



Technical Standard - TS130

**Inverter Energy Systems (IES) above 30kW and
up to or equal to 200kW**

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SA Power Networks

www.sapowernetworks.com.au

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SA Power Networks:

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

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

1 Anzac Highway, Keswick, South Australia, 5035.

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1. Purpose

This technical standard provides designers, contractors and consultants with an understanding of the technical connection requirements for inverter energy systems (IES), with a nameplate capacity above 30kW and up to or equal to 200kW which is to be connected to SA Power Networks distribution network

2. Scope

This standard outlines the equipment and installation requirements for inverter energy systems (IES) above 30kW and up to or equal to 200kW that are intended to be connected to and capable of operating in parallel with SA Power Networks' distribution network .

This document shall be read in conjunction with [NICC270](#): 'Connection Requirements of Embedded Generation' and [Service and Installation Rules \(S&IR\)](#), which are available at (www.sapowernetworks.com.au), and shall be in accordance with the relevant AS/NZS standards (eg AS/NZS 4777 series, AS/NZS 3000, AS/NZS 5033).

For small embedded generation systems refer to [TS129](#): 'Small Inverter Energy Systems (IES) Capacity not exceeding 30kW'. For embedded generating systems exceeding 200kW using IES or using rotating plant, refer to [TS131](#): 'Inverter Energy System (IES) above 200kW or Rotating Generating Systems'.

3. Inverter Phase Limits

For 3 phase systems, the IES must have a balanced output with the unbalance between phases being no greater than 5kW. For small embedded generating systems the maximum capacity for a three-phase system is 30kW (refer TS129). All IES greater than 30kW, but less than or equal to 200kW, must utilise three phase inverters compliant with AS/NZS 4777.

4. Inverter Energy Systems (IES) - Requirements

4.1 Multiple Mode Inverter (MMI)

The IES may comprise of, one or more inverters together, with one or more 'Energy Sources' (which may include 'Batteries' for energy storage) and controls. Where energy storage functionality is required, then the IES shall have 'Multiple Mode Inverter' (MMI) type that satisfies the requirements as prescribed in AS/NZS 4777.2.

The 'Multiple Mode Inverter' (MMI) operates in more than one mode, for example, having 'Grid-Interactive Functionality' when grid voltage is present, and 'Stand-Alone Functionality' when the grid is de-energised or disconnected.

Inverters with battery storage ports are considered as MMI.

Specifically note that, only inverters that have been tested by an authorised testing laboratory and certified as being compliant with AS/NZS 4777.2 and issued with an accreditation number will be regarded as an approved inverter.

The '[Clean Energy Council](#)' (CEC) maintains a list of approved solar modules and inverters that meet Australian Standards for use in the design and installation of solar PV systems.

SA Power Networks conducts independent investigation and encourages all associated proponents/installers, to ensure that the MMI is compliant with AS/NZS 4777.2 requirements, before their installation is commenced.

Where unsure of compliance, please consult the relevant SA Power Networks Project Manager for advice. SA Power Networks reserve all rights to refuse connection for any installation deemed by it to be non-complaint.

4.2 Overcurrent Protection

For installations using a PV array as an energy source, the overcurrent protection and its locations requirements shall be determined as per AS/NZS 5033.

For all other energy source(s), cabling shall be protected against overcurrent, in accordance with AS/NZS 3000.

4.3 Isolation Devices

The labelled isolation devices, with the capability of safely breaking voltage and current under both normal and fault conditions, shall be installed between any energy source and the inverter, complying with AS/NZS 3000 requirements.

The ideal location for installing an isolation device shall be adjacent to the inverter energy source port and be readily available. Where there are multiple inverter energy source ports, each port shall have an isolator for each connected energy source.

Where the energy storage and the inverter are physically integrated, then compliance with AS 62040.1.1 is required and for the energy source, such as a PV array, the isolation switches and isolation arrangements shall comply with AS/NZS 5033.

For more details on 'Isolation Devices', refer to AS/NZS 4777.1.

4.4 Signs and Labels

The IES must include warning signage to clearly indicate that the electrical installation has multiple supplies and identify which circuits are affected by these supplies.

Signage shall as a minimum be placed:

1. On the switchboard that has the inverter energy system directly connected to it
2. On all switchboards including main switchboard and distribution board(s) between the main switchboard and the board that has the inverter energy system directly connected to it.
3. In all meter boxes containing the distributor's metering equipment

Signage should describe the actual type of generation source installed.

The installer of the inverter energy system shall supply and install appropriate signage on the installation in accordance with requirements as required by AS/NZS 4777.1.

4.5 Cable Identification

The AS/NZS 4777.1 states that, all energy source (DC or AC) cables shall be clearly identified as energy source cables at intervals not exceeding 2m. Cable identification shall be permanent, legible, indelible and include type of energy source. If fixed to a surface, the identification shall be visible after mounting.

For more details on 'Cable and Wiring Enclosures Identification', refer to AS/NZS 4777.1.

5. Protection Requirements

The protection systems shall be designed in accordance with Acts, Regulations and SA Power Networks standards. For large generation systems the generator/proponent shall submit complete details of the IES protection systems, including the proposed settings, to SA Power Networks for review and agreement. The inverter grid protection shall comply with the requirements of AS4777.2:2015.

5.1 Anti-Islanding

In accordance with the grid protection requirements of AS4777.2:2015 Table 13, the inverter must incorporate under- and over-voltage and under- and over-frequency protection.

In addition, the inverter must include at least one method of active anti-islanding protection, which will operate the disconnection device within 2 seconds.

The installation must incorporate additional anti-islanding protection with a suitable relay capable of 'Rate of Change of Frequency' (ROCOF) protection elements, for systems above 30kW.

Any additional anti-islanding protection installed by the customer must be capable of automatically reconnecting to the Network once the network voltage and frequency have been maintained with their tolerable range for a minimum of 1 minute.

5.1.1 Under/Over Frequency

Under and over frequency protection must be installed at the connection point. The inverter must be disconnected from the Network for the following settings:

The inverter must be disconnected from the Network for the following settings:

1. Under-frequency (f) = 47Hz with 1 sec delay
2. Over-frequency (f) = 52HZ with 0.2 sec delay

If the frequency exceeds 50.25Hz, the inverter shall reduce the power output linearly with an increase of frequency until the +4% limit is reached.

5.1.2 Under/Over Voltage

Under and over voltage protection must be installed to monitor all three phases at the connection point. The inverter must be disconnected from the Network for the following settings:

1. Under-voltage (V) = 180V with 1 sec delay
2. Over-voltage 1 (V) = 260V with 1 sec delay
3. Over-voltage 2 (V) = 265V with 0.2 sec delay

5.2 Voltage Unbalance

Three phase inverters must be configured to ensure the maximum unbalance between phases is 5kW whilst connected to our distribution systems. All three phases of the inverter must simultaneously disconnect from, or connect to, our distribution systems in response to protection or automatic controls (eg anti-islanding trip and subsequent reconnection).

Where multiple single phase inverters are connected to more than one phase, the inverters must be interlocked and configured to behave as an integrated multiphase inverter providing balanced output (maximum unbalance between phases of 5kW) to all connected phases whilst connected to our distribution systems.

Alternatively, where inverters cannot be interlocked by internal controls, the installation must be protected by a phase balance relay which must immediately isolate the inverter in the absence of reasonable balance.

The inverters must be physically prevented from operating independently and all installed inverters must simultaneously disconnect from, or connect to, our distribution systems in response to protection or automatic controls (eg anti-islanding trip and subsequent reconnection).

5.3 Power Quality Response Modes

The Proponent/electrical contractor/installer must ensure the South Australian power quality response mode has been set in the inverter(s) and must not be changed without written approval from SA Power Networks. These settings should be proven by test by your electrical contractor/installer.

The South Australian power quality response modes are:

1. Volt-VAr response mode (AS/NZS 4777.2 Table 11) **(Mandatory)**
2. Volt-Watt response mode (AS/NZS 4777.2 Table 10)

Settings for the power quality response modes are shown below.

Reference	Voltage in Volts	VAr % Rated VA
V ₁	207 (default)	31% leading (sourcing vars, 2.4%/volt)
V ₂	220 (default)	0
V ₃	248	0
V ₄	253	44% lagging (sinking vars, 8.8%/volt)

Table 1: Mandatory: Volt-VAr response mode

Reference	Voltage in Volts	Power % rated Power
V ₁	207 (default)	100% (default)
V ₂	220 (default)	100% (default)
V ₃	250 (default)	100% (default)
V ₄	265 (default)	20% (default, 5.3%/volt)

Table 2: Volt-Watt response mode

Reference	Voltage
V _{nom-max}	258 volts

Table 3: Sustained Operation for Voltage Variations

Power quality response mode settings shall be the same for all the inverters at site. While all new inverters shall operate with the required South Australian power quality response modes, multiple power quality response mode settings are allowed where the following is satisfied:

1. All inverters installed on or after 1 December 2017 operate with the required South Australian power quality response modes.
2. Inverters installed prior to 1 December 2017 which are not capable of operating with an approved power quality response mode are operating at unity power factor.
3. Replacement inverters, including warranty replacements, shall be configured to operate with the required South Australian power quality response modes.

5.4 Protection Equipment Requirements

All protection equipment must comply with the relevant IEC standards.

All protection equipment must be tested and commissioned by a competent commissioning officer, to the agreed settings, and a certified copy of the commissioning results plus a Certificate of Compliance for the complete large-embedded generating unit installation must be issued by the embedded generator to SA Power Networks prior to connection to the distribution network.

The embedded generator must keep a written record of all protection settings and test results. A copy of this record should be available at the connection point or as required by SA Power Networks.

No alteration to the commissioned protection settings shall be made without the written approval of SA Power Networks. Any such approved changes shall be applied, tested and commissioned by a competent commissioning officer with SA Power Networks being notified in writing of the settings once applied.

6. Remote Monitoring and Control

An export inverter energy unit is an IES generating unit designed to enable the export of electricity to the distribution network.

Normally, most inverter energy systems that have a nameplate capacity less than 200kW and use inverters that are compliant with AS/NZS 4777.1 and AS/NZS 4777.2 shall not require communication links to be installed between SA Power Networks and the inverter energy unit installation to provide SCADA monitoring and control.

However, the exact requirement will be determined during SA Power Networks' assessment of the proposed IES generator connection to the distribution network, since, the nameplate capacity and operational requirements of the proposed inverter energy systems in relation to the capacity of the distribution network at the proposed connection point may influence the actual interface and communications requirements.

In the event that remote monitoring and control is required for the Generating System, the requirements of SA Power Networks' [TS131](#) will apply.

7. Transfer Capacity

SA Power Networks does not permit the connection to either the low voltage (LV) or high voltage (HV) distribution networks of single phase embedded generating unit installations unless the unit/s complies with AS/NZS 4777.

An example of a typical connection arrangement for a IES generating system (above 30kW and up to or equal to 200kW) is shown in Figure 1 below:

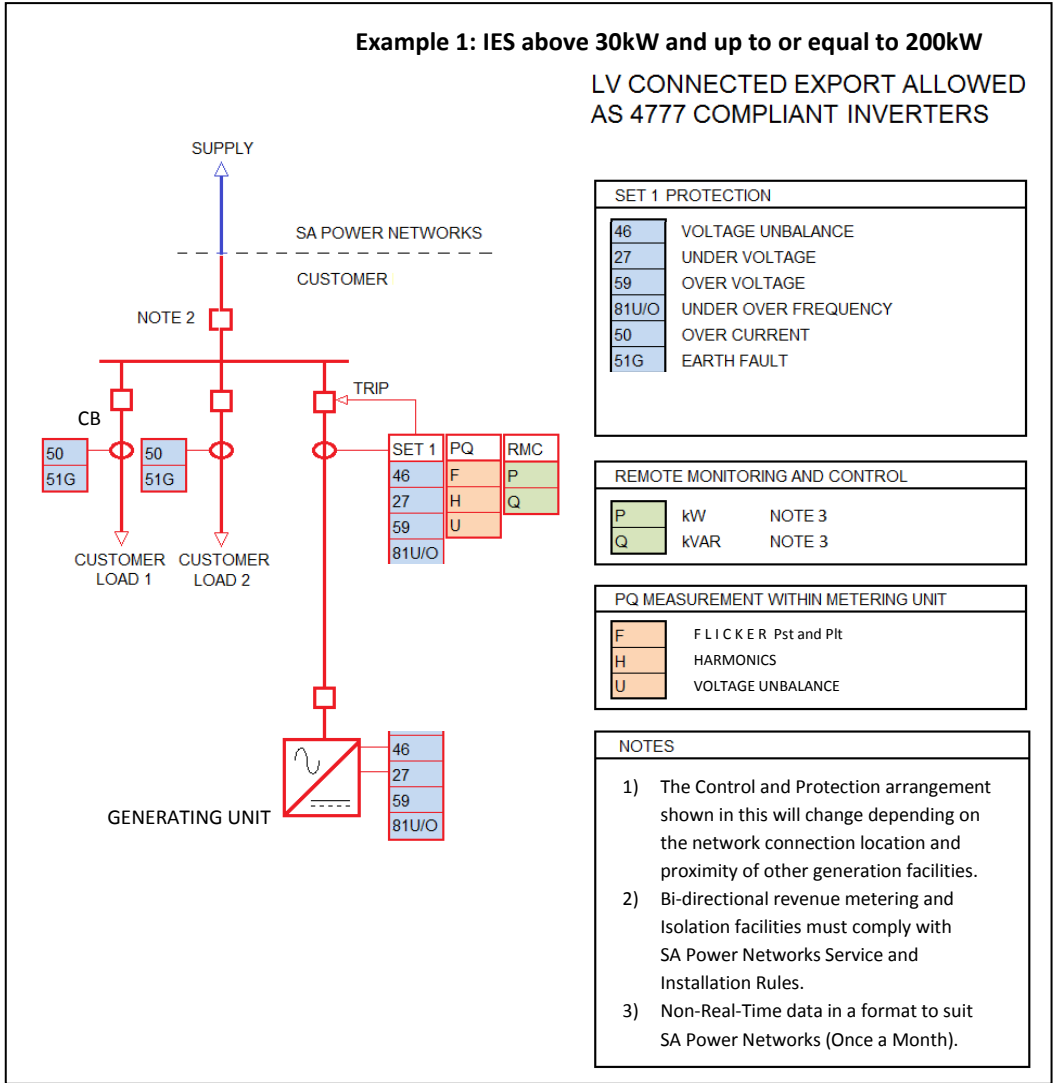


Figure 1: Typical Connection Arrangement for IES - (above 30kW and up to or equal to 200kW)

8. Reactive Power Control

Most SA Power Networks zone substation transformers are fitted with 'On-Load Tap Changing' (OLTC) facilities and will automatically act to restore network voltage levels within minutes. In addition, 'Line Drop Compensation' (LDC) controls may also be used to regulate the network voltage at a location downstream of the zone substation. These controls are commonly used to regulate network voltages and maximise transfer capacity to customers.

The connection of IES generators to the distribution network may impact on SA Power Networks' ability to regulate network voltages. For this reason, SA Power Networks requires inverter energy systems to control 'Reactive Power Output' (RPO), within their capability, to maintain the connection point voltage to an agreed target or operate at an agreed power factor such that voltage variations are maintained within prescribed limits.

The IES's RPO must be controlled within an agreed range. A generating system would typically be expected to be capable of continuously supplying or absorbing reactive power to achieve a power factor of ± 0.95 as measured at the connection point. Subject to the appropriate network studies, generating systems not able to meet these typical reactive power capabilities may still be considered acceptable.

To maintain satisfactory network voltages, the generating system's controllers will need to operate with a tolerance of 2% of the maximum reactive power generation range. To achieve this, the IES generator/proponent may require additional sources of reactive power (eg Statcoms, Reactors, Capacitors) or network augmentations to regulate network voltages within acceptable limits.

The final operating reactive power requirements for the inverter energy systems will be identified by the network studies and included within the engineering report.

8.1 Reactive power where generators/proponents are also customers

In cases where a proposed generating system is connected to a connection point that also supplies electrical load, the reactive power requirements at the connection point will be a combination of the supply and generation requirements.

When the site is exporting electricity, the generating systems would typically be expected to be capable of continuously supplying or absorbing reactive power to achieve a power factor of ± 0.95 as measured at the connection point.

When the site's supplied load is greater than 30% of the maximum demand at the connection point, irrespective of whether the generating systems is generating electricity, the reactive power requirements will be as per Section 6.5.3 of the SA Power Networks [Service and Installation Rules \(S&IR\)](#).

When the supplied load is less than 30% of the maximum demand at the connection point, SA Power Networks will accept a power factor at the connection point outside the allowed range provided this does not cause the systems standards to be violated or plant limits (eg OLTC) to be exceeded.

9. Fault level

As IES systems connected via grid connected inverters limit the fault current contribution to their full load current or a near zero value, SA Power Networks permits the connection of inverter energy systems to the distribution network without additional fault level protection and control equipment. Refer to [TS131](#), which specifies SA Power Networks' safe network fault rating design requirements.

10. Quality of Supply

The inverter energy systems must not impact on the quality of supply to SA Power Networks' other network users.

The inverter energy systems must comply with all applicable requirements of the NER, the EDC and the SA Power Networks [Service and Installation Rules \(S&IR\)](#), including but not limited to:

1. Network stability;
2. Network infrastructure thermal capacity;

3. Network voltage control;
4. Generating systems reactive capability (power factor);
5. Voltage fluctuations;
6. Harmonics; and
7. Voltage balance.

10.1 Voltage and Frequency Ranges of Operation

The inverter and customer installation must be designed, installed, and maintained in a manner that ensures that the maximum steady state voltage at any socket outlet or fixed equipment (other than the inverter) within the installation complies always with the requirements of AS/NZS 4777.1 and AS/NZS 4777.2.

The following specific voltage and frequency settings must be programmed into the Inverter:

10.1.1 Voltage

Where the Inverter has a maximum voltage limit for sustained operation (based on averaged measurements over periods 10 minutes or less), this parameter must be set no higher than 258V (phase to neutral).

If the Inverter does not have a maximum voltage limit for sustained operation setting, the anti-islanding maximum voltage trip point (based on a short-term measurement) must be set to a low enough voltage (depending on the installation characteristics), to ensure compliance.

Failure to design for this requirement may expose appliances and fixed equipment to potentially damaging voltages.

10.1.2 Frequency

- (a) Minimum frequency trip point (F_{min}) is 47Hz
- (b) Maximum frequency trip point (F_{max}) is 52Hz

If voltage and/or frequency fall outside the set limits, the generating systems must be automatically disconnected from our network. The reconnection procedure for the inverter must comply with AS/NZS 4777.

11. Earthing

The IES generator/proponent is required to ensure that their generation and/or substation facilities have an effective earthing system to limit step and touch earth potential rise to safe values and ensure compliance with the requirements of Australian Standards.

In addition, generating systems supplied via an HV connection point must ensure they are compliant with SA Power Networks' [Service and Installation Rules \(S&IR\)](#). The SA Power Networks distribution network is operated as a solidly earthed system.

Suitable measures will be applied to ensure that remote earths cannot present a hazard to telecommunication facilities and comply with the requirements of AS/NZS 3835: 'Earth Potential Rise - Protection of Telecommunications Network Users, Personnel and Plant'.

12. Operating Protocols and Procedures

Most inverter energy systems that have a nameplate capacity less than 200kW, do not require operating protocols and procedures to be developed in conjunction with SA Power Networks.

The exact requirement for operating protocols and procedures will be determined during SA Power Networks' assessment of the proposed IES generator connection to the distribution network, considering the nameplate capacity and operational requirements of the proposed inverter energy systems in relation to the capacity of the distribution network at the proposed connection point.

Any operating procedures and protocols that are required to be developed by the IES generator/proponent must be in accordance with the requirements specified in SA Power Networks' [TS131](#).

13. Commissioning and Testing of IES

Prior to the connection of a large inverter energy system to the distribution network, SA Power Networks is entitled to inspect and, where necessary, require the IES generator/proponent to test those parts of the IES generation installation that may have a direct effect on the network. This is to enable SA Power Networks to verify that the IES generation installation is acceptable for connection and complies in all respects with SA Power Networks' requirements.

SA Power Networks can only attend site to witness the performance of compliance tests once you have signed the connection contract and any augmentation works are complete.

13.1 Final Settings

To make a final assessment on the suitability of your inverter energy system connection, the customer must submit any outstanding protection settings or any other additional items SA Power Networks have requested in our Offer Letter.

1. This must be provided at least 1 month prior to the date you wish to perform and demonstrate the compliance tests
2. The information will include, but not be limited to:
 - (a) Settings for your inverters
 - (b) Settings for your back up anti-islanding protection device(s)
3. The setting information may be included as part of the commissioning program

SA Power Networks will review and comment on your final settings within 10 business days of receipt.

13.2 Commissioning Program

Before SA Power Networks can attend site and witness the performance of your compliance tests you must submit a commissioning program that outlines the testing you will do on any of your equipment that may affect the security of the electricity network. The commissioning program is to be of sufficient detail to allow SA Power Networks to understand what you are proposing to test and the pass/fail criteria for each test.

You must submit your commissioning program to us at least 1 month prior to the date you want SA Power Networks to attend site and witness testing.

Appendix A contains a template for a typical commissioning program for a solar PV generating systems less than 200kW. We will review and comment on your final settings within 10 business days of receipt.

13.3 Pre-Commissioning Documents

SA Power Networks will not attend site and witness your compliance tests until you have submitted the following:

1. A copy of the Electrical Certificate of Compliance, covering all areas of the installation;
2. A copy of the commissioning record in line with AS/NZS 5033 Appendix D and Appendix E (where applicable); and
3. A copy of the ESCOSA Generating Licence or correspondence from ESCOSA showing that exemption has been granted.

You must submit these commissioning documents to us a minimum of 5 business days prior to the date you want SA Power Networks to attend site.

13.4 Commissioning Report

Following the completion of commissioning tests, you must submit to us a copy of the commissioning test results in the form of a report within 20 business days of undertaking the tests.

The test results report should include:

1. Details of the completed and signed commissioning program; and
2. Measurement data, in a format suitable to us, from your power quality logging device.

14. Compliance Monitoring and Maintenance

The IES generator/proponent must develop a compliance monitoring program, including an agreed method by which the IES generator/proponent can demonstrate ongoing compliance of the IES generation installation with the applicable regulations and the inverter energy units continued operation in accordance with good engineering practice and the applicable regulations.

The IES generator/proponent must provide to SA Power Networks a copy of the agreed and duly authorised compliance-monitoring program.

In respect of the ongoing operation of the installation, the IES generator/proponent must maintain the protection and control systems of the generation systems (and any other service connected to the installation) to provide continual safety of operation of both generating systems and distribution network.

15. Notice of Alteration to Approved Installation

The IES generator/proponent must not significantly alter, add or replace components of the approved design or protection settings of the IES generation installation without the prior written consent of SA Power Networks. The approved design is to be the design of the plant as covered by the network studies and/or included within the connection contract. Where failure of an item of plant occurs, this may be replaced with a direct equivalent without the prior approval of SA Power Networks provided it does not contain additional protection features which may alter the philosophy of, or operation of the IES.

If at any time the IES generator/proponent wishes to propose an increase in the agreed nameplate capacity of the IES generation installation, the IES generator/proponent must request the increase in writing to SA Power Networks.

Upon receipt of the written request, SA Power Networks will advise the IES generator/proponent if it is necessary for SA Power Networks to undertake a new network analysis (at the IES generator/proponent's cost) to ascertain the operational constraints of the IES generation installation with the proposed changes to the installation and/or protection settings.

16. Metering Installation

Revenue metering is required for the connection of all IES generation systems (as outlined in [NICC270](#)) and is in addition to the SCADA and remote monitoring requirements outlined in Section: 'Remote Monitoring and Control', of this technical standard.

If required, it is the obligation of the customer to ensure that the connection point has a metering installation and that the metering installation is registered with AEMO through a 'Network Meter Identifier' (NMI).

The metering installation must be fully compliant with the NER, AEMO Metrology Procedure, ESCOSA's Electricity Metering Code EMTC/08 and SA Power Networks' [Service and Installation Rules \(S&IR\)](#).

Current and voltage transformers are always required for the purposes of metering services more than 100A and 400V (nominal) respectively.

It is a requirement that the metering installation is located on the customer's side of the connection assets and as close as practicable to the network connection point. This arrangement will eliminate the need for external service providers to work on energised SA Power Networks equipment.

Any current and voltage transformers required for metering and/or protection of high voltage installations also shall be located on the customer's side of the connection point and comply with the NER, ESCOSA's Electricity Metering Code and SA Power Networks' [Service and Installation Rules \(S&IR\)](#).

Current copies of NER compliance type test and routine test results (as applicable) for all instrument transformers must be provided to SA Power Networks before the installation can be connected to the distribution network.

The customer should note that the NER may require installation of check metering facilities depending on the number of MW hours generated per annum.

The operational requirements of the generating system and national grid metering must be addressed, with the role of responsible person/metering provider/meter data agent to be decided by the IES generator/proponent and/or their retailer.

17. Who you should talk to?

For all [General Enquiries](#), in the first instance, please contact Builders and Electrical Contractors Service on 1300 650 014 (8am to 5pm, Mon to Fri), Fax: 1300 650 016 or Email: appointments@sapowernetworks.com.au

SA Power Networks' Customer Solutions Managers:

Area	Phone (08)	Mobile
Country North (Port Lincoln/Clare))	8682 0567	0428 100 375
Metro North (Elizabeth)	8282 1545	0427 613 566
Adelaide (Keswick)	8404 5407	0403 582 220
Hills & Murray (Mount Barker)	8391 7702	0428 100 030
Metro South (St Marys)	8275 0902	0400 661 805
South East (Mount Gambier)	8724 1617	0403 582 274

Appendices

Appendix A: Commissioning Program Requirements

The commissioning and correct operation of the inverter energy system is the proponent's/owner's responsibility. The components described in this document are to be used as a guide to satisfy SA Power Networks' compliance requirements.

A.1 General

A cover page should be provided for ease of reference and filing. It should include information such as:

1. Site details (Customer name, address etc);
2. Inverter energy systems size (Inverter and panel nominal capacities); and
3. Document control (Version number, date of issue etc).

The commissioning program should include a sign off sheet for the customer, the consultant or installer and SA Power Networks.

A.2 Pre-Compliance Testing

This section should cover any items that need to be checked off prior to the compliance testing starting. Check boxes should be provided for sign off that these items have occurred. As an example, this may include, but not be limited to the following:

Pre-Compliance Testing				
	Proponent/Consultant		SA Power Networks	
	Sign	Date	Sign	Date
Isolation of all inverters				
Location of power quality logging device confirmed				
Proponent permission to begin testing received				
SA Power Networks satisfied with all documentation provided to date				
(other items as appropriate)				

Table A1: Pre-Compliance Testing - Check Box Examples

A.3 Inverter Inspection

This section outlines how to demonstrate that the agreed settings have been applied to each inverter. Visual inspection of the settings, or real-time inspection via a laptop or smart tablet, would be considered acceptable.

It is the responsibility of the proponent, or their representative, to make inspection of the inverter settings possible. The proponent must coordinate with the inverter manufacturer as required. Inability to confirm the inverter settings may result in a delay to the systems connection. As an example, this may include, but not be limited to the following:

Inverter Inspection				
			Proponent/Consultant	SA Power Networks
Global inverter protection settings:				
Protection element	Value	Time		
Over voltage				
Under voltage				
Over frequency				
Under frequency				
Active anti-islanding				
Settings verified on all inverters				
(other items as appropriate)				

Table A2: Inverter Inspection - Check Box Examples

A.4 Back Up Anti-Islanding Protection Compliance

This section outlines how to demonstrate that the backup anti-islanding protection operates in the correct manner. Once demonstrated, SA Power Networks will witness you returning all settings to their agreed values.

You should include a brief description of how you propose to demonstrate the backup anti-islanding protection, ie what steps will you take to prove that each protection element correctly detects and isolates the inverters. As an example, this may include, but not be limited to the following:

Back up anti-islanding protection inspection				
			Proponent/Consultant	SA Power Networks
Over Voltage level 1 demonstrated (include details if needed)				
Over Voltage level 2 demonstrated (include details if needed)				
(all other protection elements)				
Back up anti-islanding protection settings:				
Protection Element	Value	Time		
Over voltage level 1				
Over voltage level 2				
(all other protection elements)				
Inverters isolated on loss of a single-phase supply				
Inverters isolated on loss of supply to the relay				
Back up anti-islanding protection auto resets in ... seconds				
(other items as appropriate)				

Table A3: Back Up Anti-Islanding Inspection - Check Box Examples

A.5 Whole of Systems Compliance

This section outlines how to demonstrate that the whole systems operates as intended. Check boxes should be provided for sign off that these items have occurred. As an example, this may include, but not be limited to the following:

Whole of Systems Compliance		
	Proponent/Consultant	SA Power Networks
All inverters operating correctly		
All inverters and back up anti-islanding protection operate on opening of the following upstream device (nominate device name & location)		
Back up anti-islanding protection settings are tamper proof (Note 1) Tamper proof evidence		
(other items as appropriate)		

Table A4: Whole of Systems Compliance - Check Box Examples

Note 1: You must be able to demonstrate that the settings within the backup anti-islanding protection device cannot be changed without agreement by SA Power Networks. Fitting a uniquely numbered seal to the device, in the presence of SA Power Networks, would be considered acceptable.

Appendix B: Definitions

AEMO:	The Australian Energy Market Operator Limited (or its successor).
Applicant:	Person applying for access to the SA Power Networks network.
AS/NZS:	Stands for Australia and New Zealand Standards published by Standards Australia.
Applicable Inverter:	Means inverters which have been tested by an authorised testing laboratory and certified as being compliant with AS/NZS 4777 series and issued with an accreditation number.
Applicable Regulations:	All regulations as per Appendix C - References.
Connection Point:	As per Electricity (General) Regulations 2012: A connection point to a transmission or distribution network. For this document, the connection point also has the same meaning as Point of Supply as defined in AS/NZS 3000. The agreed point of supply established between SA Power Networks and the customer and/or generator/proponent.
Contractor:	Means a contractor and their sub-contractor who is engaged by SA Power Networks to conduct works on or near SA Power Networks infrastructure.
Distribution Network/Systems:	Has the meaning given to that term in the Electricity Act 1996, namely the whole or a part of a systems for the distribution of electricity, but does not include anything declared by regulation not to be a distribution network or part of a distribution network. For the purposes of these rules references to Distribution Network means the network poles, wires, underground cables, transformers, substations etc, operated by SA Power Networks, which transports electricity from the transmission systems to a customer's connection point.
DNSP:	Means Distribution Network Service Provider.
Electricity Distribution Code (EDC):	Means the Electricity Distribution Code made by ESCOSA pursuant to Section 28 of the Essential Services Commission Act 2002.
Embedded Generating Unit:	A generating unit connected within a distribution network and not having direct access to a transmission network.
ESCOSA:	Means Essential Services Commission of South Australia.
Generating Systems:	All generating units, inverters and the associated control and protection equipment that is located on the generator/proponent's side of the connection point.
Generating Unit:	The plant used in the production of electricity, including all related equipment essential to its function as a single entity.
Generator/Proponent:	A person/entity who engages in the activity of owning, controlling, or operating an inverter energy system that supplies electricity to, or who otherwise supplies electricity to, a transmission or distribution network.
Inverter:	The device that forms part of the generating systems which uses semi-conductor devices to transfer power between a dc source(s) or load and an AC source(s) or load.

B1: Definitions (Continued)

Inverter Energy Systems (IES)	<p>The Systems comprising of one or more inverters together with one or more energy sources (which may include batteries for energy storage) and controls.</p> <p>An installation complying with the requirements of the Australian Standard AS/NZS 4777 series, Grid connection of energy systems via inverters, Part 1: Installation Requirements, and Part 2: Inverter Requirements; and This definition includes but is not necessarily limited to generating systems such as:</p> <ul style="list-style-type: none"> • photovoltaic (PV) installations; • small wind turbine generating units connected via Inverter; and • small fuel-cell installations.
IES Embedded Generation System	An embedded generation system greater than 30kW connected to the distribution network via an inverter
IES:	<p>Includes but is not necessarily limited to such initiatives as:</p> <ul style="list-style-type: none"> • Inverter installations greater than 30 kW • synchronous and asynchronous generating units <p>The final mentioned category includes any commercial plant which is operated and connected in parallel with the distribution network by arrangement with SA Power Networks for demand management or for routine on-load testing.</p>
Must:	Is to be understood as mandatory.
Nameplate Capacity:	The maximum continuous output or consumption in kW or MW of an item of equipment as specified by the manufacturer, or as subsequently modified.
NER:	National Electricity Rules
PV:	Photo voltaic. The generation of electrical power by converting solar radiation into direct current electricity.
Retailer:	Means the holder of an electricity retail licence granted under the Electricity Act, 1996, who is contracted to sell electricity to the Customer at the Supply Address.
Shall:	Mandatory
Should:	Is to be understood as non-mandatory, ie advisory or recommended
Small Embedded Generation System	A single phase or three phase embedded generation system up to 30kW
Suitable (or Suitably):	To the satisfaction of the relevant SA Power Networks Manager
Supply:	The delivery of electricity
Supply Address:	The address at which the proponent is connected to SA Power Networks' distribution network
Transmission Network:	ElectraNet's electricity transmission network

Appendix C: References

The following listed documents are for additional information and other documentation may be required on a project specific basis.

Please Note: It is your responsibility to ensure you have complied with all applicable, SA Legislative Regulations (under Acts), ESCOSA/ENA/AEMC/IEC documentations, relevant AS/NZS standards, the SA Power Networks publications, and you have ensured their current publications, before implementing them.

South Australian Legislations: Example [Electricity \(General\) Regulations](#), [Work Health & Safety Regulations](#)

Essential Services Commission of South Australia (ESCOSA) Codes:

- SA Electricity Distribution Code (EDC)
- SA Electricity Metering Code (EMTC)

Energy Networks Association (ENA) Publications:

- ENA NENS 03: National Guidelines for Safe Access to Electrical and Mechanical Apparatus
- ENA NENS 04: National Guidelines for Safe Approach Distances to Electrical and Mech. Apparatus

Australian Energy Market Commission (AEMC) Publications: National Electricity Rules (NER)

Standards Australia Publications:

AS 1359.0	1998	Rotating Electrical Machines - General Requirements Part 0: Introduction and list of parts
AS 60038	2012	Standard voltages
AS/NZS 3000	2007	Electrical Installations (known as the wiring rules)
AS/NZS 3008.1.1	2017	Electrical Installations - Selection of cables Part 1.1: Cables for altering voltages up to and including 0.6/1 kV - Typical Australian installation conditions
AS/NZS 3010	2005	Electrical Installations - Generating sets
AS/NZS 3017	2007	Electrical installations - Testing User Guides
AS/NZS 3100	2009	Approval and test specification - General requirements for electrical
AS/NZS 3835.1	2006	Earth potential rise Part 1: Protection of telecommunications network users, Equipment personnel and plant
AS/NZS 4777.1	2016	Grid connection of energy systems via inverters Part 1: Installation requirements
AS/NZS 4777.2	2015	Grid connection of energy systems via inverters Part 2: Inverter requirements
AS/NZS 5033	2014	Installation and safety requirements for photovoltaic (PV) arrays

SA Power Networks Documents:

- Manual 14: Safety, Reliability, Maintenance & Technical Management Plan
- Manual 18: Network Tariff & Negotiated Services
- Manual 32: Service and Installation Rules
- Technical Standards & NICC Brochures, in particular:
 - NICC270: Connection Requirements of Embedded Generation
 - TS129: Small Inverter Energy Systems (IES) – Capacity not exceeding 30kW
 - TS131: Large Inverter Energy Systems (IES) above 200kW or Rotating Generating Systems