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Pr9914 - Specification for Solar Power Supply and Installation at Unitywater Sites

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Documents Details

This document is only valid on the day it was printed.

Document Sponsor	Infrastructure Standards and Products Approval Committee
Document Author (Owner)	Head of Asset Management, SIS
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8.0	14/08/2025	Y. Skinner	Nick Tompkins A/Head of Asset Management	23/12/2025	Periodic review: • Subject matter expert changed to Infrastructure Standards Engineer Electrical • New Section 2.1 Technical departures added • Section 4.2 - Added reference to Pr8187 • Section 4.4 expanded second dot point to include *"or similar modelling software system approved by Unitywater"* • New clause added 6.2.3 Batteries.

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1. Purpose

The purpose of this Specification is to define Unitywater requirements to achieve functional performance, time objectives and cost objectives for the supply, design, installation and testing of solar power supplies.

This Specification defines the minimum requirements for the strategic planning, maintenance and technical aspects of all solar system components and directly associated assets.

2. Scope

This Specification outlines/applies to:

- the design, supply, testing and installation of solar supply (PV) and associated assets at all Unitywater's sites
- the general intent of all PV systems is to connect to the Power Supply Authority distribution network to reduce daytime import power consumption and may assist with peak demand lopping, however some sites may have a standalone PV system. This specification details the requirements for grid connected systems but the principles still apply to standalone systems
- the regulatory obligations and the considerations necessary to meet Australian and international standards
- the minimum acceptable technical requirements and standards are defined for all components of the solar system, including PV arrays, inverters, protection, earthing and mounting systems
- the supply and installation of equipment directly associated with the solar system, including enclosures, switchboards, and cabinets
- the minimum requirements and standards (but is not limited to) for the design, materials fabrication, construction, installation, commissioning and performance testing
- the principles for the collection and governance of solar monitoring data that is fit for purpose and enables integration, availability and security
- works being constructed directly for Unitywater or other authority or for an owner who will hand over the ownership of the constructed works to Unitywater or who will retain ownership
- three-phase systems only and does not cover single phase systems. For small single phase installations this specification may be applied based on the project specific requirements where appropriate.

2.1. Technical departures

Departures from any requirement of this Technical Standard shall be identified and submitted for review via F10996 - Deviation to Unitywater Technical Specification or Standard.

Unitywater requires enough information to assess dispensation requests and their potential impact. The onus is therefore on the proponent to justify deviation request submissions and provide suitable evidence to support them.

The Designer shall not proceed to document/incorporate the non-conforming work before the Unitywater has assessed and accepted the proposed action in writing via F10996.

3. Planning

3.1. Location

The placement of the solar system including panels, inverters and grid connections shall considered during planning stages and detailed in the Scope of Work or the Principal's Project Requirements (PPR) or any other overarching document that details the specific requirements for the work.

3.2. Power System Requirements

Table 1 lists the details of the mains power system.

Table 1: Power System Details

Electrical Supply Aspect	Requirement
System Voltage	400/415 V AC +10, -6% (*)
Phases	3-phase and neutral (4 wire)
Frequency	50 Hz ±1%
A-Phase B-Phase C-Phase Neutral Earth	Red White Blue Black Green/Yellow

* The system voltage is dependent upon site supply. Any works ensure the new system integrates with the site's regulated distribution voltage.

3.3. Grid Connection Approval

The PV system is required to connect to the Power Supply Authority distribution network to reduce daytime import power consumption and may assist with peak demand lopping. Export systems are not excluded and Unitywater may choose to export power depending on the project specific requirements.

The system shall be designed to connect to the sites power network. The design shall include metering and all documentation to the requirement of the DNSP.

Grid connection requirements shall be considered during planning and detailed in the PPR. During the planning phase, it may be necessary to submit applications for approval to the Power Supply Authority with the necessary technical details required for a grid connection application.

4. Design

4.1. General

The design of these assets should generally be “lowest total cost of ownership” which intends to achieve an optimal balance between the cost to operate, lifecycle of the asset, safety and the reliability of plants. The design shall be in accordance with good modern practice and shall be such as will facilitate operation, inspection, cleaning, and repair to ensure long life and satisfactory operation under all service conditions.

The system shall include PV modules, inverters, mounting systems, PV array junction boxes, array string protection, disconnect switches, lightning protection, metering and system monitoring.

The system shall be designed and sized, based on, but not limited to, the following constraints:

- Withstand the local climatic conditions for a minimum design life for each component as follows:
  - PV Modules – 25 years
  - PV Mounting Structures – 25 years
  - Inverters – 10 years.
- Maximise the total energy generation over 25 years.
- Optimised for maximum annual energy production, taking into account the tilt, shading and placement of arrays of modules.
- Optimised to minimise maintenance requirements and maximise lifetime performance.
- Protection against impacts, of dust, vermin, insects, birds.
- All electrical equipment shall be mounted at least 300mm above Q100 flood levels.

The potential safety risks shall be considered during the design process, such that:

- The systems shall be installed, operated, maintained and decommissioned in the safest possible way; this shall include allowing a minimum of 200mm clearance between the system and the edge of building rooves or tops of hills and structures to minimise the future risk to team members. Suitable access for regular cleaning and maintenance activities shall also be provided.
- The systems installed on the buildings must be traversable and each panel must be accessible for maintenance and compliant with AS 1657; access for future maintenance must be considered and provided with suitable recommendations provided on how access for maintenance may be achieved.
- Roof mounted systems shall have adequate risk management plans to address asbestos roofing material.
- The systems shall be designed to wind loads in accordance with the requirements of AS/NZS 1170.2.

4.2. Safety in Design

The designers shall undertake Safety in Design, Hazard Identification (HAZID), Hazard & Operability Study (HAZOP), and Construction Hazard Assessment Implication Review (CHAIR) workshops (if required) as detailed in Pr8187 - Safety in Design Procedure.

Systems shall be designed and constructed as far as practicable to protect against foreseeable misuse and damage to the facilities and equipment and to extend the safe operation and maintenance of the installations over the duration of the nominated asset life without need of rehabilitation.

Due consideration shall be made in the design of the equipment to simplify installation and termination of field cables.

Any other hazardous materials used in the design and construction of equipment shall be submitted to Unitywater for approval prior to the items being used.

All necessary safety facilities and mechanisms shall be installed to assure that there are no exposed live conductors when any electrical asset including, but not limited to, switchboards, panels or distribution boards doors are opened.

This is to prevent accidental contact with otherwise exposed live circuits behind doors or hinged panels that may be opened without special tools and also when specifically directed within the Scope of Work or the Principal's Project Requirements or any other overarching document that details the specific requirements for the work.

4.3. Design Review and Verification

Unitywater will carry out a design review for general compliance with this specification and relevant Australian Standards.

Solar and battery designs shall be prepared by a Clean Energy Council (CEC) accredited designer for the relevant connection type (i.e. grid-connected or stand-alone power system).

All items which are designed shall be design checked or verified. The design check or verification shall be undertaken by a Registered Professional Engineer of Queensland (RPEQ) from the Board of Professional Engineers Queensland, in the category appropriate to the item being design checked or verified.

4.4. Engineering and Design

The design documents shall include but not be limited to:

- Design Basis Document, clearly stating main assumptions and justifications; the site latitude and longitude values shall be recorded and used as a key design input for the selected site.
- Energy yield estimation using commercial simulation tool such as PVSyst, SAM or similar modelling software system approved by Unitywater, taking in to account any shading from surrounding buildings and infrastructure.
- Minimum solar system capacity shall be defined in terms of instantaneous peak power, energy yield and specific yield.
- Site layout drawings including panel layout and mounting systems overlayed over provided site layout drawings.
- Modified/updated/new Power Systems Model and Report as per the requirements of Pr10618 – Specification for Power Systems Analysis and Arc Flash Studies.
- Single line diagram of the PV systems.
- Wiring diagrams of all electrical works including grid connection.
- PV modules and mounting system engineering compliance.
- Array mounting structural certification and drawings.
- Monitoring, control and communications drawings.
- Testing and commissioning plan.

The systems shall be designed, installed and signed off by suitably qualified RPEQ and CEC accredited personnel. The installer shall also obtain and register on Unitywater's behalf for Small-Scale Technology Certificates or Large-Scale Generation Certificates as required by the Renewable Energy (Electricity) Act.

Suitable irradiance, climatic and environmental data shall be used in the design of the PV array.

All materials used shall be able to withstand the below environmental conditions:

- 30 °C to 60 °C operating range
- 95% humidity, non-condensing 30 °C to 60 °C.

5. Construction

5.1. General

For ground mounted systems, the ground surface within the perimeter of the panel installation shall be covered with stones and/or incorporate weed mat to prevent the growth of vegetation.

5.2. Materials and Workmanship

Materials shall comply with the relevant Australian standards stated in this Specification and shall be CEC approved. Materials incorporated in the works shall be new and first class quality, free from imperfections and selected for long life, minimum maintenance and shall be suitable for the intended purpose.

Workmanship shall comply with good trade practices and with the relevant Australian standards stated in this Specification and in accordance with the CEC guidelines.

All Materials, fittings, accessories and equipment supplied shall be new and the best obtainable of their kind and shall comply in all respects with the requirements of the relevant Standards Australia specifications.

6. Technical Requirements

6.1. General

The CEC maintains a list of approved PV modules, inverters and batteries that meet Australian Standards for use in the design and installation of solar and battery storage systems. All components shall be CEC approved.

6.2. Components

6.2.1 PV Modules

- PV modules shall be certified as being type-tested as specified in relevant IEC Standards and be listed on CEC database for approved modules.
- PV modules shall be able to operate and withstand the environmental conditions present on site.
- The performance of PV modules shall be type tested under Standard Test Condition (STC), i.e. an irradiance of 1000 W/m² at air mass 1.5 and at a cell temperature of 25°C.
- The rated power output of PV modules after 10 years shall not be less than 90% and after 25 years shall not be less than 80% of that of the original rated output.
- The arrays shall be designed and installed to face north or as close to north as possible.
- The arrays will be designed in accordance with AS/NZS 1170.2 Regional Wind Speed Zone B and connected to the mounting system to ensure adequate lightning protection to AS/NZS 1768.

6.2.2 Inverters

- Inverters shall be high efficiency from a leading global manufacturer with European weighted efficiency of no less than 94%.
- Inverters shall be of the passive cooling type and fanless to prevent corrosion.
- Inverters shall be installed indoors.
- Inverter shall preferably be close to the switchboard it will connect to.
- Inverters may be installed in a different building to the switchboard it connects to, if necessary, due to extensive cable runs or site specific requirements.
- Where the inverter cannot be installed indoors then the inverters shall be installed within enclosures that are not directly exposed to sunlight. These enclosures shall be designed to acceptable heat rise limits such that there is no temperature degrading of the inverter units.
- Unitywater approval must be obtained prior to any outdoor inverter installations.
- Inverters shall be Australia's CEC approved and must be tested and in accordance with AS 4777.
- Inverters shall be self-commutation modules which automatically synchronise the inverter supply frequency and phase angle to the low voltage network or other embedded generating system.
- Inverters must be capable of aggregated system control with the capability to control real and reactive power across all inverters through internal control or through a separate proprietary control module.
- Inverters shall have three phase output regulating the voltage as listed in Table 1 or be capable of being teamed together in such a way to achieve the same output.
- System designers are responsible for following manufacturer's design requirements.
- System installers are responsible for following manufacturer's installation instructions.
- Inverters shall have MODBUS-TCP and/or Profinet communications for SCADA interfacing. Site specific requirements will be included in the Scope of Work or the Principal's Project Requirements or any other overarching document that details the specific requirements for the work. Wireless connections to Unitywater's networks are not acceptable.
- Remote communications capabilities of the inverters shall have the ability to be enabled/disabled by authorised Unitywater team members.

6.2.3 Batteries

Unitywater is developing the technical requirements for battery storage at our sites. Contact Unitywater for further details.

6.3. Mounting Systems

The fixed PV array mounting system may be fabricated from 316 stainless steel or anodised aluminium. The material selected shall adhere to the applicable Australian Standard and be able to withstand environmental conditions of a WWTP.

Aluminium alloys should be marine grade, e.g. the 6000 series alloys.

Aluminium sections shall be in accordance with AS 1866.

Aluminium welds shall be in accordance with AS 1665, category B. Care shall be taken during installation to prevent galvanic corrosion.

Aluminium shall not be placed in direct contact with, or be fastened to, steel members or other dissimilar materials.

When such contacts cannot be avoided, an insulating barrier between the aluminium and the dissimilar materials shall be installed. To avoid this problem the following isolation kits should be considered at bolt connections:

- Isolated Sleeve for bolts connection:
  - Materials: Mylar (Polyester film/plastic sheet) or equivalent
  - Required thickness: different thickness depends on the space allowance.
- Isolated Washers:
  - Materials: GRE or Silicone or equivalent
  - Required thickness: Minimum 3 mm.

Sufficient ventilation shall be allowed between PV modules and the ground to reduce temperature effects on the PV systems.

Array arrangements shall be free standing structures whose arrangement takes into account safe access for maintenance procedures and vehicular access. Refer to Section 4.10.

Site specific structural certification shall be provided to assess the suitability of the following:

- the down loading of the system structures
- the suitability of the fixing, and spacing of rack fixtures to suit the panels
- the suitability of the panels and their clamp zones for the specific wind loading/pressure and the mounting system.

The system shall have a minimum tilt of 10° for self-cleaning unless approved otherwise by Unitywater.

The array mounting structures must have a minimum expected lifetime of 25 years and comply with the requirements of the modules as nominated by the Contractor.

6.4. Metering and Monitoring System

The PV array shall be incorporated into the plant Control system allowing measuring, recording and output of the system performance and important system parameters:

- instantaneous electrical energy generation of array (kW/kWp)
- instantaneous building electrical energy consumption (kW)
- current daily energy generation total (kWh)
- rolling weekly energy generation profile (chart) including total (kWh)
- outside ambient air temperature (°C)
- time period / date for energy generated
- instantaneous voltage of PV system (V)
- instantaneous current of PV system (A).

The monitoring system shall be designed and installed in compliance with IEC 61724.

The monitoring system must be capable of monitoring multiple inverters (or PV systems) at once and must be able to record individual inverter performance and operation parameters of the PV strings, such as DC voltage and current, and AC voltage, current and frequency.

Monitoring, control and communications Interfaces for the PV systems shall be provided.

All components located outdoors shall have a minimum IP rating of IP56. All indoor components shall have a minimum IP rating of IP54.

Sufficient and appropriate lightning protection and earthing shall be provided in all parts of the monitoring system when necessary.

The monitoring system shall be designed in an approach of modular concept design with adequate allowance for future system expansion and modification.

System performance modelling shall be provided by factoring in actual site conditions and shading. Modelling shall be completed on PVSyst or other modelling software systems approved by Unitywater.

6.5. Solar System Electrical works

All electrical equipment supplied and installed shall be in accordance with Pr9835 - Specification for Electrical Installation at Treatment Plants.

6.6. Earthing

All earthing shall be installed in accordance with AS/NZS 3000, AS/NZS 5033, related and referenced standards and the Unitywater standard specification Pr9835.

Each PV array shall be effectively connected to all metal parts, that are not intended to be live, through copper tails of not less than 6 mm^2 to the earth bar.

The secondary circuit of each CT shall be earthed at one point only. Provision shall be made for these Earth connections to be disconnected at a readily accessible position for testing.

Minimum M10 earthing connection studs are required.

7. Testing, Commissioning and Documentation

7.1. Testing and Commissioning

Commissioning tests shall be undertaken in accordance with AS/NZS 3000, AS/NZS 5033, AS 4777, CEC Guidelines and the requirements of the DNSP as a minimum and the Commissioning Management Plan. Commissioning activities shall be carried out in conjunction with the requirements of Pr11211 - Specification for Commissioning and Handover of Active and Passive Assets.

The following testing activities shall be undertaken, but not be limited to:

- detailed electrical inspection
- continuity of all strings, sub-array and array wiring
- continuity of all Earth connections, including module frame earth connections
- voltage and polarity of all strings, sub-arrays and arrays
- open circuit voltage, short circuit current, operating current, and I-V curve measurement
- insulation resistance of array and inverter wiring
- check operation of array under load conditions
- record operation voltage and current of the PV array
- check operational string currents in a multi string array
- operate the PV array isolators under load to ensure safe isolation of the inverters from the array
- verification of correct labelling
- functional testing of all control, indication, measurement and protection circuits
- functional testing of all interfaces to the controller for remote monitoring
- performance testing to demonstrate the equipment meets the specified performance requirements
- infrared scan to detect areas of non-uniform temperature
- for inverters: Perform as a minimum the manufacturer's specified commissioning schedule
- earth fault protection test (only relevant for earthed arrays)
- review of manufacturing inspection and test documentation and records
- review of manufacturing defect lists/punchlists
- any other testing and commissioning activities as required by the DNSP.

The commissioning time shall be selected on the basis of sunlight availability.

Instruments calibrated by authorities accredited by National Association of Testing Authorities (NATA) of Australia must be used for the testing activities.

A comprehensive Site Test Report shall be provided at completion of the respective site tests. The Site Test Report shall include as a minimum:

- results of all tests
- copies of any test oscillograms, graphs, printouts, etc.
- copies of site defect lists/punchlists
- copy of the completed Site ITP
- statement confirming compliance with all specified and legislated requirements.

7.2. Quality Assurance and ITPs

7.2.1 Quality Assurance

The Supplier shall implement a quality system that complies with the requirements of AS ISO 9001 for all work on the PV arrays and inverters.

Quality records shall be provided by the Supplier in accordance with Section 7.3 Documentation and Deliverables of this Specification.

7.2.2 Inspection and Test Plans

Inspection and Test Plans (ITPs) for the PV arrays must include the following as a minimum:

- FAT ITP - Covering all off-site activities, i.e. engineering, design, supply, manufacture, factory assembly, factory testing, resolution of factory defects/punchlists, release for delivery, preparation for transport, etc.
- SAT ITP - Covering all on-site testing, resolution of site defects/punchlists, handover, etc.

The ITPs shall identify the standards and/or procedures as well as the acceptance criteria that shall apply for each stage in the ITPs. All standards, procedures and acceptance criteria included in the ITPs shall comply with the requirements defined in this Specification and the requirements of Pr11211 - Specification for Commissioning and Handover of Active and Passive Assets.

Commissioning work on the PV arrays shall be in accordance with the ITPs.

Additional witness points and/or hold points may apply on various stages of the ITPs and may be carried out by third party inspectors.

7.3. Documentation and Deliverables

7.3.1 General

Documentation for the PV arrays shall comply with Unitywater's Pr11211 - Specification for Commissioning and Handover of Active and Passive Assets and AS 1101 and AS/NZS 1102 Parts 101-111.

A complete, detailed and fully customised set of drawings shall be provided for each system.

7.4. Warranties

Major components shall have warranties in accordance with industry standard.

Solar modules shall be covered by the following warranties as a minimum:

- Ten (10) years manufacturer workmanship
- Ten (10) year 90% and twenty five (25) year 80% performance power output warranty.

Inverter units shall be covered by the following warranties as a minimum:

- Ten (10) years manufacturer workmanship warranty
- Five (5) years manufacturer workmanship with the option of purchasing an extended warranty period from the manufacturer.

Each components warranty compliance and registration shall be undertaken by the Contractor prior to Completion.

7.5. Spare Parts and Tools

Any tools required for the operation of the equipment shall be supplied.

A priced list of all spare parts and/or tools for routine and scheduled maintenance shall be provided. Prices shall include delivery to site and packing suitable for long-term storage.

8. Appendices

Refer to the following pages.

Appendix A – Definitions/Acronyms

The following definitions, abbreviations and acronyms are used throughout this specification.

Term	Meaning
AC or ac	Alternating current
CEC	Clean Energy Council
DC or dc	Direct current
DNSP	Distribution Network Service Provider
EMC	Electromagnetic Compatibility
HAZID	Hazard Identification
HAZOP	Hazard and Operability Study
IEC	International Electrotechnical Commission
IEEE	International Electrical and Electronics Engineers
NATA	National Association of Testing Authorities Australia
PV	Photovoltaic
RPEQ	Registered Professional Engineer of Queensland
SCADA	Supervisory Control and Data Acquisition
STC	Standard Test Condition
WWTP	Wastewater Treatment Plant

Appendix B – References

General

All design, equipment and workmanship shall conform to the most recent requirements of relevant statutory local, state and Commonwealth requirements and applicable, current Australian Standards.

Where no Australian Standard exists, work shall conform to the most applicable, current IEC Standard.

Where conflicts exist between this specification and any statutory requirement, the statutory requirement prevails.

In the event of ambiguity, discrepancy, divergence or inconsistency of technical requirements in or between this specification and other documents, this specification shall prevail over all other technical engineering documents.

If the requirements of this Specification do not articulate the minimum requirements of the statutory regulations and standards, the regulatory requirements are taken to apply. If the requirements of this Specification are more exacting than the minimum requirements of the statutory regulations and standards, the former shall apply.

The following legislation, Regulation and Codes apply to this specification:

- *Electricity Act 1994* (Qld)
- *Electrical Safety Act 2002* (Qld)
- *Electrical Safety Regulation 2013* (Qld)
- *Electricity Regulations 2006* (Qld)
- *Work Health and Safety Act 2011* (Qld)
- *Work Health and Safety Regulation 2011* (Qld)
- *Renewable Energy (Electricity) Act 2000* (Cth)
- *Queensland Electricity Connection and Metering Manual* – Service and Installation Rules EE NA000403R328 V10 (QECMM)
- Clean Energy Council (CEC) Guidelines:
  - Grid-Connected Solar PV Systems: Install and Supervise Guidelines for Accredited Installers – April 2019
  - Grid-Connected Solar PV Systems: No Battery Storage, Design Guidelines for Accredited Installers – May 2022.

Relevant Unitywater documents that relate to this specification

All designs and equipment shall comply with the current edition of the following standards:

Document No.	Title
Asset information and handover	
Pr8843	Specification for Drawing, Document and Equipment Tag Numbering
Pr10360	Project Information Requirements
Pr10382	Digital Engineering Execution Plan
Pr9080	Specification for Cad BIM Drafting and Modelling Standards
Pr8701	Specification for Asset Information
Pr11211	Specification for Commissioning and Handover of Active and Passive Assets
Pr10883	Safety in Design Guidelines
SEQ AIS	SEQ Asset Information Specification
Electrical	
Pr9835	Specification for Electrical Installation at Treatment Plants
Pr10618	Specification for Power Systems Analysis and Arc Flash Studies
Control Systems	
Pr9833	Specification for SCADA and PLC Architecture
Pr9834	Specification for SCADA Standard
Pr9844	Specification for SCADA and PLC Device Type - Siemens
Pr10699	Treatment Plant PLC and SCADA Specification - Device Type Schneider PLC
Pr10434	Specification for SCADA and PLC Device Type - Siemens OPC
Pr9845	SCADA and PLC Implementation Specification
Pr9846	SCADA and PLC Historian and Reporting Specification

International and Australian Standards referenced within this specification

All designs and equipment shall comply with the current edition of the following standards:

Standard	Title
General	
AS ISO 1000	The international system of units (SI) and its application
AS 1101	Graphic symbols for general engineering
AS/NZS 1102	Graphical symbols for electrotechnical documentation
Structural	
AS 1074	Steel tubes and tubulars for ordinary service
AS/NZS 1170 series	Structural design actions
AS 1627	Metal finishing – Preparation and pre-treatment of surfaces
AS 1657	Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS/NZS 1664 series	Aluminium structures
AS 1665	Welding of aluminium structures
AS/NZS 1866	Aluminium and aluminium alloys – Extruded rod, bar, solid and hollow shapes

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Standard	Title
Electrical	
AS/NZS 1768	Lightning protection
AS/NZS 2053	Conduits and fittings for electrical installations – General requirements
AS/NZS 2373	Electric cables – Twisted pair for control and protection circuits
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008.1.1	Electrical installations – Selection of cables – Cables for alternating voltages up to 0.6/1 kV – Typical Australian installation conditions
AS/NZS 3013	Electrical installations – Classification of the fire and mechanical performance of wiring system elements
AS/NZS 3017	Electrical installations - Verification guidelines
AS/NZS 3100	Approval and test specification - General requirements for electrical equipment
AS/NZS 3439.1	Low-voltage switchgear and control gear assemblies – Type-tested and partially type-tested assemblies
AS/NZS 4509	Stand-alone power systems
AS 4777 series	Grid connection of energy systems via inverters
AS/NZS 5000.1	Electric cables – Polymeric insulated – For working voltages up to and including 0.6/1 kV
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 60044.1	Instrument transformers – Current transformers
AS 60529	Degree of protection provided by enclosures (IP code)
AS/NZS IEC 60947	Low-voltage switchgear and control gear
IEC 60364	Low-voltage electrical installations
TR IEC 61000.3.6	Electromagnetic compatibility (EMC) Part 3.6: Limits—Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems
IEC 61215	Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval
IEC 61646	Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval
IEC 61724	Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis
IEC 61730 series	Photovoltaic (PV) module safety qualification
IEEE 519	IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems