CitiPower Pty Ltd/
Powercor Australia Ltd

Technical Guidelines for Basic Micro Embedded Generation Connections

07 April 2020

V1.2

Version Control

Version	Date	Updated by	Comments
1.0	11 September 2019	Electricity Networks	New document
1.1	21 November 2019	Electricity Networks	Central Protection update
1.2	07 April 2020	Electricity Networks	Table 10 headers & Appendix B Figure 2 and other minor updates

Contents

1 Introduction

This guideline covers the technical requirements for a proponent to connect a basic micro embedded generation system to the CitiPower and Powercor low voltage networks.

1. Definition

   A basic micro EG connection in CitiPower and Powercor is defined as “a micro EG system with a total system capacity less than or equal to 5 kVA for a single-phase IES (excluding ESS) network connection, and a total system capacity less than or equal to 30 kVA for a three-phase IES (excluding ESS) network connection that is:

   (a) intended to be connected to and capable of operating in parallel with any part of the LV distribution network;

   (b) involving minimal or no augmentation of the distribution network;

   (c) meeting all other technical requirements set out in this document.

2. Purpose

   The purpose of this technical requirements document is to provide proponents of basic micro EG connections recommendations and information about their obligations for connection to and interfacing with the LV distribution network.

3. Scope

   The scope of connections to which this technical requirements document applies, is for new connections of basic micro EG systems or modifications to existing basic micro EG systems, where the basic micro EG system consists of IES, ESS or a combination of both.

4. Not in Scope

   The scope of systems to which this technical requirements document does NOT apply, are:

   (a) EG units covered by CitiPower and Powercor’s LV EG Connection Technical Requirements (above 30kVA);

   (b) EG units covered by CitiPower and Powercor’s MV/HV EG Connection Technical Requirements (above 1MVA HV);

   (c) Electric vehicles, unless the on-board battery storage system is capable of exporting to the LV network (in which case the requirements shall apply);

   (d) DER systems that do not generate electricity, including demand response/demand management systems, unless they impact on the ability of the basic micro EG system to meet the technical requirements.

5. The general obligations of proponents are:

   (a) The obligation to comply with the technical requirements as well as relevant national standards, industry codes, legislation and regulations. In the event of inconsistency, an indication of which instrument shall prevail, being legislation and regulations, followed by the technical requirements, followed by national standards and industry codes;

   (b) The obligation to not connect additional inverters, make modifications or install additional micro EG units, including ESS, without prior written agreement from CitiPower and Powercor;

   (c) The obligation to comply with CitiPower and Powercor’s model standing offer;

   (d) The obligation to meet the requirements in the design, installation and operation of the basic micro EG system.

6. Safety

   CitiPower and Powercor are obligated to ensure the safe and reliable operation of the distribution system for operating personnel, customers and the general public.

7. Compliance to ENA National DER Connection Guidelines

   The technical requirements comply with the ENA National DER Connection Guidelines for Basic Micro EG Connections, with the exception of the deviations presented in Appendix A: Deviations from the National DER Connection Guidelines.

2 Definitions and Abbreviations

2.1 Definitions

This section provides a tabulated list of definitions for any technical or industry terms used throughout the technical requirements document. The definitions are consistent with the definitions provided within the National DER Connections Guidelines (and the Framework and Principles guideline) as relevant.

Basic micro embedded generation connection	*A connection between a distribution network and a retail customer's premises for a micro embedded generating unit, for which a model standing offer is in place* or an equivalent model offer is in place in jurisdictions not subject to Chapter 5A of the National Electricity Rules
Central protection	Central protection is the protection contemplated by AS/NZS 4777 (grid connection of energy systems via inverters) installed to perform the functions of: coordinating multiple inverter energy system installations at one site, providing protection for the entire inverter energy system installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public
Embedded generating unit	*A generating unit connected within a distribution network and not having direct access to the transmission network*
Embedded generating system	A system comprising of multiple embedded generating units
Distributed Energy Resources	Power generation or storage units that are connected directly to the distribution network
Energy storage system	A system comprising one or more batteries that store electricity generated by distributed energy resources or directly from the grid, and that can discharge the electricity to loads
Generating unit	*The plant used in the production of electricity and all related equipment essential to its functioning as a single entity.*
Generation	*The production of electrical power by converting another form of energy in a generating unit*
Generator	*A person who owns, operates or controls a generating unit*
Inverter energy system	A system comprising one or more inverters that convert direct current to alternating current
Low voltage	The mains voltages as most commonly used in any given network by domestic and light industrial and commercial consumers (typically 230V)
Medium voltage/ High voltage	Any voltage greater than 1kVAC
Micro embedded generation connection	*Means a connection between an embedded generating unit and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters) currently up to* 200kVA
Market generating unit	*A generating unit whose generation is not purchased in its entirety by a retailer (and receives payment for generation through the National*

	Electricity Market or Wholesale Electricity Market)
Model standing offer	*A document approved by the Australian Energy Regulator as a model standing offer to provide basic micro embedded generation connection services or standard connection services which contains (amongst other things) the safety and technical requirements to be complied with by the proponent.* This definition also applies to an equivalent model offer for jurisdictions not subject to Chapter 5A of the National Electricity Rules
Proponent	A person proposing to become a generator (the relevant owner, operator or controller of the generating unit (or their agent))
Registered generator	*A person who owns, operates or controls a generating unit that is connected to, or who otherwise supplies electricity to, a transmission or distribution system and who is registered by the Australian Energy Market Operator as a Generator under Chapter 2 of the National Electricity Rules*
Site generation limit	The generation threshold that the embedded generation system cannot exceed, measured downstream of the connection point
Small generation aggregator	*A person who has classified one or more small generating units as a market generating unit*
Small registered generator	*A generator who elects to register a generator with the Australian Energy Market Operator as a market generating unit who would otherwise be entitled to an exemption to register based on size*
Standard connection	*A connection service (other than a basic micro embedded generation connection service) for a particular class (or sub-class) of connection applicant and for which an Australian Energy Regulator approved model standing offer is in place or for which an equivalent model offer is in place in jurisdictions not subject to Chapter 5A of the National Electricity Rules*
Single Wire Earth Return	Parts of the electrical distribution network that use a single live conductor to supply single-phase or split-phase electric power with higher network impedances, and with distribution supplying low voltages to premises
Technical requirements document	The document produced by each Distribution Network Service Provider (e.g. Citipower and Powercor) setting out their requirements for proponents to enable a grid connection, to which these guidelines apply

Table 1: Definitions

[1] Definitions in italics are consistent with the definitions under the National Electricity Rules

2.2 Abbreviations

This section shall provide a tabulated list of all abbreviations used throughout the technical requirements document. The abbreviations are consistent with the abbreviations provided within the National DER Connections Guidelines (and the Framework and Principles guideline) as relevant.

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AS/NZS	A jointly developed Australian and New Zealand Standard

CBD	Central Business District
CEC	Clean Energy Council
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
EG	Embedded Generation or Embedded Generating
ESS	Energy Storage System
HV	High Voltage
IEC	International Electrotechnical Commission
IES	Inverter Energy System
LV	Low Voltage
MV	Medium Voltage
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
SWER	Single Wire Earth Return
SWIS	South West Interconnected System
WEM	Wholesale Electricity Market servicing the SWIS

Table 2: Abbreviations

2.3 Terminology

In these guidelines the following terminology is used:

1. The word ‘shall’ indicates a mandatory requirement;
2. The word ‘may’ indicates a requirement that may be mandatorily imposed on the proponent;
3. The word ‘should’ indicates a recommendation that will not be mandatorily imposed on the proponent.

2.3.1 Subcategories

The subcategories, for which different technical settings may apply, are:

1. Single-phase basic micro EG connection – Any basic micro EG system with a system capacity less than or equal to 5 kVA for a single-phase IES (excluding ESS) network connection meeting all technical requirements for basic micro EG connections set out in CitiPower and Powercor's technical requirements document;
2. Three-phase basic micro EG connection – Any basic micro EG system with a system capacity less than or equal to 30 kVA for a three-phase IES (excluding ESS) network connection meeting all technical requirements for basic micro EG connections set out in the CitiPower and Powercor's technical requirements document;
3. Non-standard basic micro EG connection – Any basic micro EG system connecting to a non-standard part of the network including (but not limited to) SWER and single phase three wire (240/480V) networks.

The hyperlink or website reference to a map to geographically identify the distribution business supplying a customer is at:

https://www.powercor.com.au/what-we-do/the-network/citipower-and-powercor-networks/

Contact details in case there is any doubt as to which subcategory applies (note that non-standard SWER and single phase three wire only exists in Powercor area):

Contact CitiPower on 13 12 80 and Powercor on 13 24 12.

https://www.powercor.com.au/contact-us/general-enquiry/

The technical requirements set out in these guidelines should be interpreted as applying to all subcategories of basic micro EG connections unless otherwise specified.

3 Relevant Rules, Regulations, Standards and Codes

3.1 Standards and Codes

This section contains a list of all the Australian and international standards and industry codes which shall apply to the design, manufacture, installation, testing and commissioning, and operation and maintenance of all plant and equipment for basic micro EG connections to the distribution network.

In the event of any inconsistency between Australian and international standards and industry codes and the CitiPower and Powercor technical requirements, the CitiPower and Powercor technical requirements shall prevail.

Victorian industry codes applicable to DNSPs			
Document Title	**Includes technical requirements**	**Legally binding**	**Description**
Electricity Distribution Code (Version 9)	Yes	Yes	Regulates the distribution of electricity, connections to distribution networks, and the transfer of electricity between distribution systems so that they are undertaken in a safe, efficient, and reliable manner

Table 3: Industry codes

Australian Standards	Standard Title
AS 1319	Safety signs for occupational environment
AS 1359	General Requirements for Rotating Electrical Machines
AS 2006	Diesel Generators/internal combustion engines
AS 2184	Low voltage switchgear
AS 2344	Limits of electromagnetic interference from overhead a.c. power lines and high voltage equipment installations in the frequency range 0.15 to 1000 MHz
AS 2373	Electric Cables
AS 2374	Power Transformers
AS 2915	Solar Photovoltaic Modules – Performance Requirements
AS/NZS 3000	Electrical Installations (Wiring Rules), 3010 – Electrical Installations – Generating Sets, 3017 – Testing Guidelines
AS/NZS 3008	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV
AS 3010	Electrical Installations
AS/NZS 3017	Electrical installations – Testing Guidelines
AS/NZS 3100	Approval and test specification – General requirements for electrical equipment
AS/NZS 3439.1:2002	Low Voltage Switchgear and control gear assemblies
AS 4509	Stand-alone power systems, Parts 1,2,3
AS 4777	Grid Connection of Energy Systems via Inverters, Parts 1 & 2
AS/NZS 5033	Installation of photovoltaic (PV) arrays
AS 60034.1	Rotating electrical machines, Part 1: Rating and performance
AS 60034.22	Rotating electrical machines, Part 22: AC generators for reciprocating internal combustion (RIC) engine driven generating sets
AS 60038	Standard Voltages
AS 60044	Instrument transformers (multiple parts)
AS/NZS IEC 60947.6-1	Low-voltage switchgear and control gear - Multiple function equipment - Automatic transfer switching equipment
AN/NZS TR 61000.3.14	Electromagnetic compatibility (EMC), Part 3.14: Limits—Assessment of emission limits for harmonics, inter-harmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems
AN/NZS TR 61000.3.15	Electromagnetic compatibility (EMC), Part 3.15: Limits— Assessment of low frequency electromagnetic immunity and emission requirements for dispersed generation systems in LV network

Table 4: Australian Standards

International Standards	Document Title
IEEE PSRC	Intertie protection of consumer-owned sources of generation, 3MVA or less
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
IEEE 1547	IEEE Standard for interconnecting Distributed Resources with Electric Power systems
IEC 60255-12	Electrical relays - Part 12: Directional relays and power relays with two input energizing quantities
IEC 60255-26	Electrical relays - Part 26: Electromagnetic compatibility requirements
IEC 60255-27	Electrical relays - Part 27: Product safety requirements
IEC 60255-127	Measuring relays and protection equipment - Part 127: Functional requirements for over/under voltage protection
IEC 62109	Safety of power converters for use in photovoltaic power systems
IEC 62116	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures
IEC 62786	Distributed energy resources connection with the grid
G59/2*	Recommendations for the connection of embedded generating plant to the DNSP's distribution systems and the provision of standby generators
G75*	Recommendations for the connection of embedded generating plant to Public distribution systems above 20kV or with outputs over 5MW
G83/18*	Recommendations for the Connection of Small-scale Embedded Generators (Up to 16A per Phase) in Parallel with Public Low-voltage Distribution Networks.
ETR 113*	Engineering Technical Report No ETR 113

Table 5: International Standards

* Energy Networks Association UK

3.2 Legislation and Regulation

This section provides a list of all the relevant legislation and regulations which shall apply to the design, manufacture, installation, testing and commissioning, and operations and maintenance of all plant and equipment for basic micro EG connections to the distribution network.

In the event of any inconsistency between legislation and regulations and the CitiPower and Powercor technical requirements, the legislation and regulation shall prevail.

Victorian legislation and regulation applicable to DNSPs			
Document Title	**Includes technical requirements**	**Legally binding**	**Description**
Electricity Industry Guideline 15 –	No	Yes	Provides arrangements for connecting embedded generating units to distribution systems

Connection of Embedded Generation			
Victorian Service and Installation Rules	Yes	Yes	Provides industry agreed technical requirements that meet all legislative and code requirements for the supply and metering related aspects of any connection to the Victorian electricity supply networks

Table 6: Legislation and Regulation

4 Technical Requirements

4.1 Labelling and Signage

All labels and signs on the installation, including cables, shall be as per AS/NZS 4777.1, AS/NZS 3000 and AS/NZS 5033.

4.2 Maximum System Capacity

This section specifies the maximum system capacity of basic micro EG connections for each subcategory consistent with the below:

1. Single-phase basic micro EG connection – For single-phase basic micro EG connections of IES (excluding ESS), the maximum system capacity shall be 5 kVA for two wire supplies (240V transformer windings) and 2 x 2.5kVA for three wire supplies (240/480V transformer windings);
2. Three-phase basic micro EG connection – For three-phase basic micro EG connections of IES (excluding ESS), the maximum system capacity at the same connection point shall be 10 kVA per phase or 30kVA three phase;
3. Non-standard basic micro EG connection – For SWER basic micro EG connections of IES (excluding ESS), the maximum system capacity shall be set 5 kVA for two wire supplies (240V transformer windings) and 2 x 2.5kVA for three wire supplies (240/480V transformer windings).

EG Connections involving different strata titles (customer entities) and having the same connection point (e.g. retirement villages, blocks of flats) are quite complex and will involve technical studies and equipment evaluation to establish conditions for connection. For these reasons they are not basic micro EG connections and the CitiPower and Powercor LV EG Connection Technical Requirements are to apply.

4.3 Generation Control

Basic micro EG connections require generation control.

4.3.1 Export Limits at Connection Point

The export limits of basic micro EG connections for each subcategory are as per below:

1. Single-phase basic micro EG connection – For single-phase basic micro EG connections of IES (excluding ESS), the export limit shall be 5 kVA at the connection point;
2. Three-phase basic micro EG connection – For three-phase basic micro EG connections of IES (excluding ESS), the export limit shall be 5 kVA per phase with a balanced output with respect to its rating and a tolerance of no more than 5 kVA unbalance between any phases as per AS/NZS 4777.1 at the connection point;
3. Non-standard basic micro EG connection – For SWER basic micro EG connections of IES (excluding ESS), the export limit shall be 5 kVA at the connection point.

The export limit is to be interpreted as “soft”, consistent with the definition of soft export limits within AS/NZS 4777.1.

The export limit is also to be interpreted by the proponent as a maximum. The ability of the proponent’s basic micro EG system to export at the export limit is not guaranteed, but rather, it will depend upon network characteristics which change over time. There are circumstances where output may need to be constrained including, but not limited to inverter power output where power quality response modes are in operation.

For example, when the voltage is above or below certain thresholds, the generator will need to operate in a power quality mode that controls voltage using reactive power control firstly to contain connection point voltage within code limits i.e. 206V to 253V. Secondly, if the voltage is above the steady state code limit of 253V, output power is constrained to bring voltage back to code limits.

Also there may be other assets e.g. LV conductors and distribution transformers, upstream of the connection point that may constrain export by the proponent due to the existing amount of connected EG. The following table shows the asset limitations based on transformer capacity for a typical LV network:

Network type	Maximum inverter size (solar and hybrid~)	Maximum export to the grid**	Maximum Battery discharge size	EG proportion of asset rating capacity limits**
SWER (2 wire LV)	5kVA	5kVA	5kVA	30% of transformer nameplate rating
SWER (3 wire LV)	2x2.5kVA	5kVA	5kVA	As per above
Single phase (2 wire)	5kVA	5kVA	5kVA	30% of rural and 50% of urban transformer nameplate rating
Single phase (3 wire)	2x2.5kVA	5kVA	5kVA	As per above
Three phase	30kVA	15kVA	15kVA	As per above

Table 7: EG sizes and asset rating limits

~A hybrid inverter is a multi-mode inverter that can control both solar PV and battery installations. It is recommended that battery storage systems should be normally set up to charge when there is excess generation and discharge only when there is a shortage of generation i.e. supply is taken from the network. An export meter and IES controller is required to detect point of supply import/export condition to assist controlling a battery storage system. Where not all phases have solar, the battery/energy storage inverter is to be connected to a phase with solar.

**The allowable export may be less depending on asset capacity. An export meter and IES Controller is required to be set to control grid export where inverter size is greater than the export limit. Network LV overhead lines and underground cables may not be able to be loaded to the maximum continuous rating due to excessive voltage drop, hence the above limitations have been applied on the basis of transformer rating. Location specific technical assessments will be required where a proponent’s application for export results in the total connected EG exceeding the limits in the above table.

4.3.2 Site Generation Limit Downstream of Connection Point

The generation limits of basic micro EG connections for each subcategory are as per below:

1. Single-phase basic micro EG connection – For single-phase basic micro EG connections of IES (excluding ESS), the site generation limit shall be set to equal 5 kVA downstream of the connection point;
2. Three-phase basic micro EG connection – For three-phase basic micro EG connections of IES (excluding ESS), the site generation limit shall be set to equal 10 kVA per phase

with a balanced output with respect to its rating and a tolerance of no more than 5 kVA unbalance between any phases as per AS/NZS 4777.1 downstream of the connection point;

3. Non-standard basic micro EG connection – For SWER basic micro EG connections of IES (excluding ESS), the generation limit shall be set to equal 5 kVA at the connection point.

As per the above Table 7, ESS size is limited to 5kVA discharge for single phase connections and 15kVA discharge for three phase installations.

4.4 Inverter Energy System

The requirements that apply to IES are:

1. IES shall be tested by an authorised testing laboratory and be certified as being compliant with AS/NZS 4777.2 with an accreditation number;
2. IES shall comprise of inverters that are registered with CEC as approved grid connect inverters;
3. IES shall comprise of inverters that are tested by an authorised testing laboratory and certified as being compliant with IEC 62116 for active anti- islanding protection as per AS/NZS4777.2;
4. IES shall comprise of inverters installed in compliance with AS/NZS 4777.1;
5. IES shall comprise of inverters that have both volt-var and volt-watt response modes available.

4.5 Network Connection and Isolation

The network connection and isolation requirements shall be as per AS/NZS 4777.1.

In addition:

1. As a minimum, mechanical isolation shall be as per AS/NZS 3000 in that the isolator must always be readily accessible;
2. Any means of isolation (where lockable) shall be able to be locked in the open position only.

4.6 Earthing

The earthing of the installation shall include:

1. For IES, earthing requirements shall be as per AS/NZS 4777.1 and AS/NZS 3000;
2. For ESS, earthing requirements shall be as per AS 3011.

4.7 Protection

Protection requirements shall be as per AS/NZS 4777.2.

4.7.1 Inverter Integrated Protection

The inverter integrated protection requirements shall be as per AS/NZS 4777.1 and AS/NZS 4777.2 for basic micro EG connections.

The passive anti-islanding requirements using voltage and frequency limits required are as per Table 13 of AS/NZS 4777.2 reproduced below:

Table 13 of AS/NZS 4777.2	Protective function	Protective function limit	Trip delay time	Maximum disconnection time
Passive anti-islanding protection (default and not able to be changed)	Undervoltage (V<)	180V	1s	2s
	Overvoltage 1 (V>)	260V	1s	2s
	Overvoltage 2 (V>>)	265V	-	0.2s
	Under-frequency (F<)	47Hz	1s	2s
	Over-frequency (F>)	52Hz	-	0.2s

Table 8: Passive anti-islanding protection settings

Active anti-islanding protection and its requirements shall be per AS/NZS 4777.2.

The Frequency Disturbance Control Protection Settings are the default settings in sections 7.5.3.1-2 of AS4777.2 as shown below:

Frequency disturbance control protection settings	Quantity	Range	Default setting	Required setting
Increase in frequency	Fstop	51-52Hz	52Hz	52Hz
Decrease in frequency	Fstop-CH	47-49Hz	49Hz	49Hz

Table 9: Frequency disturbance control protection settings

4.7.2 Central Protection

Central protection is required for a number of reasons as explained in section 3.4.4 of AS4777.1. One of the main reasons is to provide protection for the entire IES installation including (where installed) multiple IES on site, and consequently Central Protection shall be installed as close as practicable to the main switch of the installation.

Central Protection shall be installed as per Table 1 of AS/NZS 4777.1 and have voltage and frequency set points as per Table 2 of AS/NZS 4777.1 (see tables 10 & 11 below). For basic micro EG, phase balance protection is the only central protection required for non-integrated three phase inverters.

	IES ≤ 5kVA/phase	15kVA < IES ≤ 30kVA	30kVA < IES ≤ 200kVA
Connection type	Single-phase, two-phase or three-phase	Three-phase	Three-phase
Protection required for all systems	Inverter integrated protection according to AS/NZS 4777.2	Inverter integrated protection according to AS/NZS 4777.2	Inverter integrated protection according to AS/NZS 4777.2
Additional central protection	None	Phase balance protection (refer to clause 3.4.4.2 of AS/NZS 4777.1) where not inverter integrated according to AS/NZS 4777.2	Phase balance protection (refer to clause 3.4.4.2 of AS/NZS 4777.1) where not inverter integrated according to AS/NZS 4777.2 AND Under and over voltage and under and over frequency protection (refer to clause 3.4.4.3 of AS/NZS 4777.1)

Table 10: Requirements for inverter integrated protection and central protection functions (Table 1 of AS/NZS 4777.1)

Setting parameter	Disconnection time	Protective function limit
Sustained over voltage (V>) (based on average value over a period of 10 min)	15s	258V
Over voltage 2 (V>>)	2s	260V
Under voltage (V<)	2s	180V
Over-frequency (F>)	2s	52Hz
Under-frequency (F<)	2s	47Hz

Table 11: Central Voltage and Frequency Protection set points (Table 2 of AS/NZS 4777.1)

4.7.3 Interlocking

Where multiple single-phase inverters are connected to more than one phase, either of the following requirements will apply:

1. Single-phase inverters are to be interlocked and configured to operate as an integrated multi-phase inverter providing a balanced output that is no more than 5 kVA between any phases as per AS/NZS 4777.1;

OR

2. Phase balance protection as per Clause 3.4.4 of AS/NZS 4777.1 is required, with exceptions outlined within Clause 5.4.4 in AS/NZS 4777.1.

4.8 Operating Voltage and Frequency

The operating voltage and frequency requirements can be found in section 4.7 above containing the Inverter Integrated Protection requirements.

The nominated maximum voltage set point, Vnom_max as per AS/NZS 4777.2 is 258V.

The voltage rise of the installation is to be no greater than the requirement in Appendix F.2 (i) of AS/NZS 4777.1.

4.9 Metering

This section is noted as intentionally blank for Citipower and Powercor as being subject to Chapter 7 ‘Metering’ of the NER.

4.10 Power Quality

4.10.1 IES Power Quality Response Modes

Volt–watt and volt–var response modes specified in Clause 6.3.2.2 and Clause 6.3.2.3 of AS/NZS 4777.2 shall be enabled.

The following table 12 specifies the volt response reference values, the volt–watt response set-point values and the volt-var response set-point values. These settings apply to ESS and hybrid (multimode) inverters.

Voltage reference point	Volt-Watt		Volt-Var	
	Voltage set point	Setting value (% of rated power)	Voltage set point	Setting value (% of rated VA)
V1	207V	100%	208V	+44% leading
V2	220V	100%	220V	0
V3	253V	100%	241V	0
V4	259V	20%	253V	-44% lagging

Table 12: Power quality settings

Above table is current for Victoria wide settings. The setting points and values are consistent with the Model Standing Offer for CitiPower and Powercor.

Note that leading is sourcing vars to the grid (also known as ‘exporting’ or ‘capacitive’) and lagging is sinking vars from the grid (also known as ‘importing’ or ‘inductive’).

Where an additional basic micro EG unit is being added to a site with an existing basic micro EG connection that has legacy power quality settings, the above voltage response mode settings will be required for both the new and existing installation.

The power rate ramping requirements for the IES (and ESS for multimode inverters) shall be as per AS/NZS 4777.2 default settings.

Volt-Watt charging of energy storage devices shall be as per the default settings in AS 4777.2.

4.11 Communications Systems

CitiPower and Powercor does not yet have any communications system requirements for basic micro EG connections, and this section has been retained, and noted as intentionally blank.

4.12 Data and Information

4.12.1 Static Data and Information

The proponent is to supply the static data and information to CitiPower/Powercor as per Appendix D: Static Data and Information. The data is to be provided to the CitiPower/Powercor contact person/email address used for the connection and approval of the IES.

4.12.2 Dynamic Data and Information

CitiPower and Powercor does not yet have any communications systems for basic micro EG connections to transmit dynamic data and information to us and/or any other bodies, and this section has been retained, and noted as intentionally blank.

4.13 Cybersecurity

CitiPower and Powercor does not yet have any communications systems requirements for basic micro EG connections, this section shall be retained, but noted as intentionally blank.

4.14 Technical Studies

Provided that the total connected EG export does not exceed the transformer limits as specified in Table 7 in section 4.3.1, no technical studies are required to be carried out by the proponent or at the proponent’s expense to enable connection to the distribution network.

Where the total connected EG export to a transformer does not exceed the transformer and LV conductor limits as specified in Table 7, technical studies may be performed by CitiPower/Powercor at CitiPower/Powercor’s cost, and the outcomes of the technical studies shall not result in any change to the technical requirements for basic micro EG connections.

Where the total connected EG export to a transformer exceeds the transformer and LV conductor limits in Table 7 and the proponent does not wish to limit their IES export to prevent exceeding the transformer limits, technical studies will need to be performed by CitiPower/Powercor at CitiPower/Powercor’s expense. The outcomes of the technical studies may result in increasing the allowable export, with or without a change to the technical requirements, or it may identify network augmentation works, to achieve the desired export level. Any augmentation works would be at the proponent’s expense and involve separate negotiations.

5 Fees and Charges

No fees and charges are applicable for the basic micro EG connection application or technical review. There may be fees and charges for meter reconfiguration and or replacement to facilitate the registration of solar generation.

https://www.powercor.com.au/customers/electricity-connections/solar-and-other-generation/solar-meter-set-up-and-associated-charges/

Refer to the link below for the latest CitiPower or Powercor Pricing Proposal:

https://www.powercor.com.au/industry/retailer-resources/network-tariffs-and-charges/

6 Testing and Commissioning

Testing and commissioning shall be undertaken in accordance with AS/NZS 4777.1, AS/NZS 3000 and AS/NZS 5033 (where applicable), the equipment manufacturer's specifications, and CitiPower/Powercor's technical requirements to demonstrate that the basic micro EG system meets the requirements of the connection agreement. The tests shall be installation tests not type tests.

7 Operations and Maintenance

Basic micro EG systems should be operated and maintained to ensure compliance with their connection agreement and all legislation, codes, and/or other regulatory instruments at all times. CitiPower/Powercor may inspect basic micro EG systems at any time at CitiPower/Powercor's expense.

The general expectations for operating and maintaining basic micro EG systems are:

1. Maintaining the electrical installation at the supply address in a safe condition;
2. Ensuring that any changes to the electrical installation at the supply address are performed by an electrician lawfully permitted to do the work and that the customer holds a Certificate of Compliance issued in respect of any of the changes;
3. Seeking CitiPower/Powercor approval prior to altering the connection in terms of an addition, upgrade, extension, expansion, augmentation or any other kind of alteration, including changing inverter settings;
4. CitiPower/Powercor does not allow connection of non-complying basic micro EG systems to the network. Further, if connection and energization of a basic micro EG has occurred without approval, any generation credits will not be registered at the installation meter. Post installation, consumers with non-complying basic micro EG systems will need to negotiate with CitiPower/Powercor over rectification actions required. CitiPower/Powercor has a number of actions that could be taken in response to the severity of the non-compliance that include disconnection for immediate safety issues.

Appendix A: Deviations from the National DER Connection Guidelines

This appendix shall include a register of all deviations from this technical guideline in the format provided in Table 11.

Section	Description of deviation	Type of deviation	Justification
1	ENA describes a micro EG system as having a total system capacity greater than or equal to 5kVA for single phase. CitiPower/Powercor set the single phase total limit of less than or equal to 5KVA.	To promote improved benefits to consumers	For single phase, the ENA minimum is 5kVA with no maximum whereas the CP/PAL maximum is 5kVA. CP/PAL have set the maximum limit to 5kVA to allow the greatest number of customers to connect at the minimum cost given the limited capacity of the network and that the system average customer load is in the order of 3kVA. A limit of greater than 5kVA would require more network augmentation than a limit of 5kVA. This limit also aligns with the maximum export limit of 5kVA single phase and minimizes cost to the consumer by avoiding the additional expense of an export control device, if the total size is greater than 5kVA.
4.14	ENA describes that the outcome of technical studies shall not result in any change to the technical requirements for basic micro connection. CitiPower/Powercor may carryout technical studies at their own expense which may result in changing technical connection requirements (i.e. PQ Response setting changes or export limitation).	To promote improved benefits to consumers	The electricity network has been built for average loads less than 5kVA, so whilst there may be capacity for some customers to connect without the need for a technical study, there will be some cases where a study is required due to a number of factors including the amount of pre-existing connections and limited asset (transformer and LV conductor) capacity.

Table 13: Table of Deviations from National DER Connection Guidelines

Appendix B: Connection Arrangement Requirements

This appendix includes:

1. Basic single line diagrams of CitiPower/Powercor's preferred connection arrangements, and a range of other possible connection arrangements for integration of basic micro EG connection, showing:
    a) the connection point
    b) the point of common coupling
    c) the EG unit(s)
    d) load(s)
    e) meter(s)
    f) isolation device.

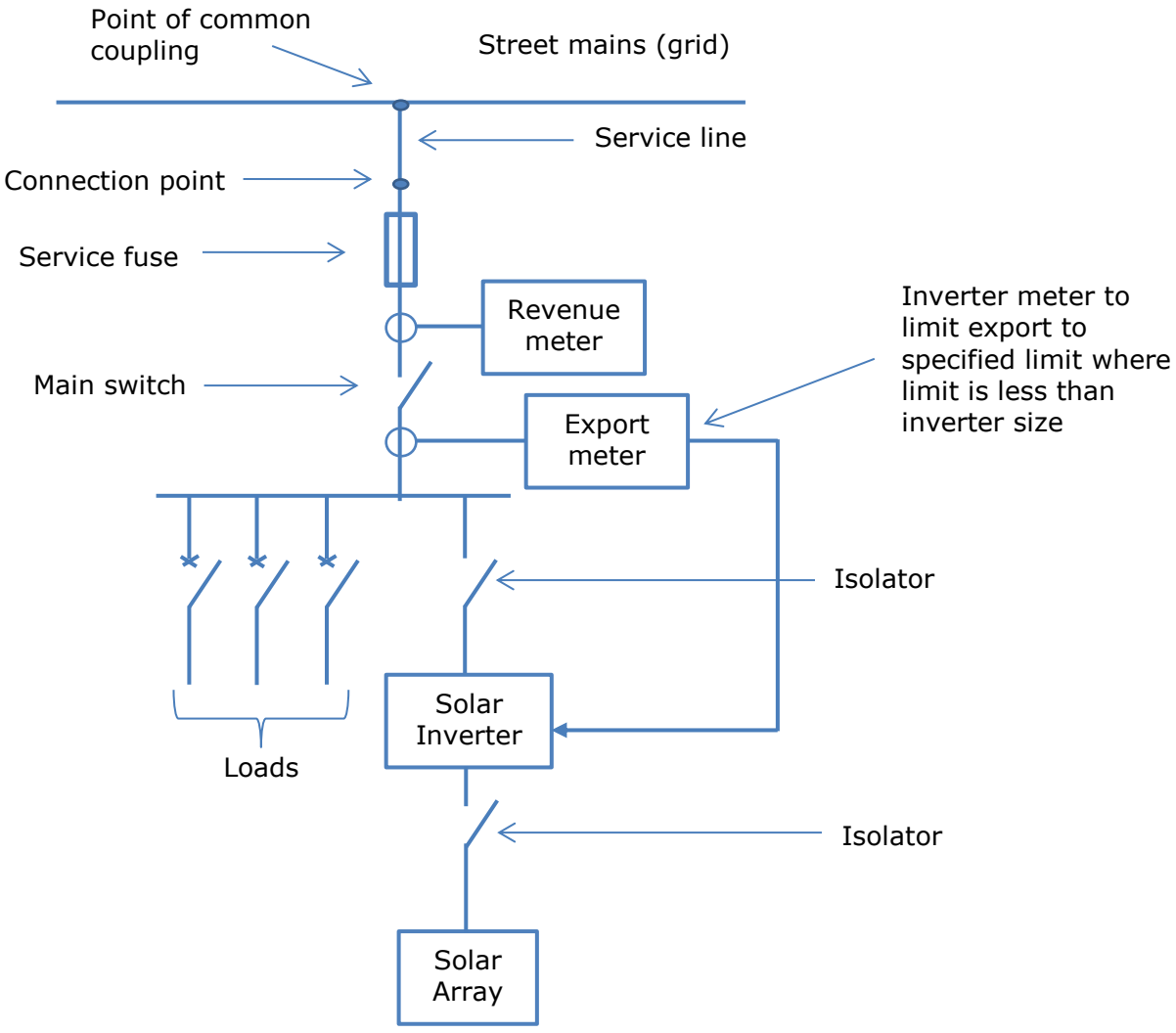

Figure 1: Solar Inverter only

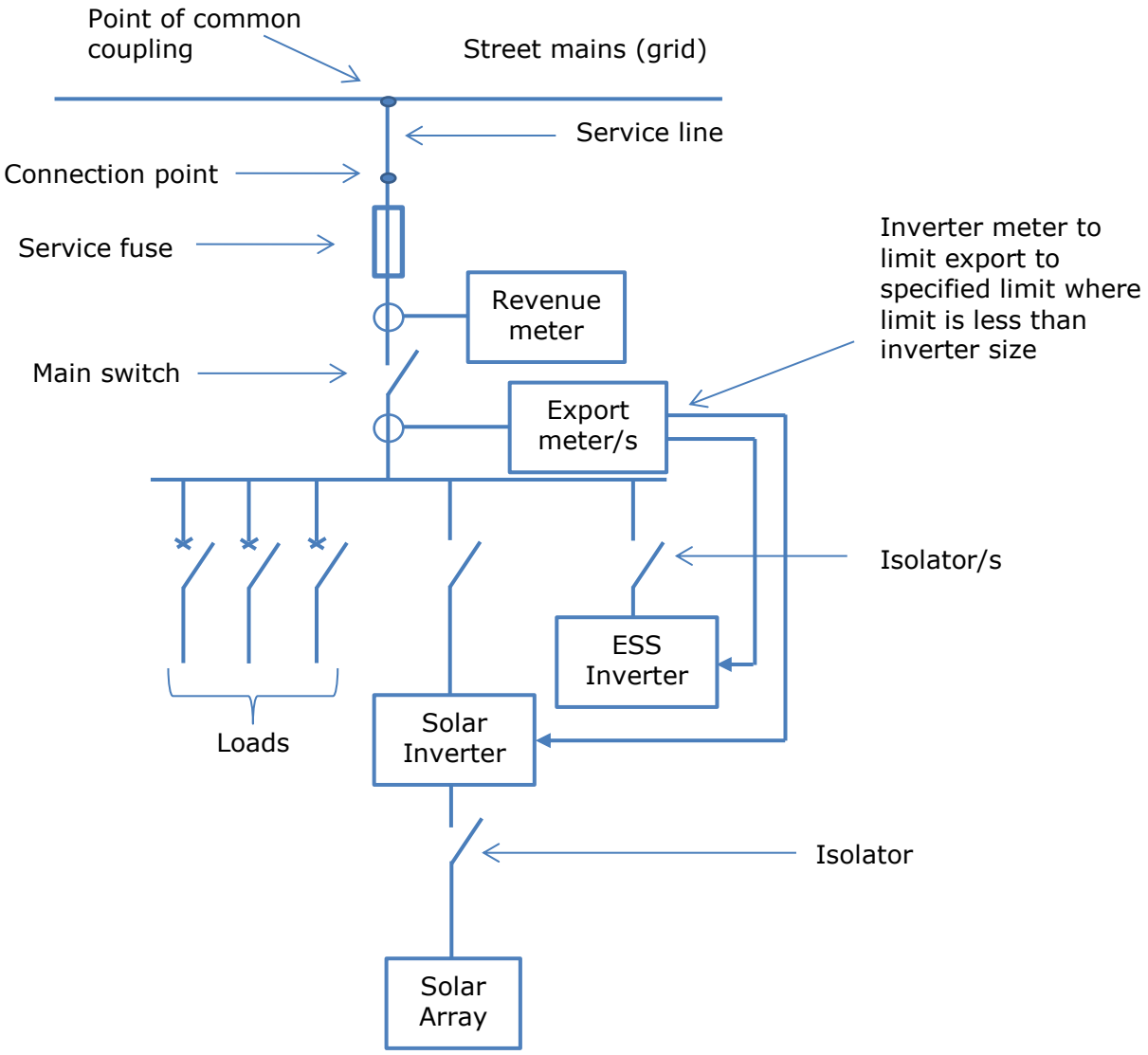

Figure 2: AC coupled schematic

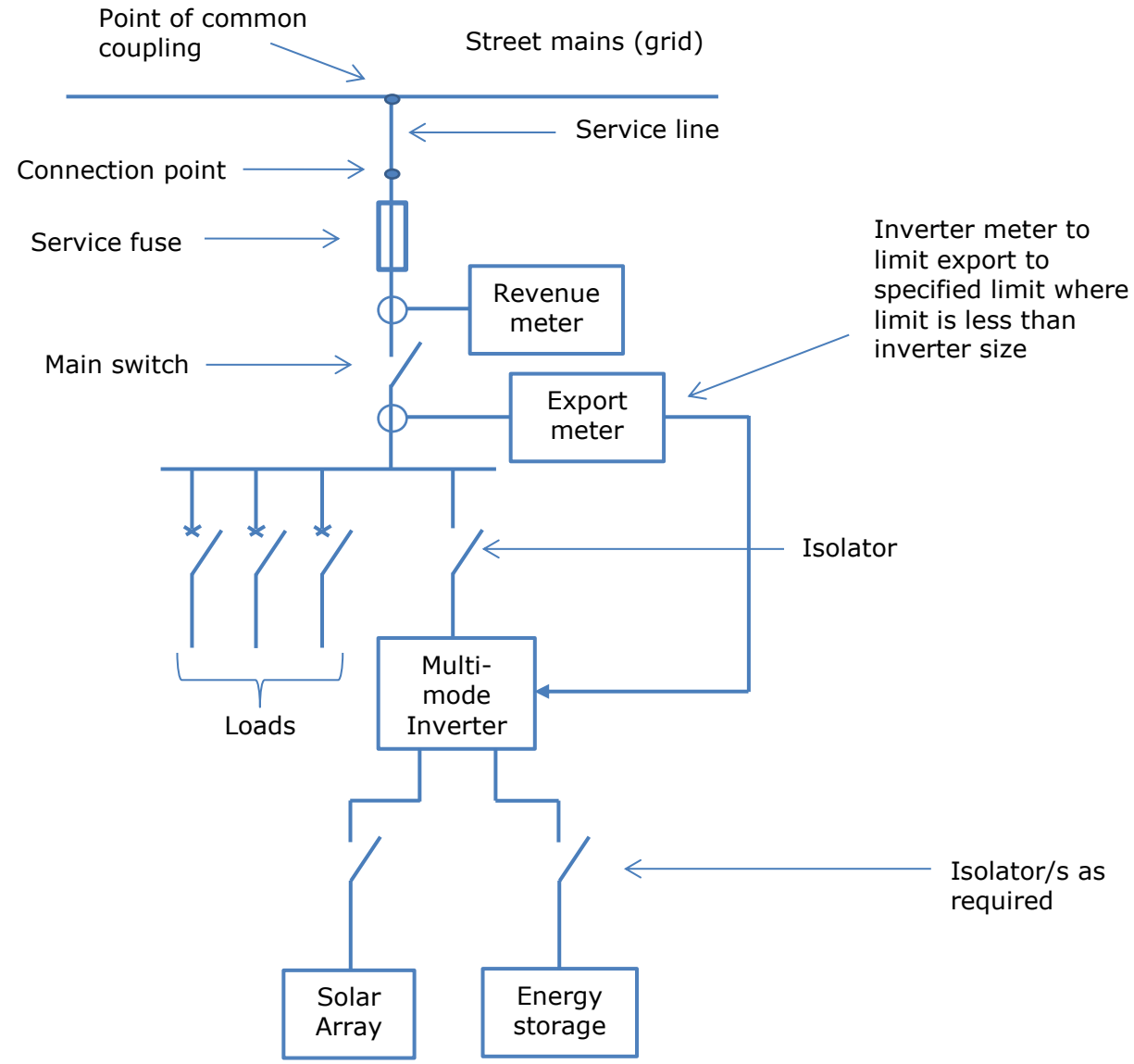

Figure 3: DC coupled schematic

2. A sample schematic diagram of the protection system and control system relevant to the connection of a basic micro EG unit to the distribution network, showing the protection system and control system, and including:
    a) All relevant current circuits
    b) Relay potential circuits
    c) Alarm and monitoring circuits
    d) Back-up systems
    e) Parameters of protection and control system elements.

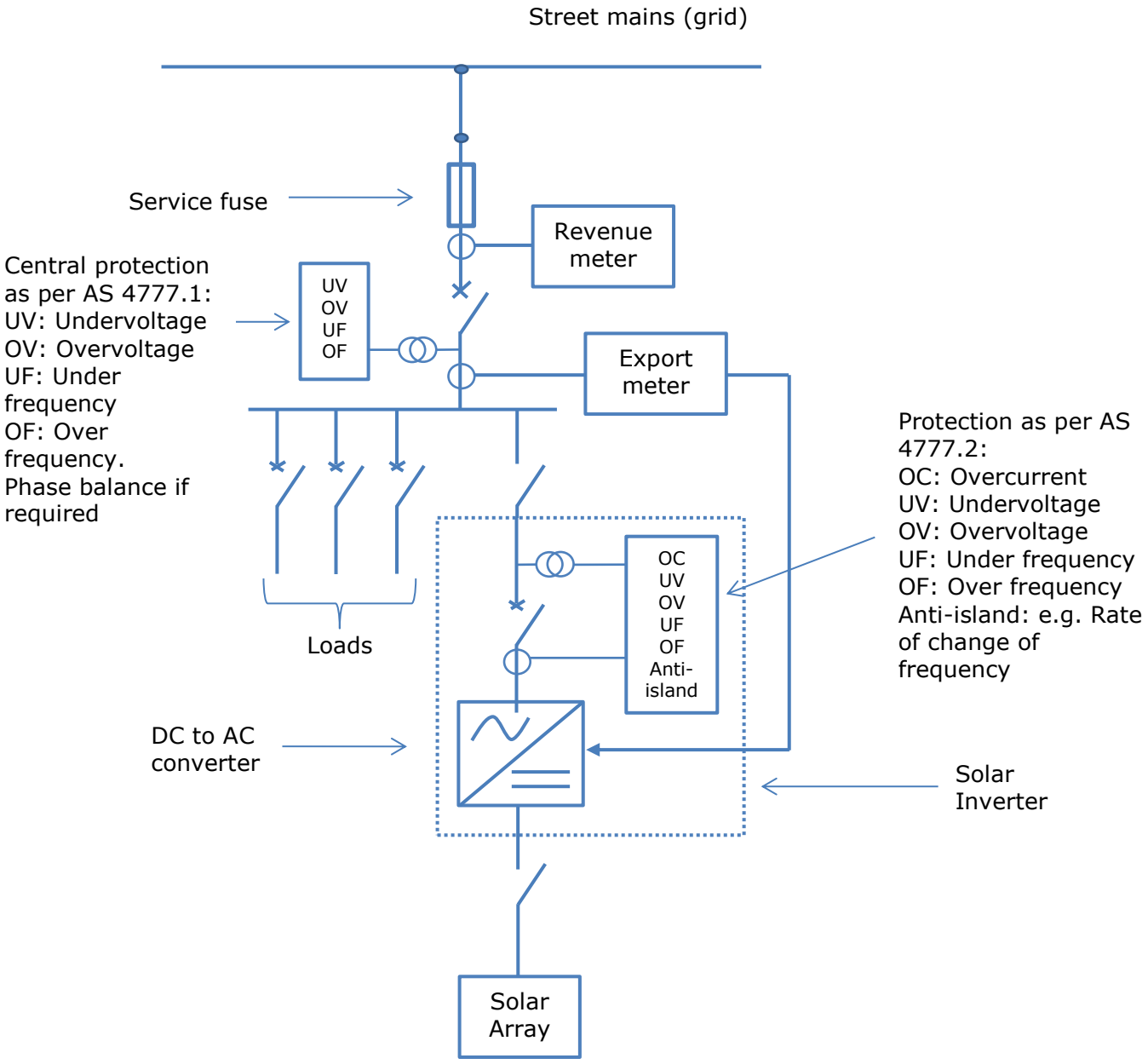

Figure 4: Solar Inverter basic protection arrangement

Appendix C: Model Standing Offer

The AER approved model standing offers for basic micro embedded generation connections for CitiPower and Powercor are available on the CitiPower/Powercor website at:

https://www.powercor.com.au/industry/electricity-connections/documents-and-further-information/

Appendix D: Static Data and Information

The following static data and information is required to be provided by the proponent to CitiPower/Powercor, as a minimum:

1. NMI meter numbers (10 digit)
2. DER Devices
    a) Fuel source – primary {renewable/biomass/waste; fossil; hydro; geothermal; solar; wave; wind; tidal; storage}
    b) Fuel source – descriptor {as per appendix 8 of the NEM Generator registration guide}
    c) Make, model and manufacturer
    d) Maximum capacity (kW or MW)
    e) Storage capacity (kWh/MWh of available storage)
    f) Installer
    g) Whether the device is registered for ancillary service provision (Y/N)
    h) Whether the device is part of an aggregated control (Y/N)
    i) Whether the device is remotely controllable (Y/N)
    j) Compliance with Australian Standards
3. Inverter
    a) Make, model and manufacture
    b) Whether the installer has changed the inverter default manufacturer settings (Y/N)
    c) Maximum capacity (kW and kVA)
    d) Date of installation
    e) Compliance with Australian Standards
4. Inverter enabled modes of operation
    a) Demand response modes enabled and enablement method
    b) Power quality modes {power response (frequency control); voltage response (voltage-watt or voltage-var); Q (reactive power), PF (power factor); standalone}
5. Trip settings
    a) Frequency trip settings {none, over-frequency, under frequency}
    b) Voltage trip settings {none, over-voltage, under-voltage}