Metrology Procedure for Metering Installations on the Western Power Network

Date: October 2014

Document Information

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Contents

1 General

1.1 Purpose

1.1.1 The purpose of this *Metrology Procedure* is to provide guidance:

a) to the *responsible person* on the correct provision, installation and maintenance of *metering installations* in line with the principles of the *Code*; and

b) to interested third parties on the requirements for metering within the *Western Power network*.

1.2 Scope

1.2.1 This *Metrology Procedure* provides information on devices and methods used by *Western Power* to:

a) measure, or determine by means other than a device, *electricity* produced and consumed at a *metering point*;

b) convey the measured or determined information to other devices using *communications links*;

c) prepare the information using devices or methods to form *energy data*;

d) provide access to the *energy data* from a telecommunications network;

e) specify the minimum requirements for *meters* and *metering installations*;

f) specify the procedures for estimating, substituting and validating *energy data* under the *Code*;

g) be consistent with the approved asset management system required by section 14 of the *Act*;

h) define the rights of access to *energy data* in the *metering installation*; and

i) define the procedures for auditing of *metering installations.*

1.2.2 The *Metrology Procedure:*

a) applies to *code participants* and *Western Power* in relation to the load and/or generation at each *connection point* on the *network*;

b) sets out those obligations and duties that are imposed on *Western Power* with regards to *energy data* provision by the *Code* and *market rules*;

c) covers the full extent of a *metering installation,* from the *metering point* at one extreme to the boundary of the telecommunications network at the other extreme. It includes connection of the *metering installation* to the telecommunications network.

1.2.3 It should be noted that the *Metrology Procedure* presents the minimum requirements and does not preclude a *meter* supplier, *or Western Power* from deploying products or developing processes that exceed or complement the requirements described herein, provided that such features are compatible with the requirements of the *Metrology*

Procedure. For example, the deployment of *meters* with *enhanced technology* features or the future provision of *interval meters* for *connection points* with low annual consumption.

1.3 Commencement

1.3.1 The date of publication of the *Metrology Procedure* is 10 days following approval by the *Authority*.

1.3.2 This *Metrology Procedure* comes into operation 3 months after the date of publication.

1.4 Definitions

Words in this *Metrology Procedure* shown in italics have the meaning specified in the following table:

Phrase/term	Meaning
access arrangement	has the meaning given to it in the Access Code
access contract	means an agreement between *Western Power* and a person for the person to have 'access' (as defined in section 103 of the *Act*) to 'services' (as defined in section 103 of the *Act*) on a *network*.
accumulated energy data	is to be expressed as a measure of *energy* over time, and means a measurement (including an *estimated* or *substituted* measurement) of the production or consumption of *electricity* at a *metering point*, which is accumulated for a period longer than a *trading interval*.
accumulated energy register	means the visible indication displayed on an *accumulation meter*, or the memory location within the *meter*, that records accumulated *energy data*.
accumulation meter	means a *meter* that measures *accumulated energy data* and records it in one or more *accumulated energy register*s.
Act	means the Electricity Industry Act 2004 (WA).
active energy	means a measure of *electricity*, being the time integral of the product of *voltage* and the in-phase component of electric *current* flow across a *metering point* expressed in Watt hours (Wh) and/or multiples thereof.
apparent energy	means a measure of *electricity*, being the time integral of the product of *voltage* and the electric *current* flow across a *metering point* expressed in Volt Amp hours (Vah) and or multiples thereof.
AS	followed by a designation means a standard so designated published by Standards Australia Limited and current as at the *Code* commencement date.
attachment point	means a point on the *network* at which *network* assets are *connected* to assets owned by another person.
Authority	means the Economic Regulation Authority established under the Economic Regulation Authority Act 2003 (WA).
average daily consumption	for a *metering point* is to be expressed in *energy units* per day, and means a measurement (including an *estimated* or *substituted* measurement) of *electricity* production or consumption over a period at the *metering point*, divided by the number of days in the period.
business day	means any day that is not a Saturday, a Sunday or a public holiday throughout Western Australia.
check meter	means a *meter* that meets the requirements of clause 3.13 of the *Code* and is used as a secondary source of *energy data*.
checksum	means a single digit numeric identifier that is calculated to reduce the frequency of *NMI data* entry errors.
Code	means the Electricity Industry (Metering) Code 2012.

Phrase/term	Meaning
Code of Conduct	means the Code of Conduct for the Supply of Electricity to Small Use Customers
code participant	has the same definition in the Code.
Communication Rules	means, in relation to *Western Power's network* and subject to clause clause 6.7 of the *Code* governing the communication of information and *data* between *code participants,* which have been published under Division 6.2 of the *Code.* These are known as the SWIS Communication Rules.
communications link	means all communications devices and methods which comply with the *Code* so as to enable a *meter* of a *metering point* to be read from a remote location (being a location not at the premises where the *meter* is situated) that lie: a) between the *data logger* and the telecommunications *network (*if the *data logger* is internal to the device containing the *measurement elements*);and b) between the *meter* and the *data logger* and between *data logger* and the telecommunications *network (*if the *data logger* is external to the device containing the *measurement elements* but is located at the same site); and c) between the *meter* and the telecommunications *network (*if the *data logger* is not located at the same site as the device containing the *measurement elements)*.
connection point	has the same meaning in this *Metrology Procedure* as the meaning given to it in the *Code.*
current transformer or "CT"	means a *transformer* for use with *meters* and protection devices in which the electric *current* in the secondary winding is, within prescribed error limits, proportional to and in phase with the electric *current* in the primary winding.
current	in connection with the flow of *electricity*, means the flow of *electricity* in a conductor.
customer	has the meaning given in section 3 of the *Act*.
data	means *energy data* or *standing data*.
data logger	means a *metering installation* database, *metering database* or a device that collects *electronic* signals from a *measurement element* and records *interval energy data*.
data stream	means a stream of *energy data* or metering *data* associated with a *metering point*, as represented by an *NMI* and a *NMI* suffix. A *NMI* can have multiple *data streams*.
demand	is the power requirement in a period expressed in kW. (E.g. if the consumption in a period is 1kWh and the period under consideration is half an hour long then the demand is 2kW)
distribution system	has the meaning given to it in the *Act*.
electricity	has the meaning given to it in the *Act*.
electronic	in relation to connection with a *meter*, means the *transfer* of information into or out of the *meter* by way of a telecommunications network for the delivery of *energy data* or pulsing signals or other widely accepted communications protocols used for the *transfer* of *data* between computerised equipment.
energy data services	means the services related to the determination, processing or storage of *energy data*.
energy data	means *interval energy data* or *accumulated energy data*.
energy	means *active energy* and/or *reactive energy*.
energy units	means Wh, VAh or VARh as appropriate.

Phrase/term	Meaning
enhanced technology	in relation to a *metering installation,* means evolving technologies that provide the *metering installation* with advanced features over and above the standard specified for installations of Type 1-6.
entry point	means a single, indivisible (except as allowed under the Applications and Queuing Policy) point, that for purposes under the *access arrangement* involving the *transfer* of electricity, is deemed to consist of a single *attachment point*, connected or to be connected to a *user's connection point*, with a single *revenue meter* (regardless of the actual configuration of *network assets* making up the *entry point*), at which electricity is more likely to be transferred into the *network* than out of the *network*.
estimate	means an *estimate* calculation of *energy data* electricity production or consumption at a *metering point* for a period which is not yet scheduled to be read, such calculation being made in compliance with the schedules to this *Metrology Procedure*.
exit point	means a single, indivisible (except as allowed under the applications and queuing policy) point, that for purposes under the *access arrangement* involving the *transfer* of electricity, is deemed to consist of a single *attachment point*, connected or to be connected to a *user's connection point*, with a single *revenue meter* (regardless of the actual configuration of *network assets* making up the *entry point*), at which electricity is more likely to be transferred out of the *network* than into the *network*.
general purpose	means the term applied by the National Measurement Institute constituted under Part 3 of the *National Measurement Act* to refer to the classification of a *meter*.
generator	means a person who generates electricity and who holds a generation licence issued by the *Authority*.
good electricity industry practice	means the exercise of that degree of skill, diligence, prudence and foresight that a skilled and experienced person would reasonably and ordinarily exercise under comparable conditions and circumstances consistent with applicable written laws and statutory instruments and applicable recognised codes, standards and guidelines.
IEC	means the International Electrotechnical Commission.
IMO	means the Independent Market Operator appointed under the *market rules* Part 9 of the *Act*.
instrument transformer	means a *CT* or a *VT*.
interval energy data	is to be expressed in *energy units* or multiples thereof, and means a measurement (including an *estimated* or *substituted* measurement) of the production or consumption of *electricity* production or consumption at a *metering point* which is accumulated for each *trading interval*, or such sub-interval as has been previously agreed between *Western Power* and a relevant *code participant*.
interval meter	means a *meter* that measures *interval energy data* and records it in a *data logger*.
ISO	means the International Standards Organisation.
load	means the amount of electrical power energy transferred out of a *network* at a *connection point* at a specified time or across a specified period.
market generator	means a *rule participant* registered as a market generator under Chapter 2 of the *market rules*.
market rules	has the meaning given to it in the *Act*.
market	means the wholesale electricity market established under Part 9 of the *Act*.

Phrase/term	Meaning
measurement element	means an *energy* measuring component of a *meter* which converts electricity into either or both of: a) an *electronic* signal; and b) a mechanically recorded electrical measurement.
meter	a device which measures and records the production or consumption of electrical *energy* or *electricity* production or consumption.
metering data agent	means *Western Power* as appointed under clause 5.29(a) of the *Code.*
meter reading period	for past dates, is the period between the date of a *meter* reading and the date of the previous *meter* reading. for future dates, is the period between the scheduled date of a *meter* reading and the previous scheduled or actual *meter* read.
metering database	means a database containing the *registry* and *energy data*.
metering equipment	means one or more parts of a *metering installation.*
metering installation	means the equipment, processes and arrangements for the purpose of metrology which lie between: at one boundary, either: a) for *a connection point* of Type 1 to 6 — the *metering point*; or b) for a *connection point* of Type 7 — the *connection point*; and at the other boundary, either: a) if a telecommunications network is used for the delivery of *energy data* from the *connection point* or *metering point* — the point of connection to the telecommunications network; or b) if there is no such telecommunications network — the interface port of either the *meter* or *data logger* or both.
metering point	means a) for Types 1-6, the point at which electricity is measured by a *revenue meter* b) for a Type 7 *meter*, the *connection point*.
metering service	means activities that are performed by or on behalf of *Western Power* or its *metering data agent* and are related to the provision of *metering installations*, *standing data* and *energy data*.
Metrology Procedure	means this document, the Metrology Procedure for Metering Installations on the Western Power Network.
National Measurement Act	means the National Measurement Act 1960 (Cth) and any regulations made under that Act.
National Metering Identifier or "NMI"	means the reference number required by the *Code*, which uniquely identifies a *connection point* and which is issued under the Western Australian NMI Allocation Procedures.
NEM12	means the file format established for the dissemination and *transfer* of *interval energy data* in the Australian National Electricity Market.
NEM13	Means the file format established for the dissemination and *transfer* of basic *energy data* in the Australian National Electricity Market.
network	means the *transmission system* and *distribution system* operated by *Western Power*.
power factor	means the ratio of the *active energy* to the *apparent energy* at a *metering point.*

Phrase/term	Meaning
reactive energy	means a measure in volt-ampère reactive hours (VARh) of the alternating exchange of stored *energy* in inductors and capacitors, which is the time-integral of the product of *voltage* and the out-of-phase component of electric *current* flow across a *metering point*.
registered metering installation provider	means a person registered by *Western Power* in accordance with the *registration process* to undertake some or all of the activities relating to the installation of *metering installations*, and who has not been deregistered under the *registration process*.
registration process	means the approved *registration process* established by *Western Power* and approved by the *Authority* under the provisions of the *Code*
registry	means a *registry* containing *standing data* in accordance with the *Code*.
responsible person	means the person who has responsibility for the provision of a *metering installation* for a particular *connection point*.
retailer	means a person who holds a retail licence or integrated regional licence issued by the *Authority*.
revenue meter	means the *meter* that is used for obtaining the primary source of *energy data*.
rule participant	means a member of the class of persons as set out in clause 2.28.1 of the *Market Rules*.
SCADA	means Supervisory Control and Data Acquisition.
scheduled meter reading	means a reading taken anytime between one working day ahead of, and two working days after, the scheduled meter reading date.
service level agreement	means a written agreement that sets out the terms and conditions under which *Western Power* must provide *metering services* to a *user*, whether or not that agreement also contains other provisions governing the parties' rights, liabilities and obligations.
standing data	means the periodically updated information about a *connection point* that is maintained in accordance with the *Code* and the associated *Communication Rules*.
substitute	means the substitution of *energy data* obtained, or scheduled to be obtained, from an actual *meter* reading with *energy data* determined in accordance with the *data* substitution procedures defined in clause 4.4 under the circumstances described in the *Code*.
supply	means the delivery of *electricity*.
trading interval	means a 30 minute period ending on the hour (WST) or on the half hour and, where identified by a time, means the 30 minute period ending at that time.
transfer	in relation to a *customer*, has the meaning given to it in section 1.3 of the Electricity Industry Customer Transfer Code 2004.
transformer	means a plant or device that reduces or increases alternating *voltage* or electric *current*.
transmission system	has the meaning given to it in the *Act*.
user	[in respect of a *connection point*] means a person who has an *Access Contract* in respect of the *connection point* for the *transfer* of *electricity* [at the *connection point*].
validation	means validation in accordance with this *Metrology Procedure*.
voltage	means the electric force or electric potential between two points that gives rise to an electric *current*.
voltage transformer or "VT"	means a *transformer* for use with *meters* and protection devices in which the *voltage* across the secondary terminals is, within prescribed error limits, proportional to and in phase with the *voltage* across the primary terminals.
Western Power	means Electricity Networks Corporation (t/a *Western Power*).

2 Provision of Metering Installations

2.1 Installation of Meters

2.1.1 *Western Power* will ensure that when each *meter* and associated *data logger* (where the *data logger* is located at the *metering point*) is installed, it is checked to ensure that:

a) it complies with the relevant requirements of section 5 of this document and it has the optical port, communications port, and/or visual display which can be readily accessed for *meter* reading;

b) the CT cores of *revenue metering installations* must not be used for any purpose other than *revenue metering* and check metering as per clauses 3.12(1)(a) and 3.12(1)(b) of the *Code*;

c) the CT cores of Types 1 and 2 check *metering installations* must not be used for other purposes subject to clause 3.12 (1) (a) of the *Code*, unless with the written approval of *Western Power*; and

d) if only one set of *VT* secondary winding is provided for a Type 1 or 2 revenue and check *metering installation,* then the *voltage* supplies to both *metering installations* must be separately fused subject to clause 3.12(1)(d) of the *Code*.

2.1.2 Where *prepayment meters* are installed:

a) they will be treated where reasonably possible as Type 6 *accumulation meters*;

b) they will be operated and maintained in accordance with *good electricity industry practice*; and

c) they will comply with the technical requirements in Part 9 of the Code of Conduct for the Supply of Electricity to Small Use Customers.

2.2 Metering Installation Components

2.2.1 The requirements in this clause are applicable to Types 1 – 6 *metering installations.*

2.2.2 *Western Power* will ensure that the components, characteristics and requirements for *meter* provision for Type 1 – 4, Type 5 and Type 6 *metering installations* are in accordance with section 5.

2.2.3 The *meter* internal real time clock must be referenced to Australian Western Standard TIME (AWST) and maintained within an absolute error of:

- Type 1. ±5 seconds
- Type 2. ±7 seconds
- Type 3 ±10 seconds
- Types 4 – 5 ± 20 seconds

2.2.4 *Western Power* will make a determination of the *metering installation* type based on the historic or anticipated annual consumption and peak *load* at the *connection point*, with the *retailer*. If the *retailer* and *Western Power* cannot agree on the type of installation, then subject to clause 3.9(3A) of the *Code*, *Western Power* may make the determination on the matter.

2.2.5 An increase in annual or peak consumption that, in the opinion of *Western Power*, places the *connection point* into a higher type will result in a *meter* upgrade. Where annual consumption has decreased with time no *meter* change is necessary.

2.2.6 Where a Type 6 *meter* is capable of recording both *interval energy data* and *accumulated energy data*, it will be treated as an *accumulation meter*, unless otherwise agreed between *Western Power* and the *retailer*.

2.2.7 Where a *metering installation* includes a Type 5 *meter* that is read as an *accumulation meter*, the *meter* will not be replaced by or, reconfigured to, an interval-read *meter* without the agreement of the *retailer,* except:

a) where another *retailer* has requested an interval survey, at which point it will be necessary to permanently convert the *meter* to an interval-read *meter*; or

b) where the *connection point* is due to *transfer* to another *retailer*, under which circumstances it may be necessary to replace or reprogram the *meter* to interval-read a few days prior to the formal *transfer*.

2.2.8 The *metering installation* database must permit collection of *data* within the timeframes specified in the relevant *service level agreement* at a level of availability of at least 99% per annum if the *metering installation* does not have a *communications link*. Where the *metering installation* does have a *communications link*, the *metering installation* database must permit collection of *data* within the timeframes specified in the relevant *service level agreement* and at a level of availability of 95% for the *communications link* and 99% for the remainder of the *metering installation*.

2.3 Maintenance of Metering Installations

2.3.1 Testing and Inspection of Meters

2.3.1.1 *Western Power* will ensure that *meters* on its *network* are sampled and tested in accordance with *AS*1284.13. Details of how *Western Power* conducts its sampling and testing are found in Appendix 2 - Meter Compliance Testing and Sampling.

2.3.1.2 *Western Power* will ensure that its *meters* meet the specifications and/or guidelines outlined by the National Measurement Institute under the *National Measurement Act*.

2.3.2 Maintenance of Metering Installations

2.3.2.1 Where *Western Power* identifies that a component of a *metering installation* is not performing in accordance with the *Code,* the *meter* specifications, or in accordance with *good electricity industry practice*, the component will be repaired or replaced.

2.3.2.2 Notwithstanding section 2.3.2.1, if *Western Power* identifies any performance issues with wiring, fuses, or modems that form part of a *metering installation,* those components must be repaired or replaced in accordance with *good electricity industry practice*.

2.3.2.3 A *code participant* who becomes aware of an outage or malfunction of a *metering* installation or any of its components must advise *Western Power* as soon as practicable.

2.3.3 Enhanced Technology Features

2.3.3.1 Where reasonably requested by a *code participant*, *Western Power* will provide *enhanced technology* features in a *metering installation* in accordance with clause 3.20(1) of the *Code*.

2.3.3.2 *Metering installations* with *enhanced technology* features will only be used where they meet or exceed the standards required for Type 1-6 *metering installations* that would otherwise be used at the *connection point* under consideration.

2.3.3.3 Where a *meter* includes enhanced features associated with a *meter* of a more advanced type, the normal provisions of the original type of *meter* apply for all aspects other than the enhanced feature.

2.3.3.4 Notwithstanding section 2.3.3.3, a *meter* will be reported as a different type within the *metering database* where this is necessary to support the *enhanced technology* feature.

2.3.3.5 Where bi-directional capability is required for the *metering installation, Western Power*, in accordance with clause 3.3C of the *Code*, must ensure the net *electricity* production and consumption is separately measured and recorded by the *meter*.

2.3.4 Replacement

2.3.4.1 Where a population of *meters* has been sampled and tested in accordance with section 2.3.1.1 and deemed to have failed, *Western Power* will remove and replace all *meters* within that population in accordance with the requirements of the *Code*.

3 Energy Data

3.1 Energy Data Collection

3.1.1 *Western Power* collects *energy data* from *metering installations* by the following methods:

a) manual *meter* read;

b) remote *meter* read (via a *communications link*); and

c) *customer* supplied *meter* read.

3.1.2 Western Power must for each *meter* on its network, at least once in any 12 month period undertake a *meter* reading that provides an actual value that passes the *validation* process as per clause 5.4 of the *Code*. A copy of the meter reading schedule can be found on *Western Power's* website.

3.1.3 *Western Power* will ensure that for Type 1-4 *metering installations, interval energy data* will be collected on a monthly basis in accordance with the relevant *service level agreement*, or by agreement with the relevant *retailer*.

3.1.4 *Western Power* will ensure that for Type 5 *metering installations, interval energy data* will be collected on a monthly basis or in accordance with the relevant *service level agreement*.

3.1.5 *Western Power* will ensure that for Type 6 *metering installations, energy data* will be collected on a monthly or bi-monthly basis or in accordance with the relevant *service level agreement*, as agreed between *Western Power* and the *retailer* at the time of installation.

3.1.6 *Western Power* will ensure that for Type 7 *metering installations*, *energy data* is calculated, *validated* and *substituted* in accordance with the *Code*.

3.1.7 Where a Type 6 *metering installation* is capable of recording both interval and *accumulated energy data*, it will be treated as an *accumulation meter*, unless otherwise agreed between *Western Power* and the *retailer*.

3.1.8 Where *energy data* for Type 1-5 *metering installations* is gathered at a frequency greater than a *trading interval* it will be aggregated into *trading intervals* as per clause 3.16(3A) of the *Code*.

3.1.9 Where *Western Power* receives a request from a *customer* to provide *energy data* or *standing data*, *Western Power* will provide such *energy data* or *standing data* in accordance with clauses 5.17 and 5.17A of the *Code.* Further requirements may be expressed in other enhamcements such as clause 10.7 of the *Code of Conduct*.

3.1.10 *Western Power* will maintain a disaster recovery plan for the *metering database*, in accordance with clause 4.1(3) of the *Code* to ensure that following an event causing loss of access to *energy data*, *code participants* regain access to *energy data* within 2 *business days*.

3.2 Energy Data Collection Schedule

3.2.1 *Western Power* will ensure that a schedule is developed and maintained to determine the scheduled dates for reading each *metering installation* in accordance with the applicable *service level agreement*. Notwithstanding the provisions of the applicable

service level agreement, the maximum interval between attempts to read each *meter* will be 12 months.

3.2.2 Where *Western Power* chooses to gather and issue *energy data* more frequently than the published *meter* reading schedule, the *retailer* will only be charged for reading in accordance with the published *meter* reading schedule or in accordance with the applicable *service level agreement*.

3.2.3 Notwithstanding sections 3.1.3 and 3.1.4, *Western Power* may choose to disseminate the *energy data* for *metering installation* Types 1-5 more frequently than provided for under the applicable *service level agreement*. Under these circumstances the published *meter* reading schedule, substitution and other deadlines will not be affected.

3.2.4 *Western Power* and a *retailer* can agree other reading frequencies for specific *meters* or classes of *meters*, as documented in a *service level agreement*.

3.2.5 *Western Power* will accept requests for special *meter* reads outside the published schedule in accordance with the provisions of the *Communication Rules* or the *Code,* and will respond to valid requests within the response times specified in the applicable *service level agreement*.

3.3 Storage and Transfer of Energy Data

3.3.1 *Western Power* will ensure that *energy data* is collected from a *meter* or a *meter*'s associated *data logger* and this *energy data* is transferred to the relevant *metering database*, no later than 2 *business days* after the scheduled reading date for that *metering installation*, or within the time frame specified in the applicable *service level agreement*.

3.3.2 Where *energy data* is collected from a *meter* or *meter's* associated *data logger* by a *user* this *energy data* must be provided to *Western Power* no more than 2 *business days* after collecting or receiving the *data*, or within the time frame specified in the applicable *service level agreement*.

3.3.3 Where a *check meter* is installed which is of the same precision as the *revenue meter, Western Power* may calculate and pass to *market* the average of the check and *revenue meter* reading for active and reactive channels to be used for billing and settlement purposes, unless otherwise agreed between *Western Power* and the *retailer*.

3.3.4 After conducting a *meter* reading and obtaining *energy data* for a *metering point, Western Power* will provide access to that *energy data* to the *user* for the *metering point* and the *IMO* in accordance with clauses 5.6 and 5.7 of the *Code* and in accordance with the *Communication Rules*.

3.3.5 Following a successful *meter* read or, *substitution* or *estimation* of *energy data*, the *metering database* will store the *energy data* for a period of at least 13 months in a readily accessible online format and for a further period of 5 years and 11 months in archive that is accessible independently of the format in which the *data* is stored.

3.3.6 The format of the *energy data* must be in accordance with the *Communication Rules*.

3.3.7 *Energy data* (actual, *substituted* or *estimated*) is required by *Western Power* by data stream for all trading intervals (that is, 48 intervals per 24 hour period) within the timeframe outlined in the *Code* or the applicable *service level agreement*.

3.4 Validation of Energy Data

3.4.1 *Western Power* validates *energy data* collected from Type 1-5 *metering installations* in accordance with section 6- *Metering installation* Types *1-5* – Validation.

3.4.2 *Western Power* validates *energy data* collected from Type 6 *metering installations* in accordance with section 8- Metering installation Type 6 – Validation, Substitution and Estimation.

3.4.3 Where the *energy data* fails *validation* under sections 3.4.1 or 3.4.2 , *Western Power* will:

a) manually correct the reading if the correct reading can be determined; or

b) re-read the *meter* if no correction has been possible and the *meter* can be re-read prior to the applicable deadline for the dissemination of *energy data* as documented in the published *meter* reading schedule; or

c) *substitute* the reading in accordance with the applicable *substitution* or *estimation* rules for the *meter installation* type.

3.4.4 Where the *energy data* fails *validation* under sections 3.4.1 or 3.4.2 , *Western Power* may review the *validation* failures to determine the cause of any apparently lost or erroneous *energy data.* Where *Western Power* believes the error is due to a *metering installation* fault identified as:

a) the *meter* performing outside of its design specification, then the *meter installation* may be tested either onsite or in the *Western Power* meter laboratory to determine the cause of the *validation* failure; or

b) the *metering installation* is defective, then the *metering installation* may be repaired or replaced in accordance with the *Code* or applicable *service level agreement*; or

c) a fault associated with the measurement of data, *Western Power* may, acting in accordance with the *Code* or *good electricity industry practice*, make corrections or adjustments to the *energy data*.

3.5 Estimation and Substitution of Energy Data

3.5.1 *Western Power estimates* or *substitutes energy data* from Type 1-5 *metering installations* in accordance with section 7 - *Metering installation* Types 1-5 – Accumulation, Substitution and Estimation, where:

a) *Western Power* has elected to perform substitution under section 3.4.3 c); or

b) *Western Power* has elected to perform estimation under section 3.5.5; or

c) there has been a failure of the *metering equipment*; or

d) an inspection or test on the *metering equipment* has established that the measurement uncertainty exceeds the specified standard for that class of *meter;* or,

e) it has not been possible to obtain a reading from the *meter*.

3.5.2 *Western Power estimates* or *substitutes energy data* from Type 6 *metering installations* in accordance with section 8 - *Metering installation* Type 6 – Validation, Substitution and Estimation, where:

a) *Western Power* has elected to perform substitution or estimation under section 3.4.3 c);or

b) *Western Power* has elected to perform estimation under section 3.5.5; or

c) there has been a failure of the *metering equipment*; or

d) an inspection or test on the *metering equipment* has established that the measurement uncertainty exceeds the specified standard for that class of *meter;* or

e) it has not been possible to obtain a reading from the *meter*.

3.5.3 *Western Power* calculates *energy data* for Type 7 *metering installations* by way of *substitution* in accordance with Appendix 3, clause A3.7(5) of the *Code – Substitution* Method 74*.*

3.5.4 *Western Power* will ensure that for Type 7 *metering installations*; *energy data* will be calculated on a monthly or bi-monthly basis in accordance with the *Communication Rules* Build Pack and specifically, the Streetlights and UMS Data CSV File Specification documents.

3.5.5 Where *energy data* is required for *market* settlement purposes and a reading is not scheduled for the *meter* prior to the end of the settlement period, *Western Power* may *estimate* the *energy data* for the period under consideration.

3.5.6 Where the *energy data substituted* or *estimated* in accordance with section 3.5.1 pertains to an *energy data* channel of a *meter* for which *reactive energy data* is recorded in addition to an *active energy* channel, then both channels must be *substituted* or *estimated* as a set to ensure consistency and the availability of correct *power factors*.

3.5.7 Where any of the alarm status descriptions listed in section 10 occur, the *energy data* may be *substituted* except where the reported status is determined to be incorrect by *Western Power*. Where an incorrect error condition has been detected, *Western Power* may consult with the *retailer* over the correct course of action or apply procedures in line with this *Metrology Procedure* or *good electricity industry practice*.

3.5.8 Where an alarm outlined in section 10 is triggered by the meter, regardless of whether it requires substitution of *energy data,* which is not caused by a *metering installation* fault but which can be compensated for by an adjustment to the *metering installation,* the *metering installation* may be reset, reprogrammed or otherwise adjusted as applicable, within the period defined in the applicable *service level agreement* for *meter* repairs, unless *Western Power* is satisfied that the alarm condition triggered will not recur.

3.5.9 *Substituted energy data* may be marked as a final *substitute* when no further updates are possible. For the avoidance of doubt, it is not necessary to issue a final *substitute* for any particular reading.

3.5.10 Where it is necessary to *substitute* a *meter* reading because of an inability to access the *meter*, a reason code will be supplied in accordance with the *NEM12* and *NEM13* meter data file format specification and in accordance with Appendix 3 of the *Code*.

3.6 Access to Energy Data

3.6.1 *Western Power* provides access to *energy data* to a *code participant* for each *connection point* at which the c*ode participant* supplies, generates or purchases *electricity* and has an *access contract* with *Western Power*.

3.6.2 Where *Western Power* receives a request from a *user's customer* or third party to provide *energy data* or *standing data*, *Western Power* will provide such *data* in accordance with clause 5.17A of the *Code.*

3.6.3 Where a *communications link* is installed for a *metering installation, Western Power* will provide a read-only password and connection details to the c*ode participants* who have access under section 3.6.1.

3.6.4 *Western Power* ensures that access to a *metering installation* and the *metering database* is secured from unauthorised access in line with clauses 4.8(4)(a) and 4.8(4)(b) of the *Code* and in line with *good electricity industry practice*.

3.6.5 The only persons entitled to have local access and/or remote access, using a read only password provided by *Western Power*, to the *energy data* from a *metering installation* are a *user* who is a *retailer* or *generator* of the *connection point* with which the *metering installation* is associated.

4 Data Quality

4.1 Energy Data Verification Requests

4.1.1 Where a c*ode participant* requests verification of *energy data* under clause 5.20(3) of the *Code* by using its Energy Data Verification Request Form, *Western Power* will use all reasonable endeavours to verify the *energy data* in accordance with this procedure by repeating any tests applicable to the *metering installation* type.

4.1.2 In accordance with section 4.1.1, *Western Power* will perform the *validation* process applicable to the *metering installation* that is the subject of the verification request in order to verify the *energy data*.

4.1.3 In accordance with clause 5.20(4)(b) of the *Code, Western Power* will make the results of the test described in section 4.2 available to the c*ode participant* as soon as practicable but no later than 5 *business days* after receiving the Energy Data Verification Request Form, or in accordance with the applicable *service level agreement*.

4.2 Test and Audit Requests

4.2.1 Where a c*ode participant* reasonably requests a test or audit of:

a) The accuracy of the *metering installation,*

b) The *energy data* from the *metering installation,* or

c) The *standing data* for the *metering installation,*

Western Power will conduct a test or audit in accordance with the request.

4.2.2 Where *Western Power* receives a request to assess the accuracy of the *metering installation* pursuant to section 4.2.1(a), the *metering installation,* or components thereof will be tested in accordance with clause 3.9 of the *Code* to ensure the *metering installation* or component tested meets the applicable accuracy requirements.

4.2.3 Where *Western Power* receives a request to test or audit the *energy data* or *standing data* pursuant to sections 4.2.1(b) or 4.2.1(c), *Western Power* may:

a) repeat any *validation* that has been performed in alignment with this *Metrology Procedure*;

b) ensure that metering statuses are reported in alignment with this *Metrology Procedure*;

c) ensure that aggregation of quarter-hourly *data* to half-hourly *data* has been performed in alignment with this *Metrology Procedure*; and/or

d) ensure that substitution and/or estimation has been performed in alignment with this *Metrology Procedure*.

4.2.4 *Western Power* will make the results of the test or audit described in section 4.2.1 available to the *code* p*articipant* as soon as practicable.

4.2.5 Where errors are detected during the test or audit that are inconsistent with the requirements of the *Code, Western Power* will advise the c*ode participant* the errors detected, and possible duration of the existence of errors.

4.2.6 Where errors are detected during the test or audit that are inconsistent with the requirements of the *Code, Western Power* will restore the accuracy of the *metering installation* in accordance with the applicable *service level agreement.*

4.2.7 Where errors are detected during the test or audit that are inconsistent with the requirements of the *Code, Western Power* may make corrections to the lost or erroneous *energy data* up to 12 months based on a test or audit, to minimise adjustments to the final settlement account.

4.2.8 When performing a test or audit pursuant to sections 4.2.1(b) or 4.2.1(c), and there is a discrepancy between:

a) *energy data* stored in the *meter* or *meter's* associated *data logger*; and
b) *energy data* stored in the *metering database* in respect of the respective *meter* or *meter*/associated *data logger*,

the *energy data* stored in the *meter* or *meter's* associated *data logger* is prima facie evidence of the amount of *electricity* supplied to that *metering point*.

4.2.9 When performing a test or audit pursuant to sections 4.2.1(b) or 4.2.1(c), if there is a discrepancy between the *energy data* or *standing data* held in the *metering database* and the physical inventory, the physical inventory is prima facie evidence of the actual *data*.

4.2.10 When performing a test or audit pursuant to sections 4.2.1(b) or 4.2.1(c), if there is a discrepancy between *energy data* determined during the testing process and the *energy data* values stored in the *metering database*, the *energy data* determined during testing shall be prima facie evidence of the amount of *electricity* pertaining to the affected *metering point*.

4.2.11 If requested by a *code participant* to undertake a test or audit of *energy data* or *standing data* for a *metering installation*, *Western Power* will, prior to any test being undertaken , provide an *estimate* of the costs of, or associated with that test, where the test does not fall within the scope of the applicable *service level agreement*.

4.2.12 Where a test or audit undertaken in accordance with section 4.2.1 reveals a non-compliance with the *Code*, *Western Power* will not charge the *code participant for* conducting the test or audit.

4.2.13 Where a *code participant* requests a *metering point* to be tested, the *meter* will be tested at Base *load current* (Full *load* test) and 10% Base *load current* (Light *load* test). *Western Power* will use the result of the Full *load* test and the Light *load* test to calculate the Weighted Average Error for the *meter*. The *meter* will be deemed defective if the result of applying the Weighted Average Error equation exceeds the accuracy limit of the *meter* under test. The equation used is:

$$\boldsymbol{WA\ error}\ (\%) = \frac{(\boldsymbol{4xFull\ Load}) + \boldsymbol{Light\ Load}}{\mathbf{5}}$$

Where;

WA error is the percentage Weighted Average Error for the meter [overall meter error] at time of test,

Full Load is the percentage full load error of meter at time of test,

Light Load is the percentage light load error of meter at time of test.

5 Components of Types 1- 6 Metering Installations – *Meter* Provision

Ref.	Metering equipment components	Metering equipment characteristics	Requirement	Code Reference (if relevant)	Applicable Metering installation Type
5.1	*Connection point*	*Metering Point*	*Electricity* flowing through the *connection point* is to be greater than 1,000 GWh per annum.	Appendix 1 Table 3	Type 1
5.2			*Electricity* flowing through the *connection point* is to be greater than 100 GWh but less than 1,000 GWh per annum.	Appendix 1 Table 3	Type 2
5.3			*Electricity* flowing through the *connection point* is to be greater than 0.75 GWh but less than 100 MWh per annum.	Appendix 1 Table 3	Type 3
5.4			*Electricity* flowing through the *connection point* is to be greater than 300 MWh but less than 750 MWh per annum.	Appendix 1 Table 3	Type 4
5.5			*Electricity* flowing through the *connection point* is to be greater than 50MWh but less than 300 MWh per annum.	Appendix 1 Table 3	Type 5
5.6			*Electricity* flowing through the *connection point* is to be less than 50 MWh per annum.	Appendix 1 Table 3	Type 6
5.7		*Metering installation*	A *metering point* must have both a *revenue meter* and a *check meter*.	clause 3.13 Table 1	Type 1
5.8			A *metering point* must have, a *revenue meter* installation and either a partial *check meter* or a *check meter*.	clause 3.13 Table 1	Type 2
5.9			No *check meter* required.	clause 3.13 Table 1	Type 3 - 6
5.10			The *metering point* is to be located as close as practicable to the *connection point*.	clause 3.5(4)	Type 1 - 6
5.11			The *meter* is to be mounted on an appropriately constructed panel.	clause 3.5	Type 1 - 6
5.12		Overall accuracy	Overall accuracy for a *metering installation* shall be no greater than 0.5% for a*ctive energy* and 1.0% for *reactive energy*.	Appendix 1 Table 3	Type 1
5.13			Overall accuracy for a *metering installation* shall be no greater than 1.0% for a*ctive energy*	Appendix 1	Type 2

			and 2.0% for *reactive energy*.	Table 3	
5.14			Overall accuracy for a *metering installation* shall be no greater than 1.5% for a*ctive energy* and 3.0% for *reactive energy*.	Appendix 1 Table 3	Type 3
5.15			Overall accuracy for a *metering installation* shall be no greater than 1.5% for a*ctive energy*.	Appendix 1 Table 3	Type 4 -6
5.16			High *voltage connection points* with an annual consumption of less than 750 MWh per annum must meet the accuracy requirements for a Type 3 *metering installation*		Type 4
5.17		Testing facilities	Suitable isolation facilities must be provided to facilitate testing and calibration of the *metering installation.*	clause 3.12(3)	Type 1 - 6
5 .18		*Check metering*	If a separate check *meter* is required, the *check meter* must not exceed twice the error level permitted under the *Code* for the *revenue meter* for the *metering point*.	clause 3.13(4)	Type 1 - 2
5.19			Check metering must use separate *current transformer* cores and separately fused *voltage transformer* secondary circuits preferably from separate secondary windings	clause 3.13(2)	Type 1
5.20			Partial check metering may be supplied from secondary circuits used for other purposes.	clause 3.13(3)(a)	Type 2
5.21			Where the check metering duplicates the *revenue metering* and accuracy level, the average of the two validated *data* sets may be used to determine the *energy* measurement.	clause 3.13(5)	Type 1 - 2
5.22	*Instrument Transformer*	*Current transformer*	The accuracy of the *current transformer* is to be in accordance with class 0.2.	Appendix 1 Table 3	Type 1
5.23			The accuracy of the *current transformer* is to be in accordance with class 0.5.	Appendix 1 Table 3	Type 2 - 5
5.24			The *current transformer* core and secondary wiring associated with the *revenue meter* may not be used for other purposes.	clause 3.12(1)(a) & (b)	Type 1 - 5
5.25			New *current transformers* must meet the relevant requirements of AS60044.1 and must also comply with any applicable specifications or guidelines (including any transitional arrangements) specified by the National Measurement Institute under the *National Measurement Act*.	clause 3.12(2)	Type 1 - 5
5.26			*Current transformers* in service at the *Code* commencement date that do not comply with	clause	Type 1 - 5

			the accuracy requirements are acceptable providing the overall accuracy of the installation meets *Code* requirements for the applicable Type *metering installation.*	3.14(3) Appendix 1 Table 3	
5.27		*Voltage transformer*	The accuracy of the *voltage transformer* is to be in accordance with class 0.2.	Appendix 1 Table 3	Type 1
5.28			The accuracy of the *voltage transformer* is to be in accordance with class 0.5.	Appendix 1 Table 3	Type 2 -3
5.29			If separate secondary windings are not provided, then the *voltage supply* to each *metering installation* must be separately fused and located in an accessible position as near as practical to the *voltage transformer* secondary winding.	clause 3.12(1)(d)	Type 1 - 3
5.30			New *voltage transformer*s must meet the relevant requirements of AS60044.2 and must also comply with any applicable specifications or guidelines (including any transitional arrangements) specified by the National Measurement Institute under the National Measurements Act.	clause 3.12(2)	Type 1 - 3
5.31			*Voltage transformer*s in service at the *Code* commencement date that do not comply with the accuracy requirements are acceptable providing the overall accuracy of the installation meets *Code* requirements for the applicable type *metering installation.*	clause 3.14(3)	Type 1 - 3
5.32		Secondary Wiring	Separate secondary windings should be provided for each *metering installation.*		Type 1 - 5
5.33			Secondary wiring must be by the most direct route and the number of terminations and links must be kept to a minimum.	clause 3.12(1)(f)	Type 1 - 3
5.34			• 2.5 mm² cable is required for current transformer secondary wiring.		Type 1 - 6
5.35			• 1.5 mm² cable is required for *voltage transformer* secondary wiring.		Type 1 - 4
5.36			The incidence and magnitude of burden changes on any secondary winding supplying the *metering installation* must be kept to a minimum.	clause 3.9(3)	Type 1 - 6
5.37		Performance	Metering *data* is required for all *trading intervals* within the time agreed with the relevant *retailers* at a level of availability of at least 99% per annum for *instrument transformers.*	clause 3.11(1)(a)	Type 1 - 6
5.38		Outages	If an outage or malfunction occurs to an *instrument transformer*, repairs must be made as soon as practicable, and in any event within the period specified within the relevant *service level agreement*.	clause 3.11(2)	Type 1 - 6
5.39	*Measurement Element*	Design standard	*Meters* must meet the relevant requirements of AS1284 and must also comply with any applicable specifications or guidelines (including any transitional arrangements) specified	clause 3.1	Type 1 - 6

			by the National Measurement Institute under the *National Measurement Act*.		
5.40			If metering class *VT*s and *CT*s are in-service at the *Code* commencement date whose accuracy does not meet *Code* requirements then *Western Power* must either, or both, install *meters* of a higher class of accuracy and apply accuracy calibration factors within the *meter* to compensate for the *transformer* errors.	clause 3.14(3)	Type 1 - 5
5.41			For whole *current* installations, *meters* that are in-service at the *Code* commencement date whose accuracy does not meet *Code* requirements, then *Western Power* must replace the *meters.*	clause 3.14	Type 4 -6
5.42			*Meters* must separately measure bidirectional *electricity* flows at the *metering point* and must record: (a) the net *electricity* production transferred into the *network* that exceeds *electricity* consumption; and (b) the net *electricity* consumption transferred out of the *network* that exceeds *electricity* production.	clause 3.16(1)(b) clause 3.3C	Type 1 - 6
5.43		*Accuracy*	The accuracy of the active and reactive *measurement elements* is to be class 0.2 and class 0.5 respectively.	Appendix 1 Table 3	Type 1
5.44			The accuracy of the active and reactive measurement elements is to be class 0.5 and class 1.0 respectively.	Appendix 1 Table 3	Type 2
5.45			The accuracy of the active and reactive *measurement elements* is to be class 0.5, 1.0 and class 2.0 respectively.	Appendix 1 Table 3	Type 3
5.46			The accuracy of the active element is to be class 0.5 and 1.0.	Appendix 1 Table 3	Type 4 - 5
5.47			The accuracy of the *meter* class is to be *general purpose.*	Appendix 1 Table 3	Type 6
5.48		Visible display	To be provided on a device and to display as a minimum the accumulated total a*ctive energy* measured by that *metering installation.*	clause 3.2(1)	Type 1 - 6
5.49		Location	The *metering point* is located as close as practicable to the *connection point.*	clause 3.5(4)	Type 1 - 6
5.50		Security	The *measurement element* must be secure and associated links, circuits and information storage and processing systems must be secured by means of seals or other devices approved by *Western Power*.	clause 3.8	Type 1 - 6
5.51		Storage	The measuring device must store active and, if required, *reactive energy data* in a *data logger*.	clause 3.5(2) Appendix 1	Type 1 - 3

				Table 3	
5.52		Access to data	Access to the visible display is to be provided without unreasonable restriction.	clause 3.2(1)	Type 1 - 6
5.53			Access to the *electronic* signal from the *measurement element* is secured. Relays or *electronic* buffers to prevent accidental or malicious damage to the *meter* must isolate interfaces to *customer* equipment.	clause 3.23	Type 1 - 6
5.54			Access to the *electronic* signal for use in evolving technologies is to be discussed with *Western Power*.	clause 3.20	Type 1 - 6
5.55			Alteration to the original stored *data* in a *meter* is not permitted except during on-site accuracy testing and calibration of a *metering installation*.	clause 5.21(12)	Type 1 - 6
5.56		Outages	If an outage or malfunction occurs to a *measurement element* or associated secondary wiring, repairs must be made within the period specified in the relevant *service level agreement*.	clause 3.11(2)	Type 1 - 6
5.57	*Data Logger*	Input connection	The *data logger* is to be electrically connected to the *measurement element* by secure means.		Type 1 - 5
5.58	*Data Logger*	Design standard	Any programmable settings available within a *metering installation, data logger* or any peripheral device, which may affect the resolution of displayed or stored *data*, must meet the relevant requirements of AS1284 and must comply with any applicable specifications or guidelines (including any transitional arrangements) specified by the National Measurement Institute under the *National Measurement Act*.	clause 3.10	Type 1 - 5
5.59		Location	The *data logger* may be located within the same housing as the *measurement element* or in a separate housing.	clause 1.3	Type 1 - 5
5.60			The *data logger* may be located at the same site as the *measurement element* or at a remote site.	clause 1.3	Type 1 - 5
5.61		Security	The *data logger* is to be secure and associated links, circuits and information storage and processing systems are to be secured by means of seals or other devices approved by *Western Power*.	clause 3.8	Type 1 - 5
5.62		Processing of data	Data relating to the amount of *active energy* and *reactive energy* passing through a *connection point* must be collated in *trading intervals* or sub-multiples of a *trading interval* within the *metering installation*.	clause 3.16(3)	Type 1 - 5
5.63		Accuracy	The *data logger* clock is to be referenced to Australian Western Standard Time and maintained to a standard of : Type 1. ±5 seconds, Type 2. ±7 seconds, Type 3 ±10 seconds, Types 4 – 5 ± 20 seconds.	Appendix 1 Table 3	Type 1 - 5
5.64		Storage	The *data logger* is to have the capability of storing *energy data* for a period of at least 35	clause	Type 1 - 5

			days.	3.16(1)(c) clause 3.21(2)	
5.65			*Western Power* must retain *energy data* in its *metering database* for each *metering point* on its *network* for the periods specified in clause 4.9 of the *Code*.	clause 4.9	Type 1 - 6
5.67		Performance	*Energy data* is required for all *trading intervals* at a level of availability of at least 99% per annum.	clause 3.11(1)(a)	Type 1 - 5
5.68		Outages	If an outage or malfunction occurs to a *data logger*, repairs must be made within the period specified in the relevant *service level agreement*.	clause 3.11(2)	Type 1 - 5
5.69	*Communication link*	Location	The *electronic* connection between the *data logger* and the telecommunications network boundary is classified as a *communications link*.	clause 1.3	Type 1 - 4
5.70		Equipment	A *communications link* may consist of a telephone line, network connection, modem or any future communication technology, with an isolation device that is connected to the *meter*. This *communications link* facilitates the downloading of *interval energy data* through a radio communication system, telecommunications network and other communication systems to connect it to *Western Power's metering database* system.	clause 3.3(3)	Type 1 - 4
5.73		Modem	A modem is used to connect the *metering installation* to the telecommunications network at a *data logger* or *metering database*.		Type 1 - 4
5.74		Security	The *communication link* is to be secure and associated links, circuits and information storage and processing systems are to be secured by means of seals or other devices approved by *Western Power*.	clause 3.8	Type 1 - 4
5.75		Access to data	The *metering installation* must be capable of remote *electronic* access.	clause 3.6	Type 1 - 4
5.76			The *metering installation* must be capable of local *electronic* access.	clause 4.8	Type 5
5.77			To be provided on a device and to display as a minimum the accumulated total *active energy* measured by that *metering installation.*	clause 3.2	Type 1 - 6
5.78			The *data* held in the *metering installation* is to be protected from direct or remote *electronic* access by suitable password and security controls.	clause 4.8(3), clause 4.8(4)(a)	Type 1 - 6
5.79		Performance	*Energy data* is required for all *trading intervals* at a level of availability of at least 95% per annum.	clause 3.11(1)(b)	Type 1 - 5
5.80		Outages	If an outage or malfunction occurs to a *communications link*, repairs must be made in accordance with the applicable *service level agreement*.	clause 3.11(2)	Type 1 - 6

5.81	Testing and Inspection	Purchase of metering equipment	All utility meters must comply with the National Measurement Act and in addition; • All new purchased *current transformers* must comply with AS60044.1 • All new purchased *voltage transformer*s must comply with AS60044.2; and • All new purchased *meters* must comply with AS1284. • All new purchased *meters* must comply with the relevant specifications of the National Measurements Institute's M6.	clause 3.1	Type 1 - 6
5.82			Appropriate test certificates are to be kept by the equipment owner.		Type 1 - 6
5.83		Testing of metering equipment	*Metering equipment* will be tested to the following class accuracy and with less than the following uncertainties: • Class 0.2 *CT* & *VT* 0.05%, 0.05Crad • Class 0.2 Wh *meter* 0.05/cosϕ% • Class 0.5 varh *meter* 0.2/sinϕ%	Appendix 1 Table 3	Type 1
5.84			The uncertainties associated with testing of the components of the *metering installation* may be carried out as follows: • *CT*/*VT* in laboratory 0.05%, 0.05Crad • *Meter* Wh in laboratory 0.05/cosϕ% • *Meter* Wh in field 0.1/cosϕ% • *Meter* varh in laboratory 0.2/sinϕ% • *Meter* varh in field 0.3/sinϕ%		Type 1
5.85			The maximum periods between sample testing are to be: • *CT* & *VT* - 10 years • Burden tests - When changes are made • Meters - 2 years Refer to Appendix 2		Type 1
5.86			Metering Installation overall accuracy requirements;	Appendix 1 Table 4	Type 1

			• At unity *power factor* Energy Rated Load 10% 50% 100% Active 0.7% 0.5% 0.5% • At 0.866 lagging *power factor* Energy Rated Load 10% 50% 100% Active 0.7% 0.5% 0.5% Reactive 1.4% 1.0% 1.0% • At 0.5 lagging *power factor* Energy Rated Load 10% 50% 100% Active n/a 0.5% n/a Reactive n/a 1.0% n/a • At zero *power factor* Energy Rated Load 10% 50% 100% Reactive 1.4% 1.0% 1.0% The above measurements are referenced to 25ºC Method of calculating the overall error is the vector sum of the errors of each component parts, that is, a + b + c, where: • a = the error of *voltage transformer* and wiring;		

			• b = the error of the *current transformer* and wiring • c = the error of the meter. *energy data* for Type 1 *metering installations* is usually based on watthour (*active energy*). Where *reactive energy* is required the *metering installation* must also satisfy the requirements for varhour in this *Metrology Procedure*.		
5.87			*Metering equipment* will be tested to the following class accuracy and with less that the following uncertainties: • Class 0.5 *CT* & *VT* 0.1%, 0.1% Crad • Class 0.5 Wh *meter* 0.1/cosΦ% • Class 1.0 varh *meter* 0.3/sinΦ%	Appendix 1 Table 3	Type 2
5.88			The uncertainties associated with testing of the components of the *metering installation* may be carried out as follows: • *CT*/*VT* in laboratory 0.1%, 0.1 Crad • *Meter* Wh in laboratory 0.1/cosΦ% • *Meter* Wh in field 0.2/cosΦ% • *Meter* varh in laboratory +0.3/sinΦ% • *Meter* Wh in field +0.4/sinΦ%		Type 2
5.89			The maximum periods between sample testing are to be: • *CT* & *VT* - 10 years • Burden tests - When changes are made • *meters* - 4 years		Type 2
5.90			Metering Installation overall accuracy requirements; • At unity *power factor* Energy Rated Load 10% 50% 100% Active 1.4% 1.0% 1.0%	Appendix 1 Table 5	Type 2

			• At 0.866 lagging *power factor* Energy Rated Load 10% 50% 100% Active 1.4% 1.0% 1.0% Reactive 2.8% 2.0% 2.0% • At 0.5 lagging *power factor* Energy Rated Load 10% 50% 100% Active n/a 1.0% n/a Reactive n/a 2.0% n/a • At zero *power factor* Energy Rated Load 10% 50% 100% Reactive 2.8% 2.0% 2.0% The above measurements are referenced to 25ºC Method of calculating the overall error is the vector sum of the errors of each component parts, that is, a + b + c, where: • a = the error of *voltage transformer* and wiring; • b = the error of the *current transformer* and wiring • c = the error of the meter.		

5.91			*Metering equipment* will be tested to the following class accuracy and with less that the following uncertainties: • Class 0.5 *CT* & *VT* 0.1% .01 Crad • Class 1.0 Wh *meter* 0.2/cosΦ% • Class 2.0 varh *meter* 0.4/sinΦ% •	Appendix 1 Table 3	Type 3
5.92			The uncertainties associated with testing of the components of the *metering installation* may be carried out as follows: • *CT*/*VT* in laboratory ±0.1% • *Meter* Wh in laboratory +0.2/cosΦ% • *Meter* Wh in field +0.3/cosΦ% • *Meter* varh in laboratory +0.4/sinΦ% • *Meter* Wh in field +0.5/sinΦ%		Type 3
5.93			The maximum periods between sample testing are to be: • *CT* & *VT* - 10 years • Burden tests - When changes are made • *Meter*s - 5 years		Type 3
5.94			Metering Installation overall accuracy requirements; • At unity *power factor* Energy Rated Load 10% 50% 100% Active 2.0% 1.5% 1.5% • At 0.866 lagging *power factor*	Appendix 1 Table 6	Type 3

			Energy Rated Load 10% 50% 100% Active 2.0% 1.5% 1.5% Reactive 4.0% 3.0% 3.0% • At 0.5 lagging *power factor* Energy Rated Load 10% 50% 100% Active n/a 1.5% n/a Reactive n/a 3.0% n/a • At zero *power factor* Energy Rated Load 10% 50% 100% Reactive 4.0% 3.0% 3.0% The above measurements are referenced to 25ºC Method of calculating the overall error is the vector sum of the errors of each component part, that is, A+B+C, where: • A = the error of *voltage transformer* and wiring; • B = the error of the *current transformer* and wiring • C = the error of the meter		
5.95			*Metering equipment* will be tested to the following class accuracy and with less that the following uncertainties:	Appendix 1 Table 3	Type 4

			• Class 0.5 *CT* 0.1%, 0.5 Crad • Class 1.0 Wh *meter* 0.2/cosΦ% • *General Purpose meter* 0.3/cosΦ%		
5.96			The uncertainties associated with testing of the components of the *metering installation* may be carried out as follows: • *CT* in laboratory 0.1% • *CT* in field 0.2% • *Meter* Wh in laboratory 0.2/cosΦ% • *Meter* Wh in field 0.3/cosΦ%		Type 4
5.97			The maximum periods between sample tests are to be: • *CT* & *VT* - 10 years • Burden tests - When changes are made • *Meter*s - 5 years • Whole current (direct connected) *General Purpose meter* - 7 years		Type 4
5.98			Metering Installation overall accuracy requirements; • At unity *power factor* Energy Rated Load 10% 50% 100% Active 2.0% 1.5% 1.5% • At 0.866 lagging *power factor* Energy Rated Load 10% 50% 100% Active 2.0% 1.5% 1.5% • At 0.5 lagging *power factor*	Appendix 1 Table 7	Type 4 - 6

			Energy Rated Load 10% 50% 100% Active n/a 1.5% n/a The above measurements are referenced to 25ºC Method of calculating the overall error is the vector sum of the errors of each component part, that is, A+B+C, where: • A = the error of *voltage transformer* and wiring; • B = the error of the *current transformer* and wiring • C = the error of the meter		
5.99			The *CT*s will be tested to the required class accuracy with less than + □0.1 % uncertainty. The testing of the *CT*'s in the *metering installation* is carried out as follows: • Maximum allowable level of testing uncertainty in the laboratory □0.1 %., 0.1 Crad • Maximum period between tests – 10 years.		Type 5
5.100			The *CT* connected *meters* will be tested to the required class accuracy with less than 0.2/cosϕ% uncertainty.		Type 5
5.101			The uncertainty associated with testing of the *CT* connected *meters* in the *metering installation* is carried out as follows: • Maximum allowable level of testing uncertainty in the laboratory 0.3/cosϕ% • Maximum allowable level of testing uncertainty in the field □0.3/cosϕ%. • Maximum period between tests – 5 years.		Type 5
5.102			The direct connected *meters* purchased must be tested to the required class accuracy with less than 0.3/cosϕ% uncertainty.		Type 5
5.103			The uncertainty associated with testing of the whole *current* connected *meters* in the *metering installation* is carried out as follows: • Maximum allowable level of testing uncertainty in the laboratory 0.3/cosϕ% • Maximum allowable level of testing uncertainty in the field 0.3/cosϕ%.		Type 5

			• Maximum period between tests – 7 years.		
5.104			The accuracy of the *measurement element* is to be in accordance with class 1.5 for *General Purpose* watthour *meters* as per AS1284 or in accordance with class 1.0 as per AS1284 or *IEC*1036 standards.		Type 4 - 6
5.105			The *metering equipment* purchased must be tested to the following class accuracy and with less that the following uncertainties: • *General Purpose meter* 0.3/cosΦ%		Type 6
5.106			The uncertainties associated with testing of the components of the *metering installation* may be carried out as follows: • *Meter* Wh in laboratory 0.2/cosΦ % • *Meter* Wh in field 0.3/cosΦ %		Type 6
5.107			The maximum periods between sample tests are to be: • Whole current (direct connected) *meter* is to be tested in accordance with *AS1284.13* and *Western Power's* Meter Compliance Testing and Sampling Plan.		Type 6
5.108			Testing of the components of the *metering installation* will be conducted in accordance with AS1284.13 and *Western Power's* Meter Compliance Testing and Sampling Plan.		Type 1 - 6
5.109			Where practicable, *current transformer* and *voltage transformer* tests are based on good electricity industry practice and relevant applicable Australian Standards.		Type 1 - 6
5.110			Other affected parties may witness the tests on request.	clause 5.21(3)	Type 1 - 6
5.111			The test results must be provided as soon as practicable to the requesting *code participant*.		Type 1 - 6
5.112			All reference/calibrated equipment shall be tested to ensure full traceability to Australian national measurement standards through verifying authorities or directly referenced to the National Measurement Laboratory.		Type 1 - 6
5.113			The calculations of accuracy based on test results, are to include all reference standard errors.		Type 1 - 6
5.114			An "estimate of testing uncertainties" must be calculated in accordance with the *ISO* "Guide to the Expression of Uncertainty for Measurement".		
5.115	Inspections of		The testing and inspection requirements must be in accordance with AS 1284.13 and		Type 1 - 6

	metering equipment		*Western Power's* Meter Compliance Testing and Sampling Plan.		
5.116			A typical inspection must include: check the seals; compare the pulse counts; compare the direct readings of *meters*, verify *meter* parameters and physical connections, verify *current transformer* ratios by comparison.		Type 1 - 6
5.117		Actions in event of non-compliance	If the accuracy of *metering installation* types 1, 2 & 3 do not comply with the requirements of the *Code*, the affected parties must be advised as soon as practicable of the errors detected and the possible duration of the existence of errors. *Western Power* will ensure the restoration of the accuracy of the *metering installation* in accordance with *electricity* industry best practice or the applicable *service level agreement.*	clause 5.21(11)	Type 1 - 3
5.118		Actions in event of non-compliance	If the accuracy of the *metering installation* does not comply with the requirements of the *Code*, the *retailer* must be advised as soon as practicable of the errors detected and the possible duration of the existence of errors, and arrange for the accuracy of the *metering installation* to be restored in a time frame agreed with the *retailer* in accordance with the applicable *service level agreement.*	clause 5.21(11)	Type 5 - 6
5.119			If a test or audit of the *metering installation* demonstrates an error of measurement of less than those detailed in the *meter* management plan , no substitution of readings is required unless in *Western Power*'s opinion a particular party would be significantly affected if no substitution was made.		Type 1 - 6
5.120			If a *metering installation* test, inspection or audit demonstrates errors in excess of those prescribed, *meter* accounts shall be determined in accordance with Section 65 of the Energy Operators (Powers) Act 1979, which specifies that where the time at which those errors arose is not known, the error is deemed to have occurred at a time half way between the time of the most recent test or inspection which demonstrated that the *metering installations,* or the *meter* family to which the *meter* of the *meter* installation belongs, complied with the relevant accuracy requirement and the time when the error was detected.		Type 1 - 4
5.121			If a *metering installation* test, inspection or audit demonstrates errors in excess of those prescribed and the time at which those errors arose is not known, the error is deemed to have occurred at a time half way between the time of the most recent test or inspection which demonstrated that the *metering installations,* or the *meter* family to which the *meter* of the *meter* installation belongs, complied with the relevant accuracy requirement and the time when the error was detected.		Type 5 - 7
5.122	Management, maintenance and auditing	Installation and maintenance	*Western Power* must ensure that any *metering equipment* installed is suitable for the range of operating conditions to which it will be exposed (e.g. temperature; impulse levels), and operates within the defined limits for that equipment.	clause 3.5(3)(c)	

5.123		Supporting information	Suitable supporting information, including drawings, if applicable, detailing the *metering installation,* must be available for maintenance and auditing purposes. This information shall be stored in an appropriate depository managed by *Western Power*.	clause 3.12(4)	
5.124		Security controls	Provide and maintain the security controls of a *metering installation.*	clause 3.8	
5.125			The *energy data* held in the *metering installation* is to be protected from direct local or remote *electronic* access by suitable password and security controls.	clause 4.8(4)(a)	
5.126			*Western Power* must keep records of *electronic* access passwords secure.	clause 4.8(5)(b)	
5.127			*Energy data, standing data* and passwords are confidential and are to be treated as confidential information.	clause 7.4(1)	
5.128			A *Registered Metering installation Provider* must be accredited by and registered with *Western Power* under a registration scheme approved by the *Authority*, and only for the type of work the *Registered Metering installation Provider* is qualified to provide.	clause 6.9	
5.129			Where relevant, *Registered Metering installation Providers*, who wish to apply for categories of *Registered Metering installation Provider* accreditation of *metering installations*, must be able to exhibit, to the reasonable satisfaction of *Western Power,* the relevant capabilities.	clause 6.9	

6 Metering installation Types 1 - 5 – Validation

6.1 Requirement to Validate

6.1.1 The *energy data* from Types 1-5 *metering installations* is required to be validated, in accordance with this section.

6.2 Validation of energy data from Types 1-5 Metering Installations with Check Metering

6.2.1 The following checks apply to *energy data* from all *metering installations* of Types 1-5 which have full *check* metering. Where discrepancies are identified between the revenue, check and SCADA validation due to inherent SCADA lower accuracies and technical losses, these discrepancies and validation errors may not be substituted and/or replaced.

a) The *energy data* must agree with the check *meter* reading to within the uncertainty limits of both *meter*s. I.e.

$$\frac{|R - C'|}{\left(\frac{R + C'}{2}\right)} \times 100 \leq |\Delta RC|$$

Where

|R-C'| means the absolute value of *R-C'.*

R is the *revenue meter* reading for the *data stream*, expressed in *energy units.*

C' is the associated *check meter* reading, expressed in *energy units*, and adjusted for known losses or systemic errors such as *transformer* losses.

ΔRC is the maximum discrepancy between the revenue and check *meter* expressed as a percentage and with a maximum value of 1%.

b) Where the *energy data* is associated with a *market generator* then it must be validated against *SCADA data* as follows:

1. *Western Power* must construct a *validation* algorithm that will facilitate comparison of interval *data* on a per interval basis.
2. *Western Power* must construct an appropriate *validation* algorithm as the *SCADA data* may be derived from a different measurement point, be of different interval collection and/or have a different base unit of measurement ,(e.g. power not *energy* value) with allowances for a larger error of measurement.
3. *Western Power* is only required to undertake *validation* of metering *data* against the *SCADA data* on the primary *data* channel, e.g. only 'B' for *generators* and 'E' channel *validation* for *loads* if applicable.
4. *Western Power* may conduct an analysis of the historical metering *data* for each *connection point* to ascertain what percent error differences between metering *data* and *SCADA data* is considered acceptable. *Western Power* may use this information to refine *validation* algorithms where applicable. Where discrepancies are identified between revenue

and SCADA validation due to inherent SCADA lower accuracies and technical losses, higher percentage error differences may occur and result in specifically assigned error percentages per connection point.

SCADA Data Algorithm to validate Metering Data:

$$\frac{|R - S'|}{\left(\frac{R + S'}{2}\right)} \times 100 \leq |\Delta RS|$$

Where

|R-S'| means the absolute value of R-S'.

R is the *revenue meter* reading for the *data stream*, expressed in *energy units.*

S' is the associated *check meter* reading, converted to *energy units*, and adjusted for known losses or systemic errors such as *transformer* losses.

ΔRS is the maximum discrepancy between the revenue and check *meter* expressed as a percentage.

c) Check all *interval meter data* against nominated maximum value. The value must be less than the registered maximum value of Wh, Varh or VAh for the *metering installation data stream*. Maximum Varh checks may be performed as follows:

1. For *CT metering installations* the maximum value is to be initially defined by the applied *CT* ratio. However, the actual value may exceed the registered maximum value of the *CT* due to the ability of the *CT* to be able to accommodate *loads* in excess of their maximum capacity (i.e. 200%). Where this occurs, *Western Power* may deem the *energy* flow as true and correct. When determining *data* flows on a per installation basis, the maximum value may be increased to cater for situations where it has been confirmed that the *CT* is overloaded on a short term basis.
2. For whole current *meters* the maximum value is to be set to the rating of the meter.

d) *Western Power* and the *user* will agree to either:

1. Check the metered value is greater than the registered minimum value for the metering installations; or
2. Check that the number of intervals with zero *data* is less than a specified number over a period of time that is deemed practicable and in alignment with *good electricity industry practice*.

e) If an interval has a null value then the reading for that interval will be rejected, placed into exception for review, or *substituted*.

f) If the *meter* has registered significant *meter* alarms over the period since the last successful read, the *energy data* for the affected intervals may be validated and placed into exception for review pending an assessment of the significance of the alarm. The list of alarms that will be processed is provided in Section 10.

g) Where apparent, reactive and *active energy* are all available, these must be checked for consistency. i.e.

$$\frac{\left|\left(A^2+R^2\right)-W^2\right|}{\left(\frac{\left|\left(A^2+R^2\right)+W^2\right|}{2}\right)}\times 100 \le \left|\Delta ARW\right|$$

Where,

$\|(A^2+R^2)-W^2\|$	means the absolute value of $(A^2+R^2)-W^2$.
A	is the *data stream* reading for *active energy.*
R	is the *data stream* reading for *reactive energy.*
W	is the *data stream* reading for *apparent energy.*
ΔARW	is the maximum discrepancy in the *apparent energy*, expressed as a percentage and with a maximum value of 1%.

h) The sum of the *interval data* readings must agree with the accumulated total for the *meter* for active and re*active energy data streams*. i.e.

$$\frac{\left|\left(\sum_{i=1}^{n} R_i\right)-A'\right|}{\left(\frac{\sum_{i=1}^{n} R_i + A'}{2}\right)}\times 100 \le \left|\Delta RA\right|$$

Where,

$\|\sum_{i=1}^{n} R_i + A'\|$	means the absolute value of $\sum_{i=1}^{n} R_i + A'$.
R_i	is the *data stream* reading for interval *i,* expressed in *energy units.*
n	is the total number of intervals in the period.
A'	is the reading from the associated *accumulated energy registers*, adjusted for any known systemic error.
ΔRA	is the maximum discrepancy between the sum of the interval readings and the accumulation register expressed as a percentage and with a maximum value of 1%.

6.3 Validation of energy data from Types 1 - 5 Metering Installations with Partial Check Metering

6.3.1 The following checks apply to *energy data* from all *metering installations* of Types 1-5 which have partial *check* metering.

a) The *energy data* must agree with the check *meter* reading to within the uncertainty limits of both *meter*s. i.e.

$$\frac{|R - C'|}{\left(\frac{R + C'}{2}\right)} \times 100 \leq |\Delta RC|$$

Where

|R-C'| means the absolute value of R-C'.

R is the *revenue meter data stream* reading, expressed in *energy units.*

C' is the associated *check meter* reading, expressed in *energy units*, and adjusted for known losses or systemic errors such as *transformer* losses.

ΔRC is the maximum discrepancy between the revenue and check *meter* expressed as a percentage and with a maximum value of 1%.

b) Where the *energy data* is associated with a *market generator* then it must be validated against *SCADA* data.

$$\frac{|R - S'|}{\left(\frac{R + S'}{2}\right)} \times 100 \leq |\Delta RS|$$

Where

|R-S'| means the absolute value of R-S'.

R is the *revenue meter* reading for the *data stream*, expressed in *energy units.*

S' is the associated *check meter* reading, converted to *energy units*, and adjusted for known losses or systemic errors such as *transformer* losses.

ΔRS is the maximum discrepancy between the revenue and check *meter* expressed as a percentage.

c) Check all *interval meter data* against nominated maximum value. The value must be less than the registered maximum value of Wh, Varh or VAh for the *metering installation data stream*. Maximum Varh checks may be performed as follows:

1. For *CT metering installations* the maximum value is to be initially defined by the applied *CT* ratio. However, the actual value may exceed the registered maximum value of the *CT* due to the ability of the *CT* to be able to accommodate *loads* in excess of their maximum capacity (i.e. 200%). Where this occurs, *Western Power* may deem the *energy* flow as true and correct. When determining *data* flows on a per installation basis, the maximum value may be increased to cater for situations where it has been confirmed that the *CT* is overloaded on a short term basis.

2. For whole current *meters* the maximum value is to be set to the maximum ampere rating of the meter.

d) *Western Power* and the *user* will agree to either:

1. Check the metered value is greater than the registered minimum value for the *metering installations,* or
2. Check that the number of intervals with zero *data* is less than a specified number over a period of time that is deemed practicable in alignment with *good electricity industry practice*.

e) If an interval has a null value then the reading for that interval will be rejected, placed in exception for review or *substituted*.

f) If the *meter* has registered significant *meter* alarms over the period since the last successful read, the *energy data* for the affected intervals may be validated and placed into exception for review pending an assessment of the significance of the alarm. The list of alarms that will be processed is provided in Section 10.

g) The sum of the active and reactive *interval energy data* readings must agree with the accumulated total for the *meter,* i.e.

$$\frac{\left|\left(\sum_{i=1}^{n} R_i\right) - A'\right|}{\left(\frac{\sum_{i=1}^{n} R_i + A'}{2}\right)} \times 100 \leq \left|\Delta RA\right|$$

Where,

$\left|\left(\sum_{i=1}^{n} R_i\right) - A'\right|$ means the absolute value of $\left(\sum_{i=1}^{n} R_i\right) - A'$.

R_i	is the *data stream* reading for interval *i.*
n	is the total number of intervals in the period.
A’	is the reading from the associated *accumulated energy registers*, adjusted for any known systemic error.
ΔRA	is the maximum discrepancy between the sum of the interval readings and the accumulation register expressed as a percentage and with a maximum value of 1%.

h) Where apparent, reactive and *active energy* are all available, these must be checked for consistency, i.e.

$$\frac{\left|\left(A^2+R^2\right)-W^2\right|}{\left(\frac{\left|\left(A^2+R^2\right)+W^2\right|}{2}\right)}\times 100 \le \left|\Delta ARW\right|$$

Where,

$\left\|\left(A^2+R^2\right)-W^2\right\|$	means the absolute value of $\left(A^2+R^2\right)-W^2$
A	is the *data stream* reading for *active energy*
R	is the *data stream* reading for *reactive energy*
W	is the *data stream* reading for *apparent energy*
ΔARW	is the maximum discrepancy in the *apparent energy*, expressed as a percentage and with a maximum value of 1%.

6.4 Validation of energy data from Types 1 - 5 Metering Installations without Check Metering

6.4.1 The following checks apply to *energy data* from all *metering installations* of Types 1-5 which have no *check* metering:

a) Check all *interval meter data* against nominated maximum value. The value must be less than the registered maximum value of Wh, Varh or VAh for the *metering installation.* Maximum Varh checks may be performed as follows:

1. For *CT metering installations* the maximum value is to be initially defined by the applied *CT* ratio. However, the actual value may exceed the registered maximum value of the *CT* due to the ability of the *CT* to be able to accommodate *loads* in excess of their maximum capacity (i.e. 200%). Where this occurs, *Western Power* may deem the *energy* flow as true and correct. When determining *data* flows on a per installation basis, the maximum value may be increased to cater for situations where it has been confirmed that the *CT* is overloaded on a short term basis.
2. For whole current *meters* the maximum value is to be set to the maximum ampere rating of the meter.

b) *Western Power* and *user* will agree to either:

1 Check the metered value is greater than the registered minimum value for the *metering installations;* or

2 Check that the number of intervals with zero *data* is less than a specified number over a period of time that is deemed practicable in alignment with *good electricity industry practice*.

c) If an interval has a null value then the reading for that interval will be rejected, placed into an exception for review or *substituted*.

d) If the *meter* has registered significant *meter* alarms over the period since the last successful read, the *energy data* for the affected intervals may be validated and placed into exception for review pending an assessment of the significance of the alarm. The list of alarms that will be processed is provided in Section 10.

e) The sum of the *interval energy data* readings must agree with the accumulated total for the *meter* for *active energy* and *reactive energy data streams,* i.e.

$$\frac{\left|\left(\sum_{i=1}^{n} R_i\right) - A'\right|}{\left(\frac{\sum_{i=1}^{n} R_i + A'}{2}\right)} \times 100 \leq \left|\Delta RA\right|$$

Where,

$\left|\left(\sum_{i=1}^{n} R_i\right) - A'\right|$ means the absolute value of $\left(\sum_{i=1}^{n} R_i\right) - A'$.

R_i is the *data stream* reading for interval *i.*

n is the total number of intervals in the period.

A’ is the reading from the associated *accumulated energy registers*, adjusted for any known systemic error.

ΔRA is the maximum discrepancy between the sum of the interval readings and the accumulation register expressed as a percentage and with a maximum value of 1%.

f) Where apparent, reactive and *active energy* are all available, these must be checked for consistency, i.e.

$$\frac{\left|\left(A^2 + R^2\right) - W^2\right|}{\left(\frac{\left|\left(A^2 + R^2\right) + W^2\right|}{2}\right)} \times 100 \leq \left|\Delta ARW\right|$$

Where,

$\left|\left(A^2 + R^2\right) - W^2\right|$ means the absolute value of $\left(A^2 + R^2\right) - W^2$.

A is the *data stream* reading for *active energy.*

R is the *data stream* reading for *reactive energy.*

W is the *data stream* reading for *apparent energy.*

ΔARW	is the maximum discrepancy in the *apparent energy*, expressed as a percentage and with a maximum value of 1%.

7 Metering installation Types 1 - 5 – Accumulation, Substitution and Estimation

7.1 Requirement to Accumulate Energy Data to Trading Intervals

7.1.1 Where *energy data* is recorded in fifteen-minute intervals this must be accumulated to half-hourly values to coincide with the *trading interval* in accordance with section 7.3.

7.2 Requirement to Provide Substituted or Estimated Energy Data

7.2.1 When *energy data* is required to be *substituted* or *estimated Western Power* will use the following *substitution* Types

a) 11, 12, 13, 14, 15, 16, 17 and 18 for *metering installation* Types 1-4

b) 51, 52, 53, 54, 55 and 56 for Type 5 *metering installations*,

c) 61,62,63,64,65 for Type 6 *metering installations*, and

d) 71,72,73,74 for Type 7 metering installation

7.2.2 For *connection points* classed as *generators*:

a) Western Power may directly undertake Type 11, 12 or 13 substitutions as a consequence of missing or erroneous metering data that has failed validation

b) Western Power may undertake Type 16 and 18 substitutions (agreed/alternate method) following consultation and agreement with the generator participant to ensure that the substituted data is an accurate reflection of the energy intervals concerned

c) In any instance where SCADA data is to be used for substitution, both the E and B channel must be used.

7.2.3 *Western Power* must not perform substitution of Type 18, 55, 56, 64 and 74 without the prior agreement of the affected parties.

7.2.4 *Western Power* will notify affected *code participant*s where *substituted energy data* is used via the quality flag in the *data* file format.

7.2.5 *Western Power* will notify affected *code participant*s of the method of substitution used via the method flag in the *data* file format.

7.2.6 *Western Power* will notify affected *code participant*s of errors and alarms associated with the *energy data* via the reason code as listed in Section 10 in the *data* file format.

7.2.7 Where one or more of the readings making up the *interval energy data* in accordance with section 3.1.8 has failed *validation* and been *substituted*, this will be reflected in the reason code, quality flags, and, where relevant, method flags of the *interval energy data* reported under section 7.2.5. The alarm status will be reported in accordance with Section 10.

7.2.8 *Western Power* must ensure that for all substitution types, *substituted energy data* is based on an actual *meter* reading, and is not based on *energy data* that has previously been *estimated* or *substituted*.

7.2.9 Where a *substitution* type requires the use of historical *data*, the *data* source for historical *data* shall be *data stream* specific rather than *meter* specific.

7.3 Accumulation of data to trading intervals

7.3.1 The formulae used for converting fifteen-minute interval readings to half-hourly interval readings are as listed in the following table:

Variable	Formula
Half-Hourly (HH) Consumption	HH Consumption at interval $_{i+1}$ = sum (Consumption at Quarter-Hourly (QH) interval $_{i}$, Consumption at QH interval $_{i+1}$) { I.e. Add the reading values (kWh) of the two adjacent QH intervals to form the HH Consumption for the HH interval. For example, QH Consumption @ 00:15 = 20 kWh QH Consumption @ 00:30 = 50 kWh then HH Consumption @ 00:30 = 70 kWh}
HH *Demand*	HH *Demand* can be determined when *data* for HH Consumption is present HH *Demand* in kW at interval $_{i+1}$ = HH Consumption in kWh at interval $_{i+1}$ x 2
HH *Reactive Energy*	HH *Reactive Energy* at interval i+1 = sum (*Reactive Energy* at QH interval i, *Reactive Energy* at QH interval i+1) {I.e. Add the reading values (kVARh) of the two adjacent QH intervals to form the HH *Reactive Energy* for the HH interval. For example , QH *Reactive Energy* @ 00:15 = 20 kVARh QH *Reactive Energy* @ 00:30 = 50 kVARh then HH Consumption @ 00:30 = 70 kVARh}
HH *Apparent Energy*	HH *Apparent Energy* at interval i+1 is not calculated from quarter-hourly readings but is derived when *data* for HH Consumption and HH *Reactive Energy* are present. HH *Apparent Energy* in kVAh at interval $_{i+1}$ $= \sqrt{\text{HH Consumption}^2 + \text{HH Reactive Energy}^2}$

Variable	Formula
	The units of Consumption = kWh The units of *Reactive Energy* = kVArh
Power Factor	*Power Factor* can only be determined when *data* for HH Consumption and HH *Apparent Energy* are present. $\textit{Power Factor} = \frac{\text{HH Consumption in kWh}}{\text{HH Apparent Energy in kVAh}}$ The *Power Factor* should be between 0 and 1 inclusive.

7.4 Substitution and Estimation Types for Metering installation Types 1-4

7.4.1 Substitution Method 11

Interval energy data obtained from another *meter* at the same measurement point for the same interval *data* periods as that being *substituted* for may be used for substitution purposes, e.g. installations where revenue and check *meters* are installed.

Method 11 substitutions also include the use of *data* from similar *meters* where the *load* profile of the second *meter* is a good match to the *load* profile of the *meter* for which substitutions are being made, e.g. where *meters* are installed on each end of a transmission line where the difference due to line losses can be accurately determined; or where *meters* are installed on parallel feeders where *supply* is 'to' and 'from' common buses and line impedances are similar.

7.4.2 Substitution Method 12

Data values may be calculated for an unknown feed to a node based on the other known *energy* flows to or from that node.

7.4.3 Substitution Method 13

Data from an *energy* management system or *SCADA data* shall only be used for substitution purposes where the *data* originates from a similar measurement point to the *meter* for which substitutions are being made.

Data from an *energy* management system or *SCADA data* may be *data* which is inferior in accuracy or resolution and which is in a dissimilar format to the *energy data*, (e.g. 30 Min. *demand* values). Where necessary the *data* will be adjusted in both magnitude and form in order that the substitution is of an acceptable quality.

7.4.4 Substitution Method 14

Where *data* substitution methods 11, 12, and 13 cannot be carried out, *Western Power* may *substitute* the missing *data* using the "Nearest Equivalent Day" or "Like Day" method, as detailed in the table below.

METHOD 14	
Substitution Day	**"Nearest Equivalent Day" or "Like Day" (in order of availability)**
Monday	Monday ♦♦
Tuesday	Tuesday ♦♦ Wednesday♦♦ Thursday ♦♦ Wednesday ♦ Thursday ♦
Wednesday	Wednesday ♦♦ Tuesday ♦ Thursday ♦♦ Thursday ♦ Tuesday ♦♦
Thursday	Thursday ♦♦ Wednesday ♦ Tuesday ♦ Wednesday ♦♦ Tuesday ♦♦
Friday	Friday ♦♦
Saturday	Saturday ♦♦
Sunday	Sunday ♦♦

Substitutions for 'Like Day' to be as detailed above, unless:

1) If no readings are available on the first listed day, then the next listed preferred day is to be used,
2) The substitution day was a public holiday, in which case the most recent Sunday is to be used,
3) The substitution day was not a public holiday and the 'Like Day' is a public holiday, the substitution 'Like Day' to be used must be the most recent *business day*.

♦♦ Occurring in the week preceding that in which the substitution day occurs.

♦ Occurring in the same week as the substitution day

7.4.5 Substitution Method 15

Where *data* substitution methods 11, 12, and 13 cannot be carried out, *Western Power* may *substitute* the missing *data* using the "Nearest Equivalent Day" or "Like Day" method, as detailed in the table below.

METHOD 15
The intervals to be *substituted* will be plugged using an average of each interval from the proceeding 4 weeks, or part thereof. This averaging technique may be applied in the following ways: 1) The averaged intervals are simply 'plugged' into the intervals requiring substitution, or 2) The averaged intervals are used to provide the profile for the intervals requiring to be 'plugged' to a predetermined number of pulses for the total substitution period. However if *data* is required to be *substituted* for a public holiday then the most recent available Sunday will be used.

7.4.6 Substitution Method 16

(a) Where *data* substitution is required for any period greater than 7 days, consideration, consultation and agreement may take place between the affected parties to resolve any abnormal equivalent days that may be applicable. In the interests of practicality, *Western Power* may use other substitution methods without consultation for periods greater than 7 days in alignment with *good electricity industry practice*. Where a *code participant* identifies discrepancies in the substitution method used, it may request *Western Power* to resolve those discrepancies or request an alternative substitution method is used.

(b) Method 16 substitutions are:

i. *data* substitutions of any format for periods greater than 7 days that are based on an agreement between all the affected parties;

ii. changes to existing substitutions for any period that are carried out where the affected parties have directed that as a result of site or *customer* specific information, the original substitutions are in error.

7.4.7 Substitution Method 17

Data substitutions for periods up to, but not exceeding 2 hours, may be carried out by simple linear interpolation.

7.4.8 Substitution Method 18

This substitution method covers the situation where an alternate method of substitution has been agreed with the *code participant*, the applicable *user* and *Western Power*. This may be a globally applied method or a site specific method where an adjusted profile is used to take into account local conditions which affect consumption (e.g. local holiday not energised *connection point* or *customer* shutdown), or where alternate *data* may be able to be used for quality checks and minor adjustments of an *estimated* profile such as using *meter* register *data*.

7.4.9 Substitution Method 18 – Not Energised Metering Points

This substitution method covers the situation where a *metering point* is in the status of Not Energised. Substitution method 18, in conjunction with reason code zero-consumption, will be used.

7.5 Substitution and Estimation Types for Metering installation Type 5

7.5.1 Substitution Method 51

This method is known as the Previous Years Method. *Western Power substitutes* the missing *data* by using the "Nearest Equivalent Day" or "Like Day" method, as detailed in the table below.

METHOD 51	
Substitution Day	**"Nearest Equivalent Day" or "Like Day" (in order of availability)**
Monday	Monday ♦♦ Monday ♦
Tuesday	Tuesday ♦♦ Wednesday♦♦ Tuesday ♦ Wednesday ♦
Wednesday	Wednesday ♦♦ Tuesday ♦♦ Thursday ♦♦ Wednesday ♦ Thursday ♦ Tuesday ♦
Thursday	Thursday ♦♦ Wednesday ♦♦ Tuesday ♦♦ Thursday ♦ Wednesday ♦ Tuesday ♦
Friday	Friday ♦♦ Friday ♦
Saturday	Saturday ♦♦ Saturday ♦
Sunday	Sunday ♦♦ Sunday ♦
Substitutions for 'Like Day' to be as detailed above, unless: 1. If no readings are available on the first listed day, then the next listed preferred day is to be used. 2 The substitution day was a public holiday, the most recent Sunday is to be used.	

METHOD 51	
Substitution Day	**"Nearest Equivalent Day" or "Like Day" (in order of availability)**
	3 The substitution day was not a public holiday and the 'Like Day' is a public holiday, the substitution 'Like Day' to be used must be the most recent *business day*. ♦♦ Occurring in the same week as the substitution day in the previous year. ♦ Occurring in the week preceding that in which the substitution day occurs in the previous year.

7.5.2 Substitution Method 52

This method is known as the Previous *Meter* Reading Method. *Western Power substitutes* the missing *data* by using the "Nearest Equivalent Day" or "Like Day" method, as detailed in the table below.

METHOD 52	
Substitution Day	**"Nearest Equivalent Day" or "Like Day" (in order of availability)**
Monday	Monday ♦♦ Monday ♦
Tuesday	Tuesday ♦♦ Wednesday♦♦ Tuesday ♦ Wednesday ♦
Wednesday	Wednesday ♦♦ Tuesday ♦♦ Thursday ♦♦ Wednesday ♦ Thursday ♦ Tuesday ♦
Thursday	Thursday ♦♦ Wednesday ♦♦ Tuesday ♦♦ Thursday ♦ Wednesday ♦ Tuesday ♦
Friday	Friday ♦♦ Friday ♦
Saturday	Saturday ♦♦ Saturday ♦
Sunday	Sunday ♦♦ Sunday ♦
Substitutions for 'Like Day' to be as detailed above, unless: 1 If no readings are available on the first listed day, then the next listed preferred day is to be used. 2 The substitution day was a public holiday, the most recent Sunday is to be used. 3 The substitution day was not a public holiday and the 'Like Day' is a public holiday, the substitution 'Like Day' to be used must be the most recent business day. ♦♦ Occurring in the last whole week of the previous *meter reading period*. ♦ Occurring in the week preceding the last whole week of the previous *meter reading period*.	

7.5.3 Substitution Method 53

(a) Where *data* substitution is required for any period greater than 7 days, consideration, consultation and agreement must take place between the affected parties to resolve any abnormal equivalent days that may be applicable. In the interests of practicality, *Western Power* may use other substitution methods without consultation for periods greater than 7 days in alignment with *good electricity industry practice*. Where a *code participant* identifies discrepancies in the substitution method used, it may request *Western Power* to resolve those discrepancies or request an alternative substitution method is used.

(b) Method 53 substitutions are:

i. *data* substitutions of any format for periods greater than 7 days that are based on an agreement between all the affected parties;

ii. changes to existing substitutions for any period that are carried out where the affected parties have directed that as a result of site or *customer* specific information, the original substitutions are in error.

7.5.4 Substitution Method 54

Data substitutions for periods up to, but not exceeding 2 hours, may be carried out by simple linear interpolation.

7.5.5 Substitution Method 55

This substitution method covers the situation where an alternate method of substitution has been agreed with the *code participant*, the applicable *user* and *Western Power*. This may be a globally applied method or a site specific method where an adjusted profile is used to take into account local conditions which affect consumption (e.g. local holiday or *customer* shutdown), or where alternate *data* may be used for quality checks and minor adjustments of an *estimated* profile such as using *meter* register *data*.

7.5.6 Substitution Method 56

This substitution method covers the situation where a substitution for *interval energy data* is required for a period prior to the first *meter* read. The *data* substitution must be done by a method agreed to by *Western Power* and the affected *code participant*.

7.5.7 Substitution Method 57 – Not Energised Metering Points

This substitution method covers the situation where a *metering point* is in the status of Not Energised. Substitution method 55, in conjunction with reason code zero-consumption will be used.

8 Metering installation Type 6 – Validation, Substitution and Estimation

8.1 Requirement to Validate *Meter* Readings

8.1.1 *Actual meter* readings will be required to be validated in accordance with section 3.4.2. The *validation* rules that will be applied to the *energy data* read from the *meter* of a Type 6 *metering installation* are:

a) *Energy data* value is numeric, and

b) *Energy data* value is greater than or equal to the minimum value specified for that *meter*; and

c) *Energy data* value is less than or equal to the maximum value specified for that *meter*; and

d) *Meter* read date > previous *meter* read date; and

e) *Meter* read value is not missing (null) for any Type 6 *meter*; and

f) Dial capacity, rollover and decimal point check. A register will be deemed to have failed a rollover check where the calculated value from a rollover exceeds 50% of the register capacity.

8.2 Requirement to Produce Substituted or Estimated Energy Data

8.2.1 In accordance with section 3.4.3 c), *energy data* for a Type 6 *metering installation* may be required to be *substituted* or *estimated*.

8.3 *Western Power* Obligations

8.3.1 When the *energy data* is required to be *substituted* or *estimated Western Power* may use Substitution Types 61, 62, 63, 64 or 65, as defined in section 8.4.

8.3.2 *Western Power* will notify affected *code participants* where *substituted energy data* is used via the status flag in the *data* file format.

8.3.3 *Western Power* will as far as reasonably practicable, ensure that for all substitution types for Type 6 *metering installations*, *substituted energy data* is not based on *energy data* that has previously been *estimated* or *substituted*.

8.3.4 Western Power may *substitute* or *estimate* readings in conjunction with an actual read to determine the point of reference to enable calculation of the *average daily consumption* for a new substitution reading. *Western Power* may apply an actual read as a reference point for substitution to ensure any substitution applied is not based on a prior substituted or estimated reading.

8.3.5 Where a substitution Type requires the use of historical *data*, the *data* source for historical *data* shall be *data* specific rather than *meter* specific.

8.4 Substitution and Estimation Types

8.4.1 Substitution/Estimation Type 61 – Previous Year Method

a) Value = *Average daily consumption* from same, or similar, *meter* read period last year × Number of days required to be *substituted*

b) *Western Power* may establish additional internal procedures to reflect a more accurate assessment of the *customer's* consumption.

8.4.2 Substitution/Estimation Type 62 – Previous *Meter* Reading Method

a) Value = *Average daily consumption* from previous *meter* read period × Number of days required to be *substituted*

b) Where the *scheduled meter reading* frequency is less frequent than monthly, Substitution Type 62 is to be used only when the consumption *data* from the same, or similar, *meter* read period last year is not available.

c) *Western Power* may define additional internal procedures to reflect a more accurate assessment of the *customer's* consumption.

8.4.3 Substitution/Estimation Type 63 – Customer Class Method

a) Value = *Average daily consumption* for the same *customer* class with the same type of usage for this period × Number of days required to be *substituted*

b) Substitution Type 63 is to be used only when the consumption *data* from the same, or similar, *meter* read period last year and the consumption *data* from the previous *meter* read period are not available.

c) *Customer* classes for Substitution Type 63 are:

i. Residential,

ii. Non-Residential,

iii. Farm, and

iv. Public Lighting, or

v. As defined in the latest *Communication Rules* Build Pack or other approved metering documentation.

c) The usage types for Substitution type 63 are:

i. peak,

ii. off-peak, or

iii. as appropriate to the metering configuration.

d) *Western Power* may define additional internal procedures to reflect a more accurate assessment of the customer's consumption.

8.4.4 Substitution/Estimation Type 64 – Agreed Method

a) The *code participant*, the applicable *user* and *Western Power* may agree to use another method of substitution (which may be a modification of an existing Substitution Type) where none of the existing substitution types are applicable.

b) The specifics of this substitution type may involve a globally applied method or a site-specific method.

c) The *code participant*, applicable *user* and *Western Power* may agree to use a globally applied substitution method in advance of its application.

d) The *code participant*, applicable *user* and *Western Power* may agree to amend a site-specific substitution method upon receipt of more accurate information relating to the site.

e) For metering points that are active but in the status of “Not Energised”, Western Power will apply substituted readings of zero for any day(s) the metering point has ”Not Energised” status. Substitution method 64, in conjunction with the appropriate reason code will be provided by *Western Power*.

8.4.5 Substitution/Estimation Type 65 – Estimation by *Average Daily Consumption*

a) Value = *Average daily consumption* × Number of days required to be *substituted*

b) Substitution Type 65 is to be used only when the consumption from the same, or similar, *meter* read period last year and the consumption from the previous *meter* read period are not available.

c) The *average daily consumption* is a configurable attribute of the *load*, agreed with the *retailer*.

9 Metering Installations Type 7 – Validation, Substitution and Estimation

9.1 Requirements to Validate

9.1.1 The *substitution* and *estimation* types detailed in clauses A3.6 and A3.7 of Appendix 3 of the *Code* are to be undertaken by *Western Power* for the calculation, substitution and delivery of metering *data* from a *metering installation* Type 7.

9.2 Type 7 Substitution Rules

9.2.1 *Western Power* must carry out all metering *data* substitutions and estimations in accordance with this *Metrology Procedure*.

9.2.2 *Western Power* must obtain clear and concise identification as to the cause of any missing or erroneous calculated metering *data* for which metering *data* substitutions are required.

9.2.3 *Western Power* must ensure that all metering *data* substitutions and estimations are based on calculated metering *data* and not on any previous substitutions.

9.2.4 *Western Power* must base calculated metering *data* for Type 7 *metering installations* in accordance with the *Communication Rules* Build Pack and specifically the Streetlights and UMS Data CSV File Specification documents:

a) Where the specification has not been updated for the period concerned, calculated metering *data* must be based on the most recent available information and provided as an *estimated* value; and

b) Where the specification is correct for the period concerned, the calculated metering *data* must be provided as an actual value; and

c) Where the specification in (b) above has a subsequent update for the period concerned, the calculated metering *data* must be provided as a *substituted* value.

9.2.5 Subject to clause A3.7 of Appendix 3 of the *Code*, *Western Power* may apply the following substitution and estimations types:

a) Substitutions may be Type 71, 72, 73, or 74.

b) Estimations must be Type 75.

9.2.6 *Western Power* must notify the *retailer* for the *connection point* of any calculated metering *data* substitution within 2 *business days* of the calculated metering *data* substitution being carried out. Notification is achieved via the participant metering *data* file as detailed in accordance with the *Communication Rules* Build Pack and specifically the Streetlights and UMS Data CSV File Specification documents.

9.2.7 *Western Power* must flag all calculated metering *data* substitutions as final (F).

9.3 Substitution and Estimation Types

9.3.1 Type 71 - Recalculation

Western Power must *substitute* calculated metering *data* with the calculated metering *data* obtained by a recalculation based on the current specification in accordance with the

Communication Rules Build Pack and specifically the Streetlights and UMS Data CSV File Specification documents.

9.3.2 Type 72 - Revised Specification

Where the error in the calculated metering *data* is due to errors in the specification outlined in the *Communication Rules* Build Pack or the UMS Data CSV File Specification documents *Western Power* must *substitute* calculated metering *data* obtained by a recalculation based on the most recent inventory tables, *load* tables and on/off tables in which there were no errors.

9.3.3 Type 73 - Revised Algorithm

Where the error in the calculated metering *data* is due to an error in the algorithm, *Western Power* must *substitute* the most recent calculated metering *data* for which there was no error.

9.3.4 Type 74 - Agreed Method

Western Power has agreed this method of calculating metering *data* substitution (which may be a modification of an existing substitution type), in accordance with the *Communication Rules* Build Pack and specifically the Streetlights and UMS Data CSV File Specification documents.

9.4 Validation for Type 7 – Registration Process

9.4.1 *Western Power* must validate the calculated metering *data* on registration of all Type 7 metered sites to verify consistency with the specifications in accordance with the *Communication Rules* Build Pack and specifically the Streetlights and UMS Data CSV File Specification documents.

9.5 Validation of Type 7 Metering Data

9.5.1 *Western Power* must undertake the following *validations* on calculated metering *data* within the metering *data* services database:

a) Check against a nominated maximum calculated metering *data* value;

b) Calculated metering *data* value is numeric and greater than or equal to zero;

c) Check for null (no values) calculated metering *data* in the metering *data* services database for all metering *data streams*

- The aim of this check is to ensure that there is a 100% calculated metering *data* set (and substitution for any missing calculated metering *data* has been undertaken)

d) Check the specifications in accordance with the *Communication Rules* Build Pack and specifically the Streetlights and UMS Data CSV File Specification documents;

e) Check against a nominated minimum value or alternatively a ”zero" check which tests for an acceptable number of zero interval values over a period of time that is deemed practicable in alignment with *good electricity industry practice* and this *Metrology Procedure,*

f) Calculated metering *data* date is greater than the previous calculated metering *data* date.

10 Metering Alarms

10.1 Validation of interval metering data alarms for installation Types 1 - 5

10.1.1 *Western Power* must validate *interval metering* data against significant metering data alarms when these are provided in the *meter*, as per the *Code*, the following alarms:

- Power failure
- VT or phase failure
- Pulse over flow
- CRC Error
- Time Tolerance

a) Where a *metering installation* Types 1 -5 assigns alarms to the meter data channel or the interval reading status ,*Western Power* may process the alarm along with the metering data as part of the required validation process;

b) As a minimum *Western Power* must have systems and processes in place that capture metering data alarms;

c) *Western Power* must retain all metering data alarms as part of the data audit trail;

d) For instances where interval data was found to be corrupted, *Western Power* may provide replacement data in alignment with the *Code* and *good electricity industry practice* and with this *Metrology Procedure;and*

e) Western Power may apply processes where data alarms may take precedence of certain types based on a priority. Channel Status codes may be deemed more serious than interval status codes and may take priority however substitution may take priority over an alarm raised in the meter.

10.2 Metering Installation Types 1 - 5 Metering Data Alarm definitions

Description	Code	Definition	Type
Power Failure (Power Outage)	PO	This status occurs when the meter detects loss of power. During the meter data retrieval process, collection system, flags each load profile interval value between the AC Power Down and AC Power Up events with a Power Outage status bit.	Interval Status
Alarm/Error	LR	This status is based on the meter manufacturer's documentation of alarm conditions. It can reflect a field device channel status such as power drop on a phase, harmonics, or a field device interval status such as program malfunction or test mode.	Channel Status
Over Flow of Channel Data	OV	This status indicates that the actual demand value collected from the meter was beyond the range of the Demand High/Low Limits.	Channel Status
CRC Checksum Error	CR	This status occurs during an internal status check or an internal read/write function within the meter. This error condition is dependent on the meter hardware.	Interval Status
Time Reset occurred	TR	This status occurs when any time change, including DST, occurs in the meter.	Interval Status

Appendix 1 – Default Metering Installation Settings

Interval Duration

Within the *Western Power network* all *interval meters* are configured to record *energy data* at either 15 minute intervals or 30 minute intervals. When recorded in 15 minute intervals these are aggregated within the metering systems to 30 minute *trading intervals*.

Time zone

All daily quantities are based on 24-hour days and the Australian Western Standard Time (AWST).

Channels

The following table shows the channels and associated *NMI* suffixes provided by default for each type of *metering installation* based on the NMI allocation procedure. Other channels can be configured upon request providing they are supported by the installed meter.

Table 1: NMI Suffixes for Consumption metered data

NMI Suffix (1)	Description	Register Use	Second Character
0	Register Unspecified (placeholder)		*Meter* numbers or measuring elements are to be 1-9 then A-Z
1	First Register	007 (Anytime)	
2	Second Register	010 (Peak)	
3	Third Register	020 (Off Peak)	
4	First LNSP defined register	030 (High Shoulder)	
5	Second LNSP defined register	040 (Low Shoulder)	
6	Third LNSP defined register	AMD (Maximum Monthly *Demand*)	
7	Fourth LNSP defined register	CMD (Cumulative *Demand*)	
8	Fifth LNSP defined register		

Table 2: NMI Suffixes for interval metered data

First Character

	AVE	MASTER	CHECK	NET
IMPORT kWh	A	B	C	N
EXPORT kWh	D	E	F	
IMPORT kvarh	J	K	L	X
EXPORT kvarh	P	Q	R	
KVAh	S	T	U	
Power Factor pF	G			
Q Metering Qh		H	Y	
Par Metering parh		M	W	
VOLTS (or V2h)		V	Z	

Second Character

Meter Numbers of measuring elements are to be 1 – 9 then A-Z

Note: Import kWh is net *electricity* generated at site and fed into the *network*, while export kWh is *electricity* provided from the *network* to the site.

Remarks:

- The B, E, K and Q will be the norm in the WA *market* (instead of N and X).
- The I and O are not used as second character in the *NMI* Suffix.

Measurement Type:

This field is on the *meter supply* point and is included in the *standing data* to *market*. The field summarises the registers defined on the meter, and should therefore be maintained automatically as a result of changes to the registers on the meter, resulting in one of the following measurement types:

- EB Bi-directional *energy* only
- E Uni-directional *energy* only
- EQ Uni-directional *energy* + reactive
- EBQK Bi-directional *energy* + reactive

Appendix 2 – Meter Compliance Testing and Sampling Plan

Meter Compliance Testing and Sampling Plan

First issue: March 2014
This Revision: First issue

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1 Introduction

1.1 Purpose

The purpose of the plan is to provide guidelines and information to Western Power personnel about the sampling and testing methodologies used to determine whether meters on the Western Power network are operating within the allowable prescribed margin of error.

1.2 Provisions in the Electricity Industry (Metering) Code 2012

Clause 3.11A (Accuracy of metering installations) of the Electricity Industry (Metering) Code 2012 (Code) requires Western Power to ensure the revenue meters are sampled and tested for accuracy in accordance with AS1284.13.

1.3 Provisions in the Metrology Procedure

Section 2.3.1 of the Metrology Procedure for Metering Installations on the Western Power Network specifies the requirement to sample and test the meters in accordance with AS1284.13 and to comply with specifications and guidelines of the National Measurement Institute under the National Measurement Act.

2 Sample Selection

The metrological performance of the electricity revenue meter population will be assessed by the use of statistical sampling in accordance with AS1284.13. Statistical sampling provides an objective, acceptable methodology to determine the sample size for the population.

The sample is randomly selected from the population so that each meter making up the population group has the same chance of selection and the probability of selection is known. The result can then be statistically evaluated, objectively interpreted and precision and reliability calculated.

3 Determination of populations

In accordance with AS1284.13, the populations for the purposes of sampling are determined on the basis of:

- Meter manufacturer.
- Design or pattern (meter) type.

The resulting population of meters grouped by manufacturer and/or design/pattern type allows Western Power to identify the appropriate meter accuracy class against which the population is assessed.

Western Power assigns each meter pattern a code that identifies both the manufacturer and type. Details of when a meter is placed in service together with location details are held in Western Power's Metering Business System (MBS).

The volume of meters that make up a population is obtained from MBS. MBS is integrated to produce, as a minimum, the following details for each meter:

- Meter type
- Meter number
- National Metering Identifier
- Location/address

- Date installed[1].

The details, by meter type, are provided in electronic spreadsheet format. From these spreadsheets the volume of meters that make up the populations are determined. A population is comprised of meters that have been assigned the same meter prefix by the supply authority, for example a Landis & Gyr meter type EM1000 has been assigned a meter prefix of 0200. The meter prefix is followed by a six digit serial number. New meter prefixes are assigned when the manufacturer has made changes to the pattern of the meter.

When determining a population, Western Power may arrange meters in sub-populations according to any of the characteristics in accordance with AS1284.13.

The sample size is based on the number of meters that make up the population.

4 Determination of sample size

In accordance with AS1284.13, the number of meters that make-up the sample when sampling by attributes and variables is given in Table 1 below.

Number of meters in Population	Sample Size – **Attributes**
2 – 8	2
9 - 15	3
16 – 25	5
26 – 50	8
51 – 90	13
91 – 150	20
151 – 280	32
281 – 500	50
501 – 1 200	80
1 201 – 3 200	125
3 201 – 10 000	200
10 001 – 35 000	315
35 001 – 150 000	500
150 001 – 500 000	800

Number of Meters in population	Sample Size – **Variables**
2 – 8	3
9 – 15	3
16 – 25	4
26 – 50	5
51 – 90	7
91 – 150	10
151 – 280	15
281 – 400	20
401 – 500	25
501 – 1200	35
1201 – 3 200	50
3201 – 10 000	75
10 001 – 35 000	100
35 001 – 150 000	150
150 001 – 500 000	200

Table 1 Sample sizes

Population numbers in excess of 500,000 meters shall be sub-divided into smaller groups and the sample sizes determined accordingly.

[1] Note installation dates prior to the introduction of MBS in 2005 have been transferred into MBS from Western Power's previous metering database CIS

4.1 Random selection of sample

In accordance with AS1284.13 the meters that are to make up the sample selection are chosen at random from each of the populations. A programming script has been developed by Western Power's Information and Communication Technology function that provides the randomly selected sample meters for each identified meter population. The actual number of meters that comprise the samples may be increased by a minimum of 10% above the required sample number given in Table 1 to allow for the replacement of faulty or damaged meters.

5 Sampling Accuracy Method

In accordance with AS1284.13, Western Power conducts testing of meters by using either one of two methods described under the standard.

Sampling by attributes is an inspection method whereby for each of the test points the meter either 'passes' or 'fails' to meet the limits of the meter accuracy class. The number of fails are counted and compared to the requirements detailed in the standard.

Sampling by variables is an inspection method which consists of measuring a quantitative characteristic for each item of a population or a sample taken from this population. This method requires a successful test for normality, and can be completed with a smaller sample size, although is more complex.

Western Power adheres to the appropriate testing sequence as outlined within AS1284.13 for each testing method.

6 Sample Testing

In accordance with AS1284.13, meters are tested either on site, or in the Western Power Meter Laboratory. All work is carried out by suitably trained metering officers, who will carry out the testing in accordance with the requirements of the Metrology Procedure for Metering Installations on the Western Power Network. Approximately 1% of the sample size may be removed for additional testing in the Western Power laboratory.

Western Power ensures the equipment used to determine accuracy and performance characteristics of the population sample holds certificates of calibration that are traceable to National Standards.

Before testing takes place, meters from the population sample are inspected for signs of damage or interference. Meters that show signs of damage are replaced with a suitable new meter. The field officer will report any damage or interference to a field inspector from Western Power's Metering Services function if a meter shows signs of tampering, and the meter may be omitted from the population.

6.1 Measurement points for accuracy testing

Table 2 details the load test points for accuracy testing of each meter configuration. For poly-phase meters, the accuracy figures relate to balanced currents.

Category of Meter	Test Points			
	Light Load	**Full Load**	**Full Load 2**	**Full Load 3**
Direct-connected single-phase	0.1 I_b	-	I_b	-
	(p.f. = 1)	-	(p.f. = 1)	-
Direct-connected poly-phase	0.1 I_b	-	I_b	I_b
	(p.f. = 1)	-	(p.f. = 0.5 lagging)	(p.f. = 1)
Transformer – connected	0.05 I_n	I_n	I_n	2 I_n or I_{max} whichever is the lesser
	(p.f. = 1)	(p.f. = 1)	(p.f. = 0.5 lagging)	(p.f. = 1)

Table 2 Accuracy measurement points

I_b = Basic current

Value of current with which the performance of a direct-connected meter is fixed

I_n = Rated current

Value of current with which the performance of a Current Transformer is fixed

7 Performance characteristics

In addition to determining the level of accuracy as outlined in section 6.1, meters will be tested in accordance with AS1284.13 for compliance of:

- Anti-creep Function (Running at no-load) [induction meters only].
- Operation of the register or display.

7.1 Anti-creep function (Running at no-load) - induction meters

Western Power will test the anti-creep function on induction meters using the most appropriate method as outlined in AS1284.13, depending on whether the meter is being tested in the field, or in the laboratory.

7.2 Operation of register or display

In accordance with AS1284.13, Western Power will test the operation of the register or display by passing energy through the meter until the fastest moving drum or pointer can be read with sufficient accuracy to enable the meter constant to be verified with an acceptable level of confidence. During the testing of the register or display operation, Western Power will verify that the relationship between the meter constant and the indication on the display complies with the marking on the nameplate. The test is carried out by applying a known load over a precise time period, and in the case of:

Induction Meters

Provide the test equipment with a 'Start' reading of the dial register and an 'End' reading of the same register at the conclusion of the check.

Electronic Meters

Provide the test equipment with a 'Start' reading of the All-time register and an 'End' reading of the same register at the conclusion of the check.

The test equipment will indicate the percentage error of the register check.

8 Assessment of Results

In accordance with AS1284.13, accuracy testing will be carried out on each meter at the "test points" outlined in Table 2.

For each test point (e.g. full load and light load) applicable to the population, the calculated error of the meter will be recorded onto a spreadsheet.

The result of each meter test is documented and totals collated to allow assessment of the metrological performance of the sample against the maximum pass-fail levels specified by AS1284.13 and in accordance with the method being employed to test the sample.

The results of the sample testing are measured against each of the criteria elements outlined in Table 3 below. Western Power may choose to redefine a population if the sample test results do not meet the desired level of accuracy in accordance with Table 3.

Meter Accuracy Class	Criteria 1		Criteria 2		Criteria 3	
	Upper and Lower error of sample	Compliance Testing Period	Upper and Lower error of sample	Compliance Testing Period	Upper and Lower error of sample	Compliance Testing Period
General Purpose	±2.0%	7 years	±2.5%	5 years	±3.0%	2 years
Class 1	±1.5%	5 years	±2.0%	5 years	±2.5%	2 years
Class 0.5	±0.75%	4 years	±1.0%	4 years	±1.25%	2 years
Class 0.2	±0.3%	2 years	±0.4%	2 years	±0.5%	1 year

Table 3: Ongoing In-Service Compliance Period for Induction and Electronic Meters

At the completion of accuracy testing the meters will undergo the following tests which are also recorded as a pass or fail condition on the spreadsheet:

- Anti-creep functionality tests.
- Register/display accuracy check.

9 Redefining Populations

If a testing sample does not achieve the required pass level in accordance with AS1284.13, the population from which the sample was taken may be redefined into an alternate population, or sub population in accordance with AS1284.13.

Where the sample was tested for accuracy using attributes, in accordance with AS1284.13, the variables method of testing for accuracy may be employed. Conversely, where the sample was tested for accuracy using variables, in accordance with AS1284.13, the attributes method of testing for accuracy may be employed.

10 On-going Compliance Testing

Once the results of the population have been determined, and the population has achieved an acceptable pass rate in accordance with the requirements of AS1284.13, the meters that comprise the population shall be left in-service for the periods specified in Table 3 according to the result. Table 3 outlines the on-going compliance period for populations that meet the requirements. The meter population will be re-tested prior to the expiry of the length of time outlined in the table for the respective accuracy class.

Meter Accuracy Class	Criteria 1		Criteria 2		Criteria 3	
	Upper and Lower error of sample	Compliance Testing Period	Upper and Lower error of sample	Compliance Testing Period	Upper and Lower error of sample	Compliance Testing Period
General Purpose	±2.0%	7 years	±2.5%	5 years	±3.0%	2 years
Class 1	±1.5%	5 years	±2.0%	5 years	±2.5%	2 years
Class 0.5	±0.75%	4 years	±1.0%	4 years	±1.25%	2 years
Class 0.2	±0.3%	2 years	±0.4%	2 years	±0.5%	1 year

Table 3: Ongoing In-Service Compliance Period for Induction and Electronic Meters

11 Determining Population Failure

Where the option to redefine a population, or substituting the method used to test a sample for accuracy in accordance with AS1284.13, has resulted in the population not achieving the required pass levels in accordance with AS1284.13, Western Power may deem that the population has failed.

If Western Power determines that the cost of redefining a population and the subsequent testing of that population (and the probability that the meters will fail the new testing) outweighs the cost of replacing the specific population, Western Power may deem that the population has failed.

The Complex Metering and Laboratory Team Leader will provide a report to the Metering Services Manager outlining the test results and analysis of any failed meter population.

Where a population is deemed to have failed compliance testing under AS1284.13, Western Power will ensure it complies with the Code requirements when removing or replacing any failed meter population.

Additionally, when Western Power, acting in accordance with good electricity industry practice, is unable to complete a removal or replacement program within the prescribed timeframe, it must request the Economic Regulation Authority to provide an extension of the time to complete the removal or replacement of the failed meters in accordance with clause 3.11A(3) of the Code.