standard Version 8.1, 27 September 2024.

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1 Introduction

SA Water is responsible for the construction and commissioning of an extensive amount of engineering infrastructure.

This standard has been developed to assist in the design, maintenance, construction, and management of this infrastructure such that it is safe and functional.

1.1 Purpose

The purpose of this standard is to detail minimum requirements to ensure that assets covered by the scope of this standard are constructed and maintained to consistent standards and attain the required asset life.

1.2 Glossary

Terms and Abbreviations utilised in this Standard are included in the following sections. The definitions presented below are to be used when interpreting this Standard and actions undertaken in relation to this Standard. Where a conflict exists, clarification is to be sought from SA Water.

1.2.1 Definitions

The following is a list of Terms applicable to this document:

Term	Description
Accepted	Determined to be satisfactory by SA Water's Representative.
Allow	Means that the cost of the item referred to is the responsibility of the Constructor
Constructor	The organisation responsible for constructing and installing infrastructure for SA Water whether it be a third party under contract to SA Water or an in-house entity.
Contract	A set of documents supplied to Constructor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes.
Corrosive Environments	Any environment where there is a presence of destructive chemicals in which the electrical assets are subject to harmful effects. Examples of destructive chemicals are: a. Hydrogen Sulphide. b. Ammonia. c. Chlorine. d. Sodium Chloride; etc. Any installation located close (within 1 km of the ocean) or in high ground water environments (exhibiting salinity) should be considered as a corrosive environment for this Technical Standard.
Designer	The organisation responsible for designing infrastructure for SA Water whether it be a third party under contract to SA Water or a Constructor, or an in-house entity. A Designer is a person who effects design, produces designs or undertakes design activities as defined in the *Work Health and Safety Act 2012 (SA)*.
Informative	Means "provided for information and guidance".
Inspection	Measuring, testing or examining of Work, materials or goods or services (includes raw materials, components and intermediate assemblies) for determining conformity with the Requirements.

Term	Description
Manufacturer	A person, group, or company that owns and operates a manufacturing facility that provides materials for use in SA Water infrastructure.
Must	See Shall
Person/s	Each word implying a person, or persons shall, where appropriate, also be construed as including corporations.
Provide	Means "supply and install".
Requirement	Need or expectation that is stated within the Contract.
Responsible Discipline Lead	The engineering discipline expert identified in the 'Approvers' table (via SA Water's Representative).
SA Water Project Requirements	Documentation (e.g., Request for Quotation, Functional Specification etc.) specifying SA Water's requirements for a given project, and inclusive of SA Water's Technical Governance.
SA Water Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): Superintendent's Representative (e.g. AS 4300 and AS 2124 etc.) SA Water Project Manager SA Water nominated contact person
Shall ~~and Should~~	Indicates~~In this standard the word "shall" indicates~~ a requirement that is to be adopted to comply with the standard. ~~The word "should" indicates practices which are advised or recommended.~~
Should	Indicates practices which are advised or recommended, but is not required
Site Schedule	The schedule of information that should be completed at the project definition phase. This information should be passed to the designer/installer for them to complete their design of the required Stand-alone Solar Power Supply System. Appendix B lists a template and example.
Standard	Reference to a SA -Water Technical Standard, Australian Standard, or International Standard.
Supplier	A person, group or company that provides goods for use in SA Water infrastructure.
Switchboard	An assembly of circuit protective devices, with or without switchgear, instruments or connecting devices, suitably arranged and mounted for distribution to, and protection of, one or more submains or final subcircuits or a combination of both.
Technical Dispensation Request Form	This form is part of SA Water's Technical Dispensation Request Procedure which details the process by which those required to comply, or ensure compliance, with SA Water's technical requirements may seek dispensation from those requirements.
Voltage	a. Extra-low voltage: Not exceeding 50VAC or 120 V ripple-free DC Low voltage: Exceeding extra-low voltage, but not exceeding 1,000VAC or 1,500VDC b. High voltage: Exceeding low voltage.
Work	Elements of a project which require design and/or construction.

1.2.2 Abbreviations

The following is a list of Abbreviations, Acronyms and Initialisms used in this document:

Abbreviation	Description
AGM	Absorbed Glass Mat
AC	Alternating Current
DC	Direct Current
AS	Australian Standards
LED	Light Emitting Diode
LiFePO4	Lithium Iron Phosphate
PV	Photovoltaic
RTU	Remote Telemetry Unit
SA Water	South Australian Water Corporation
SCADA	Supervisory Control and Data Acquisition
TDRF	Technical Dispensation Request Form
TS	SA Water Technical Standard
VRLA	Valve-Regulated Lead Acid

1.2.3 Terminology

The following is a list of specific interpretations for Terminology used in this standard.

- Where an obligation is given and it is not stated who is to undertake these obligations, they are to be undertaken by the Constructor.
- Directions, instructions and the like, whether or not they include the expression "the Constructor shall" or equivalent, shall be directions to the Constructor, unless otherwise specifically stated.
- Where a submission, request, proposal is required and it is not stated who the recipient should be, it is to be provided to SA Water's Representative for review.
- Each word imparting the plural shall be construed as if the said word were preceded by the word "all".
- "Authorised", "approval", "approved", "selected", "directed" and similar words shall be construed as referring to the authorisation, approval, selection or direction of SA Water's Representative in writing.
- "Submit" mean "submit to the SA Water Representative or their nominated delegate".
- Unless noted otherwise, submissions, requests, proposals are to be provided at least 10 business days prior to work commencing or material ordering (unless noted otherwise).

1.3 References

1.3.1 Australian and international

The following table identifies Australian and International standards and other similar documents referenced in this document:

Reference	Title
AS/NZS 1664	Aluminium structures (Series)
AS/NZS 1170	Structural design actions (Series)
AS 1768	Lightning Protection
AS/NZS 3000	Wiring Rules
AS 3600	Concrete structures
AS 4086.1	Secondary batteries for use with stand-alone power systems - General Requirements
AS 4100	Steel structures
AS/NZS 4509.1	Stand-alone power systems - Safety and installation
AS/NZS 4509.2	Stand-alone power systems - System design
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/NZS 5603	Stand-alone inverters – Performance requirements

1.3.2 SA Water documents

The following table identifies the SA Water standards and other similar documents referenced in this document:

Reference	Title
TS 0132	Operating and Maintenance Manuals
TS 0300	Supply and installation of low voltage electrical equipment
TS 0101	Safety in Design

2 Scope

2.1 Scope and application of this Technical Standard

This Technical Standard covers the design, supply and installation of stand-alone solar power supply systems for low and extra-low-voltage equipment.

This Technical Standard shall be read along with the associated project specifications, drawings, and any documents annexed to the specifications. The provisions of this Technical Standard shall apply unless they are specifically deleted or amended in the Contract or drawings, which shall then take precedence. The currency of these standards should be checked before use.

SA Water encourages and welcomes suggestions as to the improvement of this standard for future releases. These suggestions should be passed through to the SA Water Principal Electrical Engineer.

2.2 Technical dispensation

Departure from any Requirement of this Technical Standard shall require the submission of a Technical Dispensation Request Form (TDRF) for the review and approval (or otherwise) of the SA Water Principal Engineer on a case-by-case basis.

The Designer shall not proceed to document/incorporate the non-conforming work before the Principal Engineer has approved the proposed action in writing via the TDRF.

SA Water requires sufficient information to assess dispensation requests and their potential impact. The onus is, therefore, on the proponent to justify dispensation request submissions and provide suitable evidence to proceed to document/incorporate the non-conforming work before the Principal Engineer has approved the proposed action to support them.

Design projects that are carried out without being appropriately sanctioned by SA Water shall be liable to rejection by SA Water and retrospective rectification by the Designer/Constructor.

2.3 Hazards

Hazards shall be identified and addressed in accordance with TS 0101.

2.4 Design criteria

The design criteria must be ascertained and agreed upon with SA Water or its representative during all stages of investigation, concept design, and detailed design to achieve a value-for-money installation that is functional and has minimum or negligible risks to SA Water. The design criteria should consider the following aspects:

a. Life Cycle Costs:

   Designs should be innovative and incorporate the appropriate techniques and technology, in conjunction with the selection of appropriate equipment, to minimise the life cycle costs while satisfying operation and maintenance requirements. Energy consumption must be given particular attention in this respect.

b. Security of Operation:

   Designs should consider the failure of a single item of equipment or a fault in a particular area of an installation is confined to the associated part of the installation and does not affect the continuous operation of the remaining parts of the installation, where possible.

c. Reliability:

The installations are to be designed to minimise the likelihood of a failure, considering the electricity supply characteristics, ambient conditions, load characteristics and operation and maintenance requirements.

d. Upgradability:

The installations are to be designed to facilitate future upgrades where applicable.

e. Interchangeability:

The installations are to be designed to maximise the interchangeability of components and assemblies as far as possible, improving flexibility and reducing the spare parts inventory.

f. Operation, Maintenance and Fault-Finding Facilities:

The installations are to be provided with suitable and adequate facilities to allow ease of operation, maintenance and fault finding.

g. Environmental Considerations:

The installations are to be designed and suitable equipment selected to avoid or minimise the unacceptable impact on the environment as far as possible.

h. Safety Considerations:

The installations are to be designed with the safety and welfare of construction, operation, maintenance, and the general public in mind, complying with statutory regulations. Wherever possible, electrical equipment and wiring should not be in areas classified as hazardous.

3 General arrangement

A stand-alone solar power supply system shall consist of the following unless otherwise specified in the project Site Schedule (refer to Appendix B - Site schedules):

a. Concrete footing.

b. Pole support structure mounted on the concrete footing.

c. Photovoltaic array mounted at the top of the pole support structure.

d. Control cubicle integrated or attached to the pole support structure (unless specified otherwise by the Site Schedule) accommodating the associated electrical equipment.

e. Battery cubicle integrated or attached to the pole support structure (unless specified otherwise by the Site Schedule) accommodating the batteries.

f. Sun shields, as necessary (unless cubicle(s) located indoors).

g. If specified, a support bracket for the mounting of a radio antenna(s).

~~Note:~~ If the Site Schedule allows for stand-alone cabinets to be installed, special attention must be given to the provision of suitable and secure cableways between cabinets and the solar panel structure. Consider the requirements of vermin-proofing.

The design of stand-alone solar power supply systems shall consider the ergonomic aspects relating to the operation and maintenance of these systems.

4 Solar power supply system equipment

4.1 Environmental requirements

Equipment shall be rated for operation in the following ambient temperature range:

Outdoors:	-5°C	to	50°C
Indoors:	0°C	to	40°C

4.2 Array support structure

4.2.1 Concrete footing

A concrete footing shall support the pole support structure and shall be designed to consider the appropriate terrain category (for wind loading) and foundation (geotechnical) conditions at the site in accordance with AS 3600 and AS/NZS 1170.

4.2.2 Pole support structure

The pole structure shall be designed in accordance with AS/NZS 4509.1, AS/NZS 1170.2, and the following:

a. The pole structure height shall be a minimum of 5 m, to allow for PV array and 1m clearance to optional antenna support bracket below to minimise the possibility of vandalism.

b. The pole structure shall be designed and fabricated from hot-dipped galvanised steel in accordance with AS 4100 or aluminium in accordance with AS/NZS 1664.

c. The pole structure shall be capable of supporting the weight and wind-loading forces of the photovoltaic array mounted at the top of the pole and cubicles attached to the bottom of the pole.

d. The photovoltaic modules shall be mounted in such a way as to minimise the potential for theft or vandalism and at an angle that maximises solar input during winter months.

4.2.3 Pole tilt mechanism

Unless a fixed pole installation (typical installation shown in Figure 3 of Appendix A2~~Appendix A2 Figure 7-3~~) has been specified in the Site Schedule, the pole shall have the ability to be tilted down above the cubicles to facilitate maintenance of equipment at the top of the pole. The tilting shall be by means of a central pivot as shown in the typical installation in Figure 2 of Appendix A2.~~Appendix A2 Figure 7-2.~~ Equipment to provide lowering and raising of the pole, for example, rope and pulley, shall form an integral part of the pole support structure. A means of fixing the pole at any angle while lowering shall be provided. Access to this facility shall be restricted to prevent vandals from damaging equipment.

The pole shall be provided with a weight fixed at the bottom when required to counterbalance the weight of the solar panels so that the weight imbalance is between 5kg and 10kg heavier at the top of the pole.

4.2.4 Antenna support bracket

Where required by the Site Schedule, the pole structure shall be provided with a support bracket mounted at the top of the pole for others to install a radio antenna(s) and feeder cable(s).

The bracket shall be made of hot dipped galvanised steel in accordance with AS 4100 or aluminium in accordance with AS/NZS 1664 and shall be of a length sufficient to clear the PV panel in any direction by a minimum of 250mm.

The bracket shall be capable of supporting a load of 10kg at the end and sufficiently rigid to prevent distortion due to wind loading on the antenna(s). The bracket shall be set at a minimum of 4m high and adjustable in height and rotation around the pole.

4.3 Cubicles

4.3.1 General

Cubicles shall be in accordance with TS 0300 and this section.

4.3.1.1 Indoor cubicles

Indoor cubicles shall comply with the metal indoor cubicle requirements specified in TS 0300.

4.3.1.2 Outdoor cubicles and weather shield

Outdoor Cubicles shall comply with the metal outdoor cubicle requirements specified in TS 0300.

Outdoor cubicles shall be fitted with a weather shield to protect the cabinets from the direct rays of the sun and the pooling of water. There shall be at least 50mm clearance between the sides of the cubicles and the weather shield to allow for the installation of conduits.

Cubicles shall be designed to be vandal-resistant in accordance with the metal vandal-resistant cubicle requirements specified in TS 0300.

4.3.2 Control cubicle

The control cubicle shall contain all the electrical equipment supplied under this Technical Standard except for the battery bank. This includes regulators, converters, inverters, distribution boards, meters, lighting, protective equipment, terminal strips, conduits and cabling.

The cubicle shall have sufficient space as per the Site Schedule for the mounting of SA Water equipment, as required.

4.3.3 Battery cubicle

The battery cubicle shall contain only the batteries for the battery bank and shall be in accordance with AS 4086.1, AS/NZS 5139~~ 4086.2~~, AS/NZS 4509.1 and AS/NZS 4509.2.

The battery cubicle shall have natural or forced ventilation. The method of ventilation and sizing of ventilation apertures shall meet the provisions of AS/NZS 5139~~ 4086.2~~.

4.3.4 Lighting

A low-wattage (LED) light shall be provided for the inside of the electrical cubicle in accordance with TS 0300.

4.4 Electrical equipment

4.4.1 General

All electrical equipment shall comply with TS 0300.

4.4.2 Electrical capacity

The Constructor shall design and size the electrical capacity of the solar power supply system, including all components, for the specified loads. All electrical equipment shall be rated for a capacity increase of 20 per cent above the loads specified in the Site Schedule unless the Site Schedule calls for otherwise. *Notwithstanding the intention to provide components to a specification that meets the requirements of this Technical Standard, the overall intention is for the designed system to ultimately provide uninterrupted power to the system it is powering.*

The battery cubicle shall be provided with sufficient spare space and facilities to add a minimum of 20 per cent more battery capacity or an additional equally dimensioned battery, whichever is greater.

4.4.3 Photovoltaic array

The Photovoltaic (PV) array for the renewable supply of power shall be designed in accordance with AS/NZS 4509.2, AS/NZS 5033, and the following sub-sections:

4.4.3.1 PV modules

The PV modules used shall be in accordance with the following:

a. Nominal output voltage of 12VDC or 24VDC.

b. Efficiency energy conversion ratio greater than 17 per cent at the ambient temperatures specified in section 4.1.

c. Capable of operating at the installation location, considering ambient temperatures and extreme weather conditions, for example, hail, snow, etc.

d. Have a warranted power output of not less than 90 per cent nominal for a minimum of ten (10) years.

e. Bird deterrent devices shall be provided to stop birds from resting on PV modules.

4.4.3.2 PV array

The PV array shall be in accordance with the following:

a. The PV modules used for the creation of the PV array shall all be of the same model, type and characteristics.

b. An equal number of PV modules shall be used within each parallel string.

c. Capable of supplying the required load (including the capacity increase of 20 per cent).

d. Sized to account for seasonal variations and, where necessary, for local geographic features at the site.

e. Sized to account for the regulator used in accordance with AS/NZS 4509.2.

f. Adequately de-rated, considering component efficiencies, tolerances and system losses in accordance with AS/NZS 4509.2.

g. Provided with bypass diodes used in parallel with each module (preferably in parallel with each sub-section of module cells) to prevent the modules from becoming reversed-biased and causing photovoltaic hot spots. The bypass diodes used shall minimise any loss in efficiency of the modules and shall be rated in accordance with AS/NZS 5033.

4.4.4 Regulator

The regulator shall be in accordance with the following:

a. Capable of supplying the required load (including the capacity increase of 20 per cent).

b. Capable of accepting the maximum voltage from the PV array.

c. Capable of controlling the battery charging and compatible with the chosen battery type.

d. Capable of staged battery charging (Boost, Absorption, Float, and Equalisation) and shall ensure that the battery does not become overcharged.

e. Capable of altering the maximum charge voltage to account for the temperature of the electrolyte.

f. Prevent reverse current from flowing from the batteries to the PV array; otherwise, blocking diodes will be required in accordance with AS/NZS 5033.

4.4.5 Batteries

4.4.5.1 General

Batteries for the storage and supply of power shall be in accordance with AS/NZS 4509.2, AS 4086.1 and the following:

a. Suitable for stand-alone photovoltaic applications based on either lead acid or lithium-ion, specifically Lithium Iron Phosphate (LiFePO4).

b. If lead acid type, be sealed Valve-Regulated Lead Acid (VRLA) of either gel or Absorbed Glass Mat (AGM) electrolyte medium.

c. If lithium type, be complete with a battery management system to ensure battery requirements are complied with throughout the battery life cycle.

d. Have a round-trip efficiency of >80 per cent for lead acid and >90 per cent for lithium.

e. Supplied with a manufacturer's defect warranty period of a minimum of 12 months unless otherwise specified.

f. Be specified so that the battery brand, type and size are considered suitable for providing maintenance-free service in the chosen application for at least three (3) years for VRLA and six (6) years for lithium-ion unless otherwise specified.

g. Be of standard size and capacity, not exceeding 35kg.

h. Ergonomically easily field-replaceable.

i. Self-discharge rate not greater than 0.5 – 1.0 per cent per week.

j. Capable of supplying the surge demand of the installation.

k. Compatible with the specified regulator.

l. Deep cycle capability.

4.4.5.2 Battery bank

The battery bank shall comply with the following:

a. All batteries shall be of the same model type and characteristics.

b. The battery bank shall be sized to enable the solar power supply system to operate without charging current from the PV array for at least five (5) days. Calculations shall be provided to SA Water for approval to determine the battery bank's capacity. Geographical location should be considered to ensure that these requirements are met.

Site-specific service life calculations in the stand-alone solar application must consider the following:

1. Discharge and charge characteristics.
2. Effect of ambient temperature and available solar radiation throughout the year.
3. Cycle service life in relation to depth of discharge.

4.4.6 Converter

If a converter is deemed as required by the Site Schedule, then the converter shall comply with the following:

a. Capable of accepting an input voltage of 12VDC and supplying an output voltage of 24VDC.

b. Shall have conversion efficiency at full load of no less than 85 per cent.

c. Capable of supplying the required load current plus a future load capacity increase of 20 per cent.

4.4.7 Inverter

If an inverter is deemed as required by the Site Schedule, then the inverter shall comply with AS/NZS 5603 and the following:

a. Capable of accepting a nominal input voltage of 12VDC.

b. Capable of supplying a nominal output voltage of 230VAC, 50HzVAC.

c. Capable of supplying the required load current plus a future load capacity increase of 20 per cent.

4.4.8 Indications

Local indications shall be provided for the following parameters, as a minimum:

a. Solar regulator voltage.

b. Load current.

c. State of charge (%).

d. PV array voltage (open circuit).

These indications shall preferably be provided by a display built into the regulator or by a suitable multi-function meter to be approved by SA Water's Representative.

4.4.9 Output signals

Unless signals can be implied or provided from elsewhere, the following signals shall be provided at a terminal strip within the control cubicle for input to equipment provided by SA Water:

a. Solar regulator voltage (analog - actual voltage from a protected circuit).

b. Low battery voltage alarm (digital – voltage free contact rated at 12VDC, 1A, which opens on low battery voltage).

5 Installation

5.1 General

All electrical work shall be in accordance with AS/NZS 3000, this Technical Standard and TS 0300.

5.2 Support structure

The location of the pole support structure shall be as approved by SA Water's Representative. Care shall be taken in locating the final position of the pole to avoid problems such as future shadows from growing trees.

The pole support structure shall be appropriately fixed to the concrete footing. The pole footing shall be designed considering all the forces on the structure in accordance with the relevant Australian Standards and the site soil conditions. The pole footing shall not be found in fill material unless it is certified engineered fill.

5.3 Cubicles

The installation of cubicles shall be in accordance with the following:

a. The cubicles shall be installed in accordance with the typical installation shown in Appendix A2 and as per the Site Schedule. (Either outdoors, attached to the pole support structure, or indoors in an approved location.)

b. For outdoor cubicle installations, a suitable air gap, according to heat load calculations, shall be provided between the rear of the cubicles and the weather shield, and there shall be at least 100mm free space below the control cubicle to allow for the installation of conduits. The bottom of the weather shield and the battery cubicle shall both be a minimum of 100mm above the concrete base to facilitate the installation of conduits.

c. Where stainless steel cubicles are fixed to a hot-dipped galvanised or aluminium structure, then stainless-steel bolts, nuts and washers shall be used, and plastic washers shall be used to prevent contact between the dissimilar materials, such as stainless steel and hot-dipped galvanised or aluminium materials.

d. Signage shall be provided on the battery cubicle in accordance with AS/NZS 5139 ~~4086.2~~.

5.4 Electrical equipment

5.4.1 Photovoltaic array

The photovoltaic array shall be installed in accordance with AS/NZS 4509.1 and AS/NZS 5033, noting the following:

a. The array shall be positioned, orientated, and installed to maximise power output while considering geographic features and eliminating shading. Refer to AS/NZS 5033.

b. The array shall be mounted to avoid contact between dissimilar metals that could produce electrolysis; refer to AS/NZS 5033.

5.4.2 Battery bank

The battery bank shall be installed in accordance with AS/NZS 5139 ~~4086.2~~ and AS/NZS 4509.1.

5.4.3 Cabling

All cables shall be supplied and installed in accordance with TS 0300.

5.5 Labelling and signs

Labelling and signs shall be in accordance with AS 4509.1, AS/NZS 5033 and TS 0300.

5.6 Earthing and lightning protection

5.6.1 Earthing

The installation shall be earthed in accordance with AS/NZS 3000.

5.6.2 Lightning protection

A lightning protection risk assessment shall be conducted in accordance with AS/NZS 1768, and if deemed required, the installation shall comply with AS/NZS 1768.

6 Inspection and testing

6.1 Inspection and testing

SA Water's Representative reserves the right to inspect the installation and shall be given ample notice of any testing to be carried out. Inspection and testing shall be completed in accordance with the inspection and testing sections of TS 0300, and the installation shall be tested in accordance with AS 4509.1 and AS/NZS 5033.

The results of all tests carried out on the electrical equipment shall be recorded on test sheets that have been approved by SA Water.

7 Technical information to be provided

7.1 Design

The Constructor shall provide the following information, as a minimum, prior to construction:

a. Details (datasheets) of all equipment offered (manufacturer, model, ratings, etc.).

b. Structural capability details of poles provided.

c. Details of the method of pole lowering/raising.

d. Details of the antenna support bracket (if specified).

e. Lightning risk assessment and protection study, if relevant.

f. Details of construction relating to vandal-proofing.

g. Calculations supporting the determination of panel array and battery bank sizing/capacity. This shall include an analysis of the proposed location and the number of "sun days" obtained from information obtained from the Bureau of Meteorology.

h. Cubicle heat loading calculations.

i. Details of how the battery temperature will be regulated.

j. Proposed inspection and test sheets.

7.2 Operation and maintenance manual

The Constructor shall provide an Operation and maintenance manual which complies with the requirements of TS 0132.

Appendix A - Typical drawings

A1 Typical electrical schematic

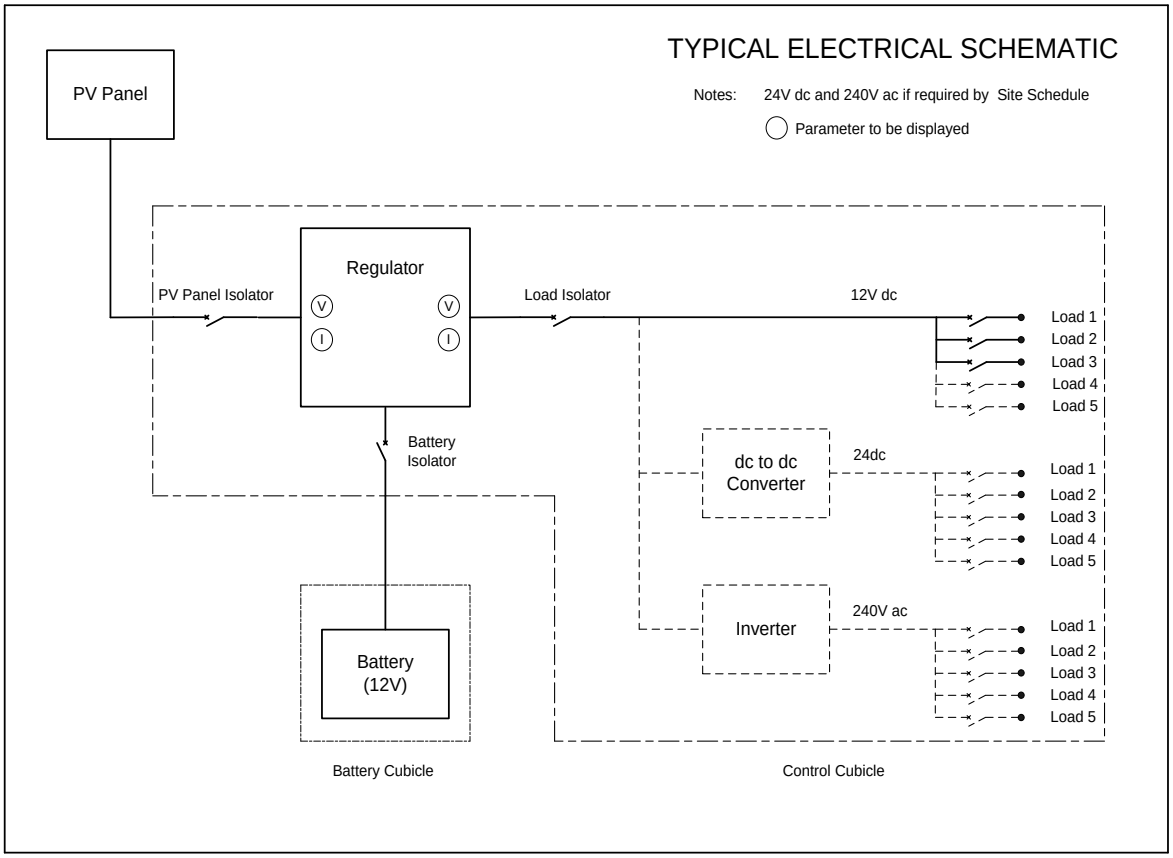

Figure 1: Typical electrical schematic

A2 Typical installation

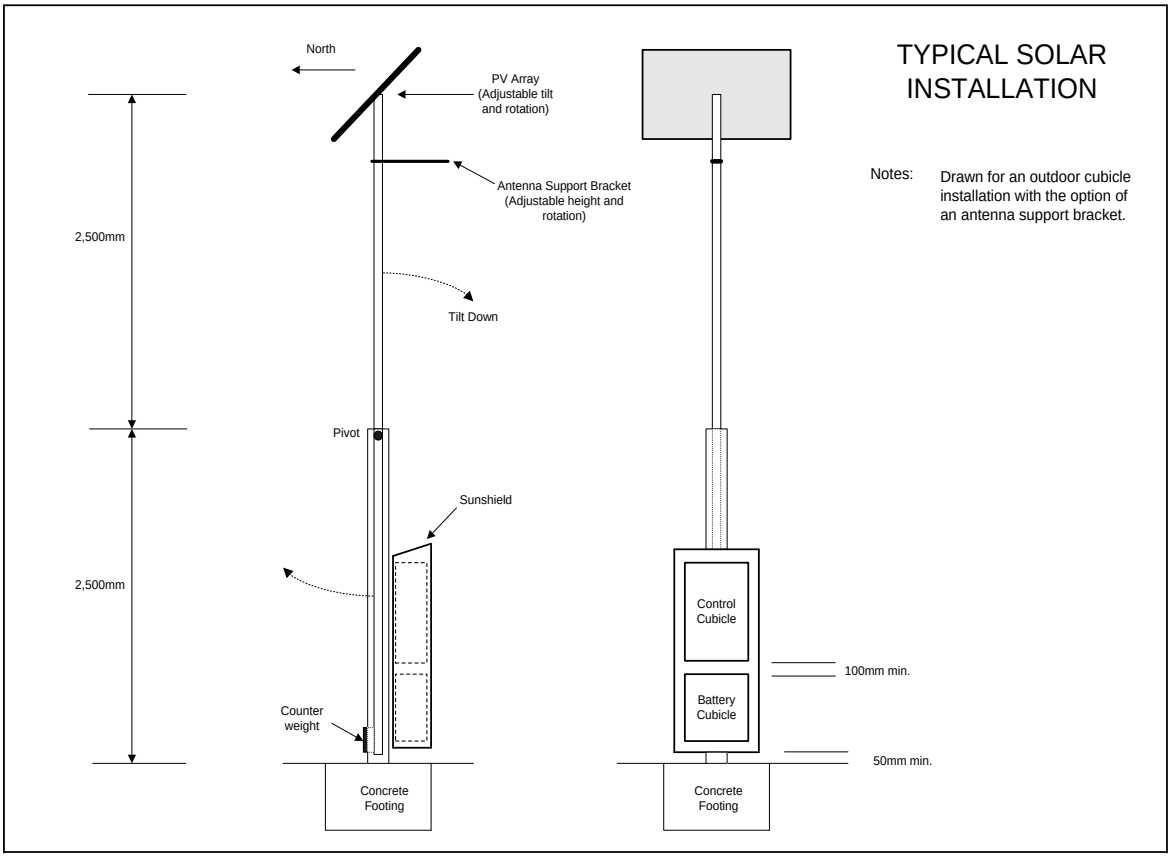

Figure 2: Typical tilt pole solar installation[1]

[1] Dimensions are typical only

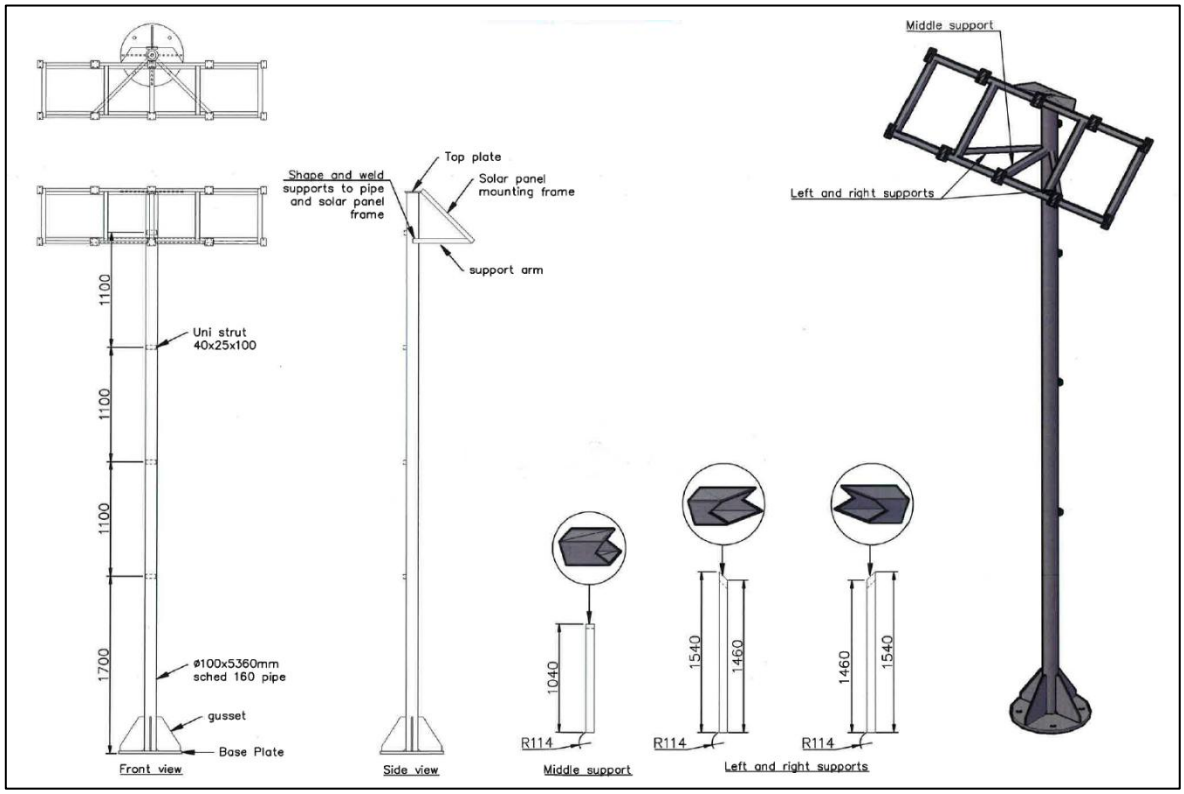

Figure 3: Typical fixed pole solar installation

B Appendix B - Site schedules

B1 Stand-alone solar power supply system site schedule

SITE SCHEDULE			
Site Name			
Site Location Details			
Cubicle Location (Indoor/Outdoor) (If indoors, detail the location)			
Any Specific Installation Requirements			
LOAD DETAILS	Load Name	Load I (mA)	Duty (% of time)
12V DC			
Load 1			
Load 2			
Load 3			
Load 4			
Load 5			
24V DC			
Load 1			
Load 2			
Load 3			
Load 4			
Load 5			
240V AC			
Load 1			
Load 2			
Load 3			
Load 4			
Load 5			
SA WATER EQUIPMENT DETAILS			
Space Required in Control Cubicle	…….. W ……. H …… D (mm)		
Pole (Tilt / Fixed)			
Antenna Support Required (Y/N)			

Example schedule

SITE SCHEDULE			
Site Name	Belair North Tank		
Site Location Details	GPS Coordinates: 2222 222 222		
Cubicle Location (Indoor/Outdoor) **(If indoors, detail the location)**	Outdoors		
Any Specific Installation Requirements	None		
LOAD DETAILS	Load Name	Load I (mA)	Duty (% of time)
12V DC			
Load 1	SCADA Pack RTU	720	100
Load 2	Radio APQQ-R400-SSC-HD-ENAA	3500	20
Load 3	Cabinet LED (3W)	125	Negligible
Load 4	Security	1500	100
Load 5			
24V DC			
Load 1	Level Sensor	24	100
Load 2	Instrumentation Loops	40	100
Load 3			
Load 4			
Load 5			
240V AC			
Load 1			
Load 2			
Load 3			
Load 4			
Load 5			
SA WATER EQUIPMENT DETAILS			
Space Required in Control Cubicle	400 W 300 H 200 D (mm)		
Pole (Tilt / Fixed)	Tilt		
Antenna Support Required (Y/N)	Yes		