HORIZON POWER METROLOGY PROCEDURES

For all Metering installations connected to the Horizon Power Networks

Produced by:
Horizon Power
ABN: 579 550 11697

April 2017

About this document

Author/Custodianship

Author:	Metering Services, Customer Service Branch, Corporate Services and Finance Division
Custodian:	Manager Customer Service

Distribution list

When this document is updated, the following people must receive a copy of the updated version:

Name	Position/title
Metering Services	
Economic Regulation *Authority*	
Independent Market Operator	

Document version history

Version	Date	Change request no.	Amendment
V1	6 September 2006		Initial Approved Metrology Procedure.
V2 Draft	1 October 2014		Draft Revision for Internal review and approval.
V3 Draft	17 December 2014		Internal Approved Draft for Approval by the ERA.
V4 Draft	28 September 2016		Draft Revision for Internal review and approval.
V5 Draft	7 April 2017		Draft Revision for Internal review and approval
V6	10 April 2017		Published for Review and Approval by the ERA.
V7	28 December 2017		Amended pursuant to ERA final findings

Review and approval

Name	Role	Signature	Date
Greg Will (Review)	Metering Services Manager		28/12/2017
Geoff White (Approval)	Manager Customer Services		10/04/17

Table of Contents

1 General

1.1 Introduction

1.1.1 The title of this document is the “Horizon Power Metrology Procedure for Metering Installations”.

1.1.2 The short title of this document is the “Horizon Power Metrology Procedure”.

1.1.3 The *Horizon Power Metrology Procedure* is made in accordance with clauses 6.2 and 6.8 of the *Code*.

1.2 Purpose

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

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

b) to interested third parties on the requirements for *meter*ing within the *Horizon Power Network*s.

1.3 Scope

1.3.1 This *Metrology Procedure* provides information on devices and methods used by *Horizon 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 link*s

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

d) 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) for the sampling and testing of meters for the purposes of and in accordance with clause 3.11A(1) of the *Code*

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

i) define the procedures for auditing of metering installations

1.3.2 The *Metrology Procedure*:

a) applies to *Code Participant*s and *Horizon 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 *Horizon Power* with regards to *energy data* provision by the *Code* and *market rules as they relate to a metering installation*

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

1.3.3 It should be noted that the *Metrology Procedure* presents the minimum requirements and does not preclude a *meter* supplier, or *Horizon 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 meter*s for *connection point*s with low annual consumption.

1.4 Commencement

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

1.4.2 This *Metrology Procedure* comes into operation immediately after the date of publication.

1.5 Definitions

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

Phrase/term	Meaning
access arrangement	has the meaning given to it in the Electricity Networks (Access) *Code* 2004
*access contr*act	means an agreement between *Horizon 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 *estimate*d or *substitute*d 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 registers	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 registers*.
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 *estimate*d or *substitute*d measurement) of *electricity* production or consumption over a period at the *metering point*, divided by the number of days in the period.
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.
Code of Conduct	means the Code of Conduct For The Supply Of Electricity To Small Use Customers 2016
Code Participant	has the same definition in the *Code*.
Communications Rules	means, in relation to *Horizon Power*'s *network* and subject to clause 6.7 of the *Code*, a document governing the communication of information and data between *Code Participant*s, which has been published under clause 6.19A of the *Code*.

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 element*s);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 element*s 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 element*s).
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 stream*s.
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 act*ive energy* and/or *reactive energy*.
energy units	means Wh, VAh or VARh as appropriate.

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 license 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.
Horizon Power	means Regional Power Corporation (t/a Horizon Power).
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 *estimate*d or *substitute*d 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 *Horizon 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*.
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 alarms and data statuses	means where interval capable *metering installation*s assign specific alarms to the data channel and or the *interval meter*ing data.
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 *Horizon Power* or its metering data agent and are related to the provision of *metering installation*s, *standing data* and *energy data*.
Metrology Procedure	means this document, the Metrology Procedure for Metering installations on the Horizon Power Networks.
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 *Horizon Power*.
power factor	means the ratio of the *active energy* to the *apparent energy* at a *metering point*.
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 *Horizon Power* in accordance with the *registration process* to undertake some or all of the *Act*ivities relating to the installation of *metering installation*s, and who has not been deregistered under the *registration process*.
registration process	means the approved *registration process* established by *Horizon 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*.
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 *Horizon Power* must provide *metering service*s 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 *Communications 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 contr*act 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.

2 Provision of Metering Installations

2.1 Installation of Meters

2.1.1 *Horizon 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 installation*s must not be used for any purpose other than *revenue meter*ing and *check meter*ing 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 installation*s must not be used for other purposes subject to clause 3.12 (1) (a) of the *Code*, unless with the written approval of *Horizon Power*

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

2.1.2 Where prepayment meters are installed:

e) they will be treated where reasonably possible as Type 6 *accumulation meter*s

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

g) they will comply with the technical requirements in Part 9 of the *Code of Conduct*

2.2 Metering Installation Components

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

2.2.2 *Horizon Power* will ensure that the components, characteristics and requirements for *meter* provision for Type 1 – 6 *metering installation*s are in accordance with section 5 of this document.

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 *Horizon 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*, as agreed with the *retailer*. If the *retailer* and *Horizon Power* cannot agree on the type of installation, then subject to clauses 3.9(3A) and 5.1 of the *Code*, *Horizon Power* may make the determination on the matter.

2.2.5 An increase in annual or peak consumption that, in the opinion of *Horizon 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 *Horizon 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 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 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 Testing and Inspection of Meters

2.3.1 *Horizon Power* will ensure that meters on its *network* are sampled and tested in accordance with *AS*1284.13. Details of how *Horizon Power* conducts its sampling and testing are found in Appendix 1 - Meter Compliance Testing and Sampling Plan.

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

2.4 Maintenance of Metering Installations

2.4.1 Where *Horizon 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.

2.4.2 Notwithstanding section 2.4.1, if *Horizon 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*.

2.4.3 A *Code Participant* who becomes aware of an outage or malfunction of a *metering installation* or any of its components must advise *Horizon Power* as soon as practicable.

2.5 Enhanced Technology Features

2.5.1 Where reasonably requested by a *Code Participant*, *Horizon Power* will provide *enhanced technology* features in a *metering installation* in accordance with clause 3.20(1) of the *Code*.

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

2.5.3 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.

2.5.4 Notwithstanding clause 2.5.3, a *meter* will be reported as a different type within the *metering database* where this is necessary to support the *enhanced technology* feature.

2.5.5 Where bi-directional capability is required for the *metering installation*, *Horizon 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*.

2.6 Replacement

2.6.1 Where a population of meters has been sampled and tested in accordance with section 2.3.1 and deemed to have failed, *Horizon Power* will remove and replace all *meter*s within that population in accordance with the requirements of the *Code*.

3 Energy Data

3.1 Energy Data Collection

3.1.1 *Horizon Power* collects *energy data* from *metering installation*s by the following methods:

a) Manual *meter* read.

b) Remote *meter* read (via a *communications link*).

c) Customer supplied *meter* read.

3.1.2 *Horizon 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 *Horizon Power*'s website.

3.1.3 *Horizon Power* will ensure that for Type 1-4 *metering installation*s, *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 *Horizon Power* will ensure that for Type 5 *metering installation*s, *interval energy data* will be collected on a monthly basis or in accordance with the relevant *service level agreement*.

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

3.1.6 *Horizon Power* will ensure that for Type 7 *metering installation*s, *energy data* is calculated, validated and *substitute*d in accordance with the *Code*.

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

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

3.1.9 Where *Horizon Power* receives a request from a *customer* to provide *energy data* or *standing data*, *Horizon 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 enhancements such as clause 10.7 of the *Code of Conduct*.

3.1.10 *Horizon 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 Participant*s regain access to *energy data* within 2 *business day*s.

3.2 Energy Data Collection Schedule

3.2.1 *Horizon Power* will ensure that a schedule is developed and maintained to determine the scheduled dates for reading each *metering installation* in accordance with clauses 5.3 and 5.4 of the *Code*, or such time specified in the applicable *service level agreement*.

3.2.2 Where *Horizon 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, *Horizon Power* and the *Code Participant* may choose, by agreement, to disseminate the *energy data* for *metering installation* Types 1- 5 more frequently. Under these circumstances the published *meter* reading schedule, substitution and other deadlines will not be affected.

3.2.4 *Horizon 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 *Horizon Power* will accept requests for special *meter* reads outside the published schedule in accordance with the provisions of the *Communications 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 *Horizon 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 *Horizon 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*, *Horizon 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 *Horizon Power* and the *retailer*.

3.3.4 After conducting a *meter* reading and obtaining *energy data* for a *metering point*, *Horizon 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 *Communications 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 *Communications Rules*.

3.3.7 *Energy data* (actual, *substitute*d or *estimate*d) is required by *Horizon Power* by *data stream* for all *trading interval*s (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 *Horizon 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 *Horizon Power validates energy data* collected from Type 6 *metering installations* in accordance with Section 8

3.4.3 Metering Installation Type 6 – Validation, Substitution and Estimation.

3.4.4 Where the *energy data* fails *validation* under sections 3.4.1 or 3.4.2 , *Horizon 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

3.4.5 Where the *energy data* fails *validation* under sections 3.4.1 or 3.4.2 , *Horizon Power* may review the *validation* failures to determine the cause of any apparently lost or erroneous *energy data*. Where *Horizon 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 *Horizon Power meter* laboratory to determine the cause of the *validation* failure, or

b) the *metering installation* being 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, *Horizon 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 *Horizon Power estimate*s or *substitute*s energy data from Type 1-5 *metering installations* in accordance with section 7 Metering Installation Types 1-5 – Accumulation, Substitution and Estimation of this document, where:

a) *Horizon Power* has elected to perform substitution under section 3.4.4c) or

b) *Horizon Power* has elected to perform estimation under section 3.5.6, 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 *Horizon Power estimate*s or *substitute*s *energy data* from Type 6 *metering installation*s in accordance with section 8 of this document - Metering Installation Type 6 – Validation, Substitution and Estimation, where:

a) *Horizon Power* has elected to perform substitution or estimation under section 3.4.3 (c),or

b) *Horizon Power* has elected to perform estimation under section 3.5.6, 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) the customer has agreed to an *estimate*d or *substitute*d *scheduled meter reading*; or

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

3.5.3 For *metering installation*s of type 7 *Horizon Power* must ensure that the *energy data* is *substitute*d or *estimate*d in accordance with Section 10 Metering Installation Type 7 – Validation and Substitution, where:

a) an audit under clause 10.1.2 of the information and algorithms used in the calculation of *energy data* for a Type 7 *metering installation* establishes that an error exists in the *energy data* calculation.

3.5.4 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, *Horizon Power* may *estimate* the *energy data* for the period under consideration.

3.5.5 Where the *energy data substitute*d or *estimate*d 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 *substitute*d or *estimate*d as a set to ensure consistency and the availability of correct *power factor*s.

3.5.6 Where any of the alarm status descriptions listed in section 11 occur, the *energy data* may be *substitute*d except where the reported status is determined to be incorrect by *Horizon Power*. Where an incorrect error condition has been detected, *Horizon 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*.

3.5.7 Where an alarm outlined in section 11 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 *Horizon Power* is satisfied that the alarm condition triggered will not recur.

3.5.8 *Substitute*d *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.

3.5.9 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 Calculation of Energy Data for Type 7 Metering Installations

3.6.1 *Horizon Power* must ensure that *energy data* for a type 7 *metering installation* is calculated in accordance with Section 9 Metering Installation Type 7 – Energy Calculation.

3.6.2 *Horizon Power* must ensure that the *energy data* for a type 7 *metering installation*, which is calculated in accordance with clause 3.6.1, is validated in accordance with Section 10 Metering Installation Type 7 – Validation and Substitution, clause 10.1.2.

3.6.3 *Horizon Power* must ensure that the *energy data* is *substitute*d in accordance with substitution method 74 as defined in Section 10 Metering Installation Type 7 – Validation and Substitution, where the *energy data* calculated for a type 7 *metering installation* fails the *validation* test conducted in accordance with clause 10.1.2

3.6.4 *Horizon Power* must ensure that, where *energy data* for a type 7 *metering installation* is *substitute*d in accordance with clause 3.6.4, affected *Code Participant*s are advised that *substitute*d data will be used for settlements purposes.

3.7 Access to Energy Data

3.7.1 *Horizon Power* provides access to *energy data* to a *Code Participant* for each *connection point* at which the *Code Participant* supplies, generates or purchases *electricity* and has an *access contr*act with *Horizon Power*.

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

3.7.3 *Horizon 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*.

Access to energy data will be provided through an agreed reporting process or through a User or Customer portal. Access may also be provided through the signals output of the meter. For clarity, direct access to the Horizon Power telecommunications devices will not be granted to a user or a customer

4 Data Quality

4.1 Energy Data Verification Requests

4.1.1 Where a *Code Participant* requests verification of *energy data* under clause 5.20(3) of the *Code* by using its Energy Data Verification Request Form, *Horizon 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, *Horizon 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*, *Horizon Power* will make the results of the test described in section 4.2 available to the *Code Participant* as soon as practicable but no later than 5 *business day*s 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 *Code Participant* reasonably requests a test or audit of:

a) the accuracy of the *metering installation*, or

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

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

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

4.2.2 Where *Horizon 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 *Horizon 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), *Horizon Power* may:

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

b) ensure that *metering data alarms and data 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 *Horizon Power* will make the results of the test or audit described in section 4.2.1 available to the *Code Participant* in accordance with clause 5.20(4) of the *Code* or as specified in the applicable *service level agreement*.

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

4.2.6 Where errors are detected during the test or audits that are inconsistent with the requirements of the *Code*, *Horizon 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*, *Horizon 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 4.2.1c) 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*, *Horizon 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*, *Horizon 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). *Horizon 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 750 MWh 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 *active 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 *Active energy* and 2.0% for *reactive energy*.	Appendix 1 Table 3	Type 2

5.14			Overall accuracy for a *metering installation* shall be no greater than 1.5% for *Active 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 act*ive energy*.	Appendix 1 Table 3	Type 4-6
5.16			High *voltage connection point*s 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 meter*ing	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 meter*ing 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 meter*ing may be supplied from secondary circuits used for other purposes.	Clause 3.13(3)(a)	Type 2
5.21			Where the *check meter*ing duplicates the *revenue meter*ing 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 transformer*s must meet the relevant requirements of *AS*60044.1 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 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) Appendix 1 Table 3	Type 1-5

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 *AS*60044.2 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 *supply*ing 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 interval*s within the time agreed with the relevant *retailer*s at a level of availability of at least 99% per annum for *instrument transformer*s.	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 *AS*1284 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 3.1	Type 1 - 6

5.40			If metering class *VT*s and CTs are in-service at the *Code* commencement date whose accuracy does not meet *Code* requirements then *Horizon 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 *Horizon 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 element*s 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 element*s 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 element*s 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 *active 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 *Horizon 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 Table 3	Type 1 - 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 *Horizon 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 *AS*1284 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 *Horizon 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 interval*s 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			*Horizon 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 interval*s 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 *Horizon 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 *Horizon 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 interval*s 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 *Horizon Power* meters must comply with the *National Measurement Act* and in addition: • All new purchased *current transformer*s must comply with *AS*60044.1. • All new purchased *voltage transformer*s must comply with *AS*60044.2. • All new purchased meters must comply with *AS*1284. • 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	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 installation*s 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*	Table 4	

5.87			*Metering equipment* will be tested to the following class accuracy and with less than 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% • 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%	Appendix 1 Table 5	Type 2

			• 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 • Meters - 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* *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:	Appendix 1 Table 6	Type 3

			• 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: • Class 0.5 *CT* 0.1%, 0.5 Crad • Class 1.0 Wh *meter* 0.2/cosΦ% • *General purpose meter* 0.3/cosΦ%	Appendix 1 Table 3	Type 4
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 • Meters - 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	Appendix 1 Table 7	Type 4 - 6

			10% 50% 100% Active 2.0% 1.5% 1.5% • At 0.5 lagging *power factor* *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 CTs 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:		Type 5

			• 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 – 7 years.		
5.104			The accuracy of the *measurement element* is to be in accordance with class 1.5 for *General purpose* watt hour meters as per *AS*1284 or in accordance with class 1.0 as per *AS*1284 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 *AS*1284.13 and *Horizon 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 *AS*1284.13 and *Horizon 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 *metering equipment*		The testing and inspection requirements must be in accordance with *AS* 1284.13 and *Horizon Power*’s *Meter* Compliance Testing and Sampling Plan.		Type 1 - 6
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. *Horizon 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 *Horizon 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 installation*s, 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 installation*s, 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	*Horizon 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 *Horizon 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			*Horizon 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 *Horizon 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 provider*s, who wish to apply for categories of *Registered metering installation provider* accreditation of *metering installation*s, must be able to exhibit, to the reasonable satisfaction of *Horizon 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 *metering installation*s of types 1-5 is required to be validated, in accordance with clause 3.4.1 of this *Metrology Procedure*.

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 installation*s of types 1-5 which have full *check meter*ing

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

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

Where

|x|	means the absolute value of a quantity, *x*
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%

{e.g. *Meter* A has a reading of 107.5 and the associated *check meter* reads 106. An analysis of historical data, systemic errors and the known uncertainties for the meters shows that the maximum acceptable difference is 0.9%. (107.5-106)/107.5 □100 = 1.40% which is greater than the maximum allowable value so the reading will fail *validation*.

However, if we know that there is a *transformer* loss for the *Check meter* of 2% then we need to first determine an adjusted *check meter* reading. This would be 106/0.98 = 108.1. In this case (108.1-107.5)/107.5 □100 = 0.6% which is within the tolerance allowed and the reading would pass *validation*.}

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

|x|	means the absolute value of a quantity, *x*
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) The value must be less than the registered maximum value of Wh, Varh or VAh for the *metering installation data stream*.

d) *Horizon Power* and *user* will agree to either:

1 Check the metered value is greater than the registered minimum value for the *metering installation*, or

2 Check that the number of intervals with zero data is less than a specified number.

e) If an interval has a null value then the reading for that interval will be rejected.

f) If the *meter* has registered significant *meter* alarms over the period since the last successful read, the *energy data* will be rejected. Significant alarms include, but need not be limited to,:

1 Power failure,

2 *VT* or phase failure

3 Pulse overflow

4 CRC error

5 Time tolerance

g) The sum of the interval 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,

|x|	means the absolute value of a quantity, *x*
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 revenue and *check meter* expressed as a percentage

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 installation*s of types 1-5 which have partial *check meter*ing

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

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

Where

|x|	means the absolute value of a quantity, *x*
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%

{e.g. Meter A has a reading of 107.5 and the associated check meter reads 106. An analysis of historical data, systemic errors and the known uncertainties for the meters shows that the maximum acceptable difference is 0.9%. (107.5-106)/107.5 ×100 = 1.40% which is greater than the maximum allowable value so the reading will fail validation.

However, if we know that there is a transformer loss for the Check meter of 2% then we need to first determine an adjusted check meter reading. This would be 106/0.98 = 108.1. In this case (108.1-107.5)/107.5 ×100 = 0.6% which is within the tolerance allowed and the reading would pass validation.}

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

|x|	means the absolute value of a quantity, *x*
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) The value must be less than the registered maximum value of Wh, Varh or VAh for the *metering installation*.

d) *Horizon Power* and *user* will agree to either:

1 Check the metered value is greater than the registered minimum value for the *metering installation*, or

2 Check that the number of intervals with zero data is less than a specified number.

e) If an interval has a null value then the reading for that interval will be rejected.

f) If the *meter* has registered significant *meter* alarms over the period since the last successful read, the *energy data* will be rejected. Significant alarms include, but need not be limited to:

1 Power failure,

2 *VT* or phase failure

3 Pulse overflow

4 CRC error

5 Time tolerance

g) The sum of the interval 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,

|x|	means the absolute value of a quantity, *x*
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 revenue and *check meter* expressed as a percentage

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 installation*s of types 1-5 which do not have *check meter*ing

a) The value must be less than the registered maximum value of Wh, Varh or VAh for the *metering installation*.

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

1 Check the metered value is greater than the registered minimum value for the *metering installation*, or

2 Check that the number of intervals with zero data is less than a specified number.

c) If an interval has a null value then the reading for that interval will be rejected.

d) If the *meter* has registered significant *meter* alarms over the period since the last successful read, the *energy data* will be rejected. Significant alarms include, but need not be limited to:

1 Power failure,
2 *VT* or phase failure
3 Pulse overflow
4 CRC error
5 Time tolerance

e) The sum of the interval 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,

|x|	means the absolute value of a quantity, *x*
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 revenue and *check meter* expressed as a percentage

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

7.1 Requirement to Produce Substituted or Estimated Energy Data

{Note – substitution generally occurs in response to a failure or problem with the *metering installation* or in response to data quality issues whereas estimation generally occurs when there is no physical or data problem but it has not been possible to take a reading for any reason.}

7.1.1 In accordance with clause 3.5.1 of this *Metrology Procedure*, *energy data* for a type 1-5 *metering installation* may be required to be *substitute*d or *estimate*d.

7.2 Requirement to Accumulate Energy Data to Trading Intervals

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

7.3 Network Operator Obligations

7.3.1 When the *energy data* is required to be *substitute*d or *estimate*d *Horizon Power* may use Substitution Types 11, 12, 13, 14, 15, 16, 17 and 18 for *Metering installation*s of Types 1-4 and Substitution Types 51, 52, 53, 54, 55 and 56 for *Metering installation*s of Type 5, all substitution types as defined in section 7.5 and 7.6.

7.3.2 *Horizon Power* must not perform substitutions or estimations for generating plant without prior consultation with the *generator* unless reliable *check meter*ing is available.

7.3.3 *Horizon Power* must not perform substitution of type 16 without the prior agreement of the affected parties.

7.3.4 *Horizon Power* will notify affected *Code Participant*s where *substitute*d *energy data* is used via the status flag in the data file format.

7.3.5 Where one or more of the readings making up the interval data in accordance with clause 3.1.8 has failed *validation* and been *substitute*d, this will be reflected in the status of the interval data reported under 7.3.4 and the status reported will reflect the most serious of the statuses associated with the constituent data.

{Note. Consider where data is collected in 15 minute intervals and aggregated to half hour periods. If one period had a warning status but the data was manually approved while the other 15 minute period failed and was *substitute*d, the entire *trading interval* would be marked as a *substitute*.}

7.3.6 Horizon Power must ensure that for all Substitution Types, *substitute*d *energy data* is based on an Actual *meter* reading, and is not based on *energy data* that has previously been *estimate*d or *substitute*d.

7.3.7 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.

{I.e. if a *meter* is swapped out the process will look at the history for the same *data stream* for the previous *meter* not just the limited data set available that is associated with the replacement *meter*.}

7.4 Accumulation of data to trading intervals

7.4.1 The formulae to use for converting fifteen-minute interval readings to half-hourly interval readings are listed in the following table:

Variable	Formula
HH Consumption	HH Consumption at interval $_{i+1}$ = sum (Consumption at QH interval $_{i}$, Consumption at QH interval $_{i+1}$) { I.e. Sum 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 $\frac{\text{Number of Intervals Per Day}}{48 \text{ HH Intervals Per Day}}$ Where Number of Intervals Per Day = 48 HH intervals per day
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. Sum 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 kVAh QH *Reactive energy* @ 00:30 = 50 kVAh then HH Consumption @ 00:30 = 70 kVAh}
HH *Apparent energy*	HH *Apparent energy* at interval $_{i+1}$ can only be determined when data for HH Consumption and HH *Reactive energy* are present. HH *Apparent energy* in kVAh at interval $_{i+1}$ = $\sqrt{\text{HH Consumption}^2 + \text{HH Reactive Energy}^2}$ 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. *Power factor* = $\frac{\text{HH Consumption in kWh}}{\text{HH Apparent Energy in kVAh}}$ The *Power factor* should be between 0 and 1 inclusive.

7.5 Substitution and Estimation methods for Metering Installation Types 1-4

7.5.1 Substitution Method 11

Interval energy data obtained from another *meter* at the same measurement point for the same interval data periods as that being *substitute*d for may be used for substitution purposes, e.g. installations where revenue and *check meter*s 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; where meters are installed on parallel feeders where *supply* is 'to' and 'from' common buses and line impedances are similar.

7.5.2 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.
{Note: For example if sub meters are available then a value could be determined by summing the readings from the sub-meters.}

7.5.3 Substitution Method 13

Data from an *energy* management system or *SCADA* data may be used for substitution purposes, where the data originates from a similar measurement point as 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). It may be necessary to adjust the data in both magnitude and form in order that the substitution is of an acceptable quality.

7.5.4 Substitution Method 14

Where data substitution methods 11, 12, and 13 cannot be carried out, then *Horizon Power* may *substitute* for 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, in which case 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

7.5.5 Substitution Method 15

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

METHOD 15
The intervals to be *substitute*d 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) where the averaged intervals are simply 'plugged' into the intervals requiring substitution. 2) where the averaged intervals are used to provide the profile for the ones to be 'plugged' to a predetermined number of pulses for the total substitution period. However if data is required to be *substitute*d for a public holiday then the most recent available Sunday will be used.

7.5.6 Substitution Method 16

(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.

(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.

7.5.7 Substitution Method 17

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

7.5.8 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 *Horizon 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 able to be used for quality checks and minor adjustments of an *estimate*d profile such as using *meter* register data.

7.6 Substitution and Estimation methods for Metering Installation Type 5

7.6.1 Substitution Method 51

This method is known as the Previous Years Method. Where data substitution methods 11, 12, and 13 cannot be carried out, then *Horizon Power* may *substitute* for the missing data 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: If no readings are available on the first listed day, then the next listed preferred day is to be used. 1 The substitution day was a public holiday, in which case the most recent Sunday is to be used. 2 The substitution day was not a public holiday and the 'Like Day' is a public holiday, in which case 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.	

7.6.2 Substitution Method 52

This method is known as the Previous *Meter* Reading Method. Where data substitution methods 11, 12, and 13 cannot be carried out, then *Horizon Power* may *substitute* for the missing data 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: If no readings are available on the first listed day, then the next listed preferred day is to be used.	

METHOD 51	
Substitution Day	**“Nearest Equivalent Day” or “Like Day” (in order of availability)**
1 The substitution day was a public holiday, in which case the most recent Sunday is to be used. 2 The substitution day was not a public holiday and the ‘Like Day’ is a public holiday, in which case 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 that in which the substitution day occurs in the previous year.	

7.6.3 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.

(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.

7.6.4 Substitution Method 54

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

7.6.5 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 *Horizon 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 able to be used for quality checks and minor adjustments of an *estimate*d profile such as using *meter* register data.

7.6.6 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 *Horizon Power* and the affected *Code Participant*.

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 clause 3.4.2 of this *Metrology Procedure*. The *validation* rules that may be applied to the *energy data* read from the *meter* of a type 6 *metering installation* are:

(a) *Meter* read value is numeric, and

(b) *Meter* read value is greater than or equal to the minimum value specified for that *meter*; and

(c) *Meter* read 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.

{These checks mainly apply to older styles of mechanical meters. For example:

- A dial capacity check means ensuring that if a *meter* dial has 5 digits then the maximum value recorded against that dial should be 99999 – a larger number should be flagged.
- A roll over check is required where upon successive reads a meter is showing a lower reading. For example consider a hypothetical mechanical meter with four digits. If on the last reading the value was 9995 and on the next reading it is 0010 then the dial is deemed to have "rolled over". The correct interpretation is that consumption is 10 + 10000 – 9995, or 15, units. On the other hand if the last reading was 0010 and this reading is 0009 then something is wrong since it is highly unlikely that the connection point consumed 9999 units since it was last read. It is more likely that the reading was wrong (perhaps the last two digits were swapped around when it was recorded) or the meter is faulty.
- A decimal point check means checking that the reading has the correct number of digits after the decimal point for the dial. For example if a dial has 4 digits and the last digit denotes tenths of a unit then the reading should be in the range 000.0 to 999.9. If the reading is recorded as 12.34 then it needs to be flagged up and checked –(e.g. should it really be 123.4). }

8.2 Requirement to Produce Substituted or Estimated Energy Data

{Note – substitution generally occurs in response to a failure or problem with the *metering installation* or in response to data quality issues whereas estimation generally occurs when there is no physical or data problem but it has not been possible to take a reading for any reason.}

8.2.1 In accordance with clause 3.5.2 of this *Metrology Procedure*, *energy data* for a type 6 *metering installation* may be required to be substituted or *estimate*d.

8.3 Network Operator Obligations

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

8.3.2 *Horizon Power* will notify affected *Code Participant*s where *substitute*d *energy data* is used via the status flag in the data file format.

8.3.3 *Horizon Power* must ensure that for all Substitution Types, *substitute*d *energy data* is based on an Actual *meter* reading, and is not based on *energy data* that has previously been *estimate*d or *substitute*d.

8.3.4 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.

{I.e. if a *meter* is swapped out the process will look at the history for the same *data stream* for the previous *meter* not just the limited data set available that is associated with the replacement *meter*.}

8.4 Substitution and Estimation methods

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 *substitute*d

8.4.2 Substitution/Estimation method 62 – Previous Meter Reading Method

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

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

8.4.3 Substitution/Estimation method 63 – Customer Class Method

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

(b) Substitution Type 63 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) Customer classes for Substitution Type 63 are

i. Residential,
ii. Non-Residential,
iii. Farm, and
iv. Public Lighting.

(d) The usage types for Substitution type 63 are:

i. peak, or
ii. off-peak, or
iii. as appropriate to the metering configuration.

8.4.4 Substitution/Estimation method 64 – Agreed Method

a) The *Code Participant*, the applicable *user* and *Horizon 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 is applicable.

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

8.4.5 Substitution/Estimation method 65 – Estimation by *Average daily consumption*

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

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.

9 Metering Installation Type 7 – Energy Calculation

9.1 Requirement to Produce Energy Data

9.1.1 Agreed market loads

a) Type 7 meters are associated with un-metered loads, as defined in article 3.9(2) of the Metering *Code*.

b) The metrology coordinator and *IMO* may, from time to time, agree to classify other types of *load* as unmetered, where, in their opinion, the *load* is similar in nature to the existing unmetered loads.

c) As a guide, a similar *load* is likely to be one that is uneconomic to *meter* individually

{e.g. the cost of type 6 metering is not much less than the likely cost of *electricity* consumed over the *meter* lifetime} and where it is not practical to *meter* the consumption points at an economically viable aggregate level {e.g. it is not possible to connect all consumption points in the *load* behind a single *meter* to give a larger aggregate reading at an economical level}.

9.1.2 Application to device types

a) The agreed *market load* that is published by the metrology Coordinator will be generic in nature (for example, street lighting). For each agreed *market load* there may be one or more device types which are listed in the Load Table developed in accordance with clause 9.1.6 of this *Metrology Procedure*.

9.1.3 Application of *NMI*

a) *Energy data* for an unmetered *load* is calculated by *NMI data stream*. A *NMI* is assigned for each unique combination of:

- Financially Responsible *Code Participant*,
- End-use customer,
- LNSP,
- TNI, and
- Distribution loss factor.

The *NMI* may contain different agreed *market* loads and/or different device types, but they must have the same Financially Responsible *Code Participant*, end-use customer, LNSP, TNI and Distribution loss factor.

b) Where permitted by the *Code* or guidelines issued by the *IMO*, an unmetered *load* may be included in the *NMI* for a related metered *load*, where the number of devices is small, for example watchman lights, the *energy* consumption of those devices is immaterial relative to the total *energy* consumption for that *NMI*, and the Financially Responsible *Code Participant*, end-use customer, LNSP, Marginal loss factor and Distribution loss factor are the same.

9.1.4 Inventory Table

a) *Horizon Power* and *Customer* must agree and maintain the following inventory information for each *load* type for each *NMI*:

1 The device type.

2 The start date, being the first date on which this device type is to be included in the *energy data* calculations.

3 The end date, being the last date upon which the device type is to be included in the *energy data* calculations.

4 The proportion of the *load* that is attributable to the *NMI*. The total proportion attributable to all *NMI*s must equal 100%.

5 The number of devices of this type. This may vary with time and a complete history of the applicable numbers must be maintained for a seven-year period.

6 The *Responsible person* must use its reasonable endeavours to update the inventory for the *NMI*s for which it is responsible and must communicate any material changes to the affected *Code Participant*s.

7 The relevant time *Code* (on-off) table.

8 The applicable loss factor, either directly or through an associated characteristic (such as the distribution zone). This defines the efficiency with which power is transported to the point of consumption.

9 The maximum daily *energy* reading for *validation* purposes.

10 The minimum daily *energy* reading for *validation* purposes (which may be zero).

11 Optionally, where *trading interval* data is required, the number of *trading interval*s in the day for which a zero value is acceptable.

b) The information must be agreed prior to the installation of any new *load* and must be regularly reviewed and maintained in line with good industry practice.

9.1.5 Time *Code* table

a) *Horizon Power*, *retailer* and *Customer* must agree and maintain the on-off times for each specific *load* type.

b) These will be one of the following:

1 The number of hours in the day during which the *load* is on.

2 The number of off-peak hours in the day during which the *load* is on and the number of peak hours in the day during which the *load* is on.

3 A *load* profile indicating whether the *load* is on or off in each *trading interval*.

c) The on-off times will be allowed to vary with time. I.e. the times on for a particular period - such as day, week, month, quarter or year - may differ in succeeding periods.

d) The information must be agreed prior to the installation of any new *load* and regularly reviewed and maintained in line with good industry practice.

{Note: for example, a *load* might be defined as follows:

Dec – Feb:	10 hours per day
Mar – May:	12 hours per day
June – Aug:	14 hours per day
Sep – Nov:	12 hours per day

While another might be defined as:

	Interval Status										
	0:00	*0:30*	*1:00*	*1:30*	*2:00*	*2:30*	*3:00*	*3:30*	*4:00*	*4:30*	*etc.*
Jan	1	1	1	1	1	1	1	1	1	1	*etc.*
Feb	0	0	0	1	1	1	1	1	1	1	
Mar	0	0	0	0	0	1	1	1	1	1	
Apr	0	0	0	0	0	0	0	0	1	1	
May	0	0	0	0	0	0	1	1	1	1	
etc.	*etc.*										

Where 1 indicates the device is on and 0 indicates it is off.}

9.1.6 Load Table

a) The *load* table will record the calculated device wattage. This is the agreed *average daily consumption* for the device together with any control gear.

b) The *load* rating should represent the average anticipated power rating in the applicable time period. Where possible the device *load* should be determined from measurement tests conducted by a suitable accredited laboratory.

c) The information must be agreed prior to the installation of any new *load* and regularly reviewed and maintained in line with good industry practice.

9.2 Type 7 Energy Calculation

9.2.1 The default method of calculation is based upon a calculation from the inventory parameters, *load* table and on-off table.

$$C_{NMI,i,\tau} = \frac{(k \times n \times h \times P \times L)}{1000}$$

and

$$C_{NMI,\tau} = \sum C_{NMI,i,\tau}$$

Where:

$C_{NMI,i}$	is the consumption, in *energy units*, for an *NMI* for a device type, *i*, for a period, τ.
C_{NMI}	is the consumption, in *energy units*, for an *NMI* across all device types, for a period, τ.
k	is the proportion of the device *load* attributable to the *NMI*.
n	is the number of devices of the applicable type for the *NMI*.
h	is the number of hours in the period during which the device is switched on. For the avoidance of doubt, this does not have to be an integer number – fractions of hours are permitted.
P	is the average power consumption for the device, expressed in Watts.
L	is the applicable loss factor.
τ	is the applicable period, for example *trading interval*, day, peak period, off-peak period, shoulder period, etc.

9.2.2 Where half hourly consumption data is required, this shall be calculated as either:

a) Where no interval "on-off" data is available, consumption in each interval shall be the calculated power consumption for the day divided by the number of *trading interval*s in the day.

Or,

b) Where hours on in peak/off peak/shoulder periods is available then:

1 For every interval in the off-peak period, the consumption shall be the power consumption for the off-peak period divided by the number of *trading interval*s in the off-peak period.

2 For every interval in the peak period, the consumption shall be the power consumption for the peak period divided by the number of *trading interval*s in the peak period.

3 For every interval in the shoulder period, the consumption shall be the power consumption for the shoulder period divided by the number of *trading interval*s in the shoulder period.

Or,

c) Where interval "on-off" data is available:

1 For every *trading interval* marked as "off" the consumption shall be zero.

2 For every *trading interval* marked as "on" the consumption shall be the total daily consumption divided by the number of "on"-intervals in the day.

{Note: this is equivalent to calculating the interval consumption from first principles using the calculation method in 17.2.1 above.

For example, consider that we require a reading for the period 1 Feb to 30 Apr for the hypothetical load described below:

Rating	*150W*
Inventory	*1000*
Loss Factor	*0.97*
Proportion	*1*
Period	*On-time*
1 Dec	*20:00 to 05:00*
1 Mar	*19:00 to 06:00*
1 Jun	*18:00 to 07:00*
1 Sep	*19:00 to 06:00*

This would be calculated as follows:

Period	*Applicable On-time*	*Consumption*
1 Feb to 28 Feb	*28 days at 9 hours/day*	= *1 × 1000 × 9 × 150 × 0.97 Wh/day* = *1309.5 kWh/day* = *72.75 kWh for each half hour trading interval for which the load is on* = *36.666 MWh in total*
1 Mar to 30 Apr	*61 days at 11 hours per day*	= *1 × 1000× 11 × 150 × 0.97 per day* = *1600.5 kWh/day* = *72.75 kWh for each half hour trading interval for which the load is on* = *97.6305 MWh in total*
Grand total for period from 1 Feb to 30 Apr	*923 hours*	= *134.2965 MWh for the period as a whole.*

End of example}

10 Metering Installation Type 7 – Validation and Substitution

10.1 Requirement to Perform Validation

10.1.1 *Energy data* calculations are required to be validated in accordance with clause 3.6.2 of this *Metrology Procedure*.

10.1.2 The *validation* rules that may be applied to the *energy data* calculated for a Type 7 *metering installation* are:

a) Check against maximum permitted value

The calculated value will be automatically checked after calculation and if the maximum value is exceeded substitution will be performed.

b) Check for null (missing) *energy data*

A check for null (missing) *energy data* will be performed for each type 7 *NMI data stream* for an individual day and, where necessary, for each *trading interval*. Any null values will be *substitute*d.

c) Check of *standing data*

Check the Inventory tables, Load tables and On/Off tables to ensure that the correct version of the tables are being used for the *energy data* calculations. *Horizon Power* will perform such checks periodically in accordance with good industry practice. The results of these audits of the tables will be circulated to the relevant parties. The interval between checks will not exceed six months. If an error is detected then substitution will be performed on all *energy data* for affected type data since the time of the last check.

{Note: It will be sufficient to manually calculate the *substitute*d values at the aggregate level for periods for which billing has already occurred. This will then allow the error in the billing to be determined without placing an onerous burden on *Horizon Power* or Retail staff. E.g. if the error has been in place for six months it would be sufficient to determine the consumption for the six month period. This could then be compared to the previous calculated consumption and the necessary billing corrections performed.}

d) Check against minimum permitted value

Check against a nominated minimum value or alternatively a 'zero' check that tests for an acceptable number of zero interval values per day.

i. If no *trading interval* data is required, then if the calculated daily consumption is less than the minimum specified consumption, the value will be rejected and substitution performed.

ii. If *trading interval* data is required, then if the consumption in any *trading interval* is less than the minimum specified consumption, or if the total number of *trading interval*s with a reading of zero exceeds the allowed number, then the values for the day and all *trading interval*s will be rejected and substitution performed.

e) Check that the *energy data* date > previous *energy data* date. If the *energy data* date is earlier than the last received *energy data* date then the value is rejected and substitution will occur.

10.2 Requirement to Perform Substitution

10.2.1 In accordance with clause 3.5.3 of this *Metrology Procedure*, *energy data* for a type 7 *metering installation* will require to be *substitute*d where the *energy data* calculation fails the *validation* tests.

10.2.2 The approved substitution types are

a) Method 71 – recalculation

The preferred substitution method consists of the recalculation of the *energy* consumption using the latest time-*Code*, *load* and inventory tables and the formulae defined in clause 9.2, Type 7 Energy Calculation.

b) Method 72 – revised tables

Where the value derived in clause 9.2, Type 7 Energy Calculation

is found to be incorrect due to an error in the inventory, time-*Code* or *load* tables, the value will be *substitute*d with the value derived as per method 71 but utilizing the most recent tables for which no error is evident.

c) Method 73 – revised algorithm

Where the error in the calculation of the *energy data* in clause 9.2, Type 7 Energy Calculation

, is due to an error in the algorithm, the *energy data* is *substitute*d with the most recent *energy data* for which there was no error.

Thus, if we are calculating the consumption for a period and it is determined that the algorithm is being applied incorrectly then the calculated value for the last undisputed period will be determined. This will then, if necessary, be pro-rationed by the duration of the periods to determine the applicable *substitute*d value.

{For example, consider a load for which we are calculating the load for the months of April-May. It is determined that the algorithm is in error and the last period calculated without error was February-March. If the consumption value for 31 March had been available and was 3.7 kWh then the calculation would have been:

Reading on 31 March	*= 3.7 kWh*
Days in April-May	*= 61 days*
Substituted consumption for each day in April May	*= 3.7 kWh*
Substituted value for entire period	*= 61 × 3.7 = 225.7 kWh*

Alternatively, if we do not have daily or interval data but the aggregate consumption was 220 kWh. We could calculate the consumption as:

Days in April-May	*= 61 days*
Days in February March	*= 59 days*
Substituted value	*= (61/59) × 220 = 227.46 kWh*
Substituted value for each day in April May	*= 227.46/61 = 3.7289 kWh*

End of example}

d) Substitution Method 74: Agreed Method.

The *Code Participant*, the applicable *user* and *Horizon Power* may agree to use another method of substitution (which may be a modification of an existing substitution method) where none of the existing substitution methods is applicable.

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

11 Metering Alarms

11.1 Validation of interval metering data alarms for Metering Installation Types 1 - 5

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

- Power Outage/Failure.
- Alarm/Error – i.e *VT* or phase failure.
- Overflow of Channel Data (Pulse over flow).
- CRC Error/*Checksum* error.
- Time Reset (Time Tolerance).

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

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

c) *Horizon 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, *Horizon Power* may provide replacement data in alignment with the *Code* and *good electricity industry practice* and with this *Metrology Procedure*.

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

11.2 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 – Meter Compliance Testing and Sampling Plan

Meter Compliance Testing and Sampling Plan

First issue: xx month year

Horizon Power ABN 579 550 11697

Table of contents

1 Introduction

1.1 Purpose

The purpose of the plan is to provide guidelines and information to *Horizon Power* personnel about the sampling and testing methodologies used to determine whether meters on the *Horizon Power Network*s 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 installation*s) of the Electricity Industry (Metering) *Code* 2012 (*Code*) requires *Horizon Power* to ensure the *revenue meter*s are sampled and tested for accuracy in accordance with *AS*1284.13.

1.3 Provisions in the Metrology Procedure

Section 2.3.1 of the Metrology Procedure for *Metering installation*s on the *Horizon Power Network*s specifies the requirement to sample and test the meters in accordance with *AS*1284.13 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 *AS*1284.13. 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 *AS*1284.13, 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 *Horizon Power* to identify the appropriate meter accuracy class against which the population is assessed.

Horizon 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 *Horizon Power*'s Metering System.

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

- Meter type.
- Meter number.
- *National Metering Identifier*.
- Location/address.
- Date installed .

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 *Horizon Power*, 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, *Horizon Power* may arrange meters in sub-populations according to any of the characteristics in accordance with *AS*1284.13.

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

Note: installation dates prior to the introduction of Horizon Powers Meter Data Management System (MData21) in 2011 have been transferred into Horizon Power from the Western Power metering database.

4 Determination of sample size

In accordance with *AS*1284.13, 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

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

Table 1 Sample sizes

4.1 Random selection of sample

In accordance with *AS*1284.13 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 *Horizon Power*'s Information and 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 *AS*1284.13, *Horizon 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.

Horizon Power adheres to the appropriate testing sequence as outlined within *AS*1284.13 for each testing method.

6 Sample Testing

In accordance with *AS*1284.13, meters are tested either on site, or in the *Horizon 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 installation*s on the *Horizon Power Network*s. Approximately 1% of the sample size may be removed for additional testing in the *Horizon Power* laboratory.

Horizon 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 *Horizon Power*'s Inspectorate 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 *current*s.

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 *AS*1284.13 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

Horizon Power will test the anti-creep function on induction meters using the most appropriate method as outlined in *AS*1284.13, 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 *AS*1284.13, *Horizon 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, *Horizon 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 *AS*1284.13, 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 *AS*1284.13 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. *Horizon 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 *AS*1284.13, the population from which the sample was taken may be redefined into an alternate population, or sub population in accordance with *AS*1284.13.

Where the sample was tested for accuracy using attributes, in accordance with *AS*1284.13, the variables method of testing for accuracy may be employed. Conversely, where the sample was tested for accuracy using variables, in accordance with *AS*1284.13, 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 *AS*1284.13, 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.

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 *AS*1284.13, has resulted in the population not achieving the required pass levels in accordance with *AS*1284.13, *Horizon Power* may deem that the population has failed.

If *Horizon 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, *Horizon 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 *AS*1284.13, *Horizon Power* will ensure it complies with the *Code* requirements when removing or replacing any failed meter population.

Additionally, when *Horizon 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*

12 Provision of Testing Services

Horizon Power may seek to outsource part or all of the services required to meet the requirements of this “Meter Compliance Testing and Sampling Plan” to a National Association of Testing Authorities, Australia (NATA) qualified laboratory or third party.