WHOLESALE MARKET METERING PROCEDURES (VICTORIA)

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Approved for distribution and use by:

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Current version release details

Version	Effective date	Summary of changes
2.0	1 May 2024	Update to the Procedure to account for: 1. AEMC's Review into extending the regulatory frameworks to hydrogen and renewable gases rule change which is effective from 1 May 2024. 2. AEMC's DWGM distribution connected facilities rule change which is effective from 1 May 2024. 3. Minister's request for the application of a zonal heating value to replace the statewide heating value. 4. Update to auto subs process, outlined in section 8.4, to implement the Calculated substitution. 5. Minor editorial amendments.

Note: There is a full version history at the end of this document.

1. Introduction

1.1. Purpose and scope

These are the Wholesale Market Metering Procedures (Victoria) (**Procedures**) made in accordance with section 91BL of the National Gas Law (NGL) and Rules 292A, 297, 303(6), 308(4), 309(3), 311(4), 314(2) of the National Gas Rules (NGR).

The NGL and the NGR prevail over these Procedures to the extent of any inconsistency.

These Procedures may only be amended in accordance with Part 15B of the NGR.

These ~~purpose of these~~ Procedures ~~is to govern~~include:

(a) *metering uncertainty limits and calibration requirements procedures* ~~relating to~~:

(i) the uncertainty limits and calibration requirements for *metering installations* in the DTS.

~~(a)~~(ii) the uncertainty limits allowed for heating values of all *metering installations* in the *market*.

(b) *energy calculation procedures*:

(i) specifying the industry standards to be used to calculate the energy content of gas flowing through a *metering point*.

(ii) pursuant to which A~~-~~EMO and affected Participants are to calculate energy content for *meters* and *metering installations* at *distribution delivery points*.

(c) *metering communications procedures* relating to:

~~(b)~~(i) the transfer of energy data from *metering installations* to the *metering database*.

(d) ~~*i*~~*installation database procedures* setting out:

~~(c)~~(i) the data required to be held in the *metering installation database*.

(e) *metering installation coordination procedures* providing for:

~~(d)~~(i) the obligations of the *responsible person* with respect to matters relating to *metering installations* for *settlement metering points*.

(f) *metering register procedures*~~.~~ relating to:

~~(e)~~(i) the purpose of, and the information to be included in, the metering register.

(g) *data validation procedures* setting out:~~.~~

~~(f)~~(i) the data validation process that is used at *metering installations* for *settlement metering points*, daily meters and gas quality monitoring equipment.

AEMO notes that these Wholesale Market Metering Procedures have been updated to incorporate *primary gases* (e.g. hydrogen).

Registered participants should be aware that as Australian Standards or International Standards are updated or amended, these Procedures may require changes to reflect the updated and amended Standards.

AEMO has made reasonable endeavours to take into consideration potential changes to Australian Standards based on information provided from industry and the Future Fuels CRC. However, AEMO cannot guarantee that if Standards are changed and they are required to be reflected within these Procedures, that metering configurations will not also need to change over time to reflect the updated Standards.

Therefore, this document does not constitute legal or business advice, and should not be relied on as a substitute for obtaining detailed advice about the National Gas Law, the National Gas Rules, or any other applicable laws, procedures, policies or standards. AEMO has made every effort to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of these Procedures:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representation in this document, or any omissions from it, or for any use or reliance on the information in it.

1.2. Application

These Procedures apply to AEMO and each person to whom they are expressed to apply.

1.3. Legal and regulatory framework

These Procedures have been made under section 91BL of the National Gas Law.

AEMO is required to have these~~is~~ Procedures to meet the requirements of:

(a) *metering uncertainty limits and calibration requirements procedures* made under rule 297 of the NGR.

(b) *energy calculation procedures* made under rule 303 (6) of the NGR.

(c) *metering communications procedures* made under rule 308 (4) of the NGR.

(d) *installation database procedures* made under rule 309 (3) of the NGR.

(e) *metering installation coordination procedures* made under rule 292A of the NGR.

(f) *metering register procedures* made under rule 311 (4) of the NGR.

(g) *data validation procedures* made under rule 314 (2) of the NGR.

Rule 303(7) requires AEMO to publish the amended *energy calculation procedures* not less than 60 business days before the amendments take effect, unlike amendments to the other amended *Wholesale Market Procedures* which must be published by AEMO at least 15 business days before the day on which the amended Procedures are to take effect.

1.4. Definitions and interpretation

1.4.1. Glossary

Terms defined in the NGL and the NGR have the same meanings in these Procedures unless otherwise specified in this clause.

Terms defined in the NGL and NGR are intended to be identified in these Procedures by italicising them, but failure to italicise a defined term does not affect its meaning.

The words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Procedures.

Table 1 Glossary of Terms

Term	Definition
Actual flow	The volume flow at the pressure and temperature existing in the *meter* (sometimes referred to as the *uncorrected flow*)
~~Connection Point~~	~~A delivery point, a transfer point or a receipt point~~
Corrected Flow	The volume flow as it would be at the reference or base pressure and temperature (101.325 kPa and 15°C).
CTM or Custody Transfer Meter	Custody Transfer Meters (CTMs) are the *metering installations* at *settlement metering points*. AEMO may include logical meters as CTMs where required by these Procedures. AEMO provides a list of CTMs in the MIBB report CTM to Heating Value Zones. ~~Custody Transfer Metering (CTM) facility that includes the metering equipment, RTU, and associated field data processing systems. Specifically in the context of this document it is a metering installation at a transmission delivery point, a transfer point or a receipt point~~
~~DDN~~	~~Digital Data Network (Leased line)~~
~~Distribution Delivery Point~~	~~A point on a distribution pipeline at which gas is delivered to a Customer or injected into a storage facility~~
declared metering requirement	*declared metering requirement*, as defined in Part 19 of the Rules, is required by the National Gas (Victoria) Act.
~~D~~daily meter or DM~~M~~	Daily Meter (DM) ~~(~~is a~~volume or energy~~a *data logger* *meter* which is ~~a). Specifically in the context of this document, it is~~ a *metering installation* at a *distribution delivery point* ~~as required for market settlement~~.
DDS	*declared distribution system* as defined in Part 19 of the Rules. [Note only declared distribution systems that are directly connected to the DTS are covered by Part 19]
DTS	~~The~~ *declared transmission system*~~, also referred to as the gas transmission system.~~
DTS SP	*declared transmission system service provider*
DWGM	Declared Wholesale Gas Market in Victoria
~~Gas Chromatograph or GC~~	~~An instrument that is part of a *gas quality monitoring system* used for to measure and determineing *gas composition data* and calculateing the *gas heating value* of gas.~~
gas composition data or GCD	Gas composition data (GCD) is determined by each *gas quality monitoring system* and calculated for each heating value zone using the heating value allocation model.
heating value or HV	Heating value – the Higher Volume Heating Value is used at *metering installations* to convert a *gas* flow to energy content. The heating value is determined by AEMO following the process in clause 3.4 of *energy calculation procedures*
heating value allocation model	Heating value allocation model is described in conjunction with heating value zones and is used to determine the heating value and gas composition data at each heating value zone. As described in clause 3.4 of this Procedure.
heating value zone or HVZ	heating value zone (HVZ) which is determined in clause 3.4.1 of the *energy calculation procedures*.
Julian time	Time based on Julian calendar as a numbered sequence.
maximum physical capacity	The maximum energy or volume flow that can physically flow through a *meter* with the available pressure and without damage to the *meter*.
maximum valid capacity	The maximum energy or volume flow through a *meter* that can be considered to be a real (valid) reading.
~~MCE~~	~~Market Clearing Engine~~
MDA	Metering Data Agent (MDA) is an agent appointed by AEMO to create, maintain and administer the *metering database* according to rule 310 (2)

Term	Definition
MDA application	Meter Data Agent application is ~~. The~~ AEMO software that handles the automatic validation and~~,~~ substitution ~~and application of~~of *metering data* supplied by CTMs and *gas quality monitoring systems* (including composition data and heating value ~~and Heating Value~~ data).
~~Metering Database~~	~~The metering database kept by AEMO pursuant to rule 310 of the NGR~~
~~Metering Installation~~	~~The meter and associated equipment and installations installed as required under Part 19 Division 3 Subdivision 4 of the NGR for connection points~~
MIBB	AEMO's Market Information Bulletin Board.
NGL or Law	National Gas Law
NGR or Rules	National Gas Rules
~~Poll Frequency~~	~~The frequency at which the SCADA host requests information~~
~~PSTN~~	~~Public Switched Telephone Network~~
~~Responsible Person~~	~~The person or organisation responsible for providing the metering installation under the NGR (see rule 292).~~
RTU	Remote Terminal~~/~~ or Telemetry Unit (RTU) is usually associated with ~~. (Usually, when associated with~~ a *metering installation*~~,~~ (~~where~~ the greater part of flow and energy calculations are carried out) or a *gas quality monitoring system*.
SCADA	Supervisory Control And Data Acquisition (SCADA) – the systems used (among other things) to collect data from *gas quality monitoring systems* ~~GCs~~ and CTMs and send data to CTMs
~~Settlement~~	~~The determination of trading imbalances, trading amounts and settlement amounts in respect of Market Participants who trade in the market, as defined in the NGR.~~
~~System Injection Point~~	~~A connection point on the declared transmission system designed to permit gas to flow through a single pipe into the declared transmission system, which may also be, in the case of a transfer point, a system withdrawal point.~~
~~System Withdrawal Point~~	~~A connection point on the declared transmission system designed to permit gas to flow through a single pipe out of the declared transmission system, which may also be, in the case of a transfer point, a system injection point.~~
uncorrected flow	See "*Actual flow*"
uncertainty	A number that quantifies the precision of a measurement, the smaller the uncertainty the more precise the measurement.

1.4.2. Interpretation

The following principles of interpretation apply to these Procedures unless otherwise expressly indicated:

(a) These Procedures are subject to the principles of interpretation set out in Schedule 2 of the National Gas Law.

(b) References to time are references to Australian Eastern Standard Time.

(c) Rounding is carried out in accordance with AS 2706–2003.

1.5. Related documents

The following documents support this Procedure.

Table 2 Related Procedures

Reference	Title	Location
Retail Market Procedures	Retail Market Procedure (Victoria)	https://www.aemo.com.au/energy-systems/gas/gas-retail-markets/procedures-policies-and-guides/victoria
Connection Approval Procedures	Wholesale Market Connection Approval Procedures (Victoria)	https://www.aemo.com.au/energy-systems/gas/declared-wholesale-gas-market-dwgm/procedures-policies-and-guides
Gas Quality Monitoring Procedures	Wholesale Market Gas Quality Monitoring Procedures (Victoria)	
Maintenance Planning Procedure	Wholesale Market Maintenance Planning Procedures (Victoria)	
Market Operations Procedures	Wholesale Market Operations Procedures (Victoria)	
System Security Procedures	Wholesale Market System Security Procedures (Victoria)	

1.6. Technical documents

The following technical documents support this Procedure.

Table 3 Related Technical Documents

Reference	Title	Location
CTM Data Requirements	Gas Metering – CTM Data Requirements	AEMO website
~~DM Data Requirements~~	~~Gas Metering – DM Data Requirements~~	~~AEMO website~~
Pressure Correction Factors	AEMO's Pressure Correction Factors	AEMO website

2. Metering uncertainty limits and calibration requirements procedure

2.1. Introduction

Under rule 299(2) each *metering installation* must be calibrated in accordance with the requirements in these *metering uncertainty and calibration requirements procedures*. The uncertainty limits are consistent with limits in literature and were chosen to ensure that commercially available *meters* are capable of meeting ~~them~~ if they are calibrated at the intervals set out in section 2.4.4.

2.2. Scope

~~The procedures in this chapter are made under rule 297 of the NGR. They apply to all metering installations where gas is injected into or withdrawn from the DTS and apply to responsible persons in the DWGM.~~

These *metering uncertainty and calibration requirements* procedures in this chapter are made under rule 297 of the NGR.

In relation to uncertainty limits, the requirements are determined by rule 298(1) as applying to a transmission delivery point.

In relation to calibration, required by rule 299(1), these *metering uncertainty limits and calibration requirements procedures* apply to *metering installations* at *settlement metering points*.

~~2.2.~~2.3. Uncertainty limits for measuring volume

2.3.1. Overview of metering uncertainty limits

This overview is provided for guidance only and does not for part of these Procedures.

In general, uncertainty associated with measuring volume at *metering installations* is required to be within the acceptable limits to ensure compliance with regulatory requirements, to limit fiscal risk, and to help manage unaccounted for *gas*.

Measurement uncertainty is a non-negative parameter, associated with the results of a measurement, that characterises the dispersion of the values that could reasonably be attributed to the measurement. Uncertainty should not be confused with accuracy of measurement which is the closeness between a measured value and a true value of a measurement.

2.3.2. Industry standard for metering uncertainty limits

AEMO has used the following industry standards to inform the *metering* uncertainty limits for *metering installations*.

Table 4 Industry standards to calculate the energy content of gas

Standard No.	Title/Description
ISO 5168	Measurement of fluid flow Procedures for the evaluation of uncertainties
ISO/IEC GUIDE 98-1	Uncertainty of measurement Part 1: Introduction to the expression of uncertainty in measurement
ISO/IEC GUIDE 98-3	Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement

Uncertainty analysis is completed based on the general methodology recommended in the Guide to the expression of Uncertainty in Measurement (GUM). This methodology is generally consistent with the study objective to complete an ISO 5168 overall uncertainty analysis, noting that ISO 5186 is applicable to differential flow *meters* and defers to the GUM as the authoritative document where ISO 5168 does not provide enough depth or detail.

2.3.3. Metering uncertainty limits for *metering installations*

~~The table below sets out the uncertainty limits required to be met by the *responsible person* for *metering installations* for *transfer points* on the DTS.~~

The tables below set out the acceptable uncertainty limits of measurement required to be met by the *responsible person* for *metering installations* at *transmission delivery points*.

The *metering* uncertainty limits detailed in Table 5 apply to *metering installations* used for the measurement of:

- natural gas;
- natural gas including up to 10 mol% hydrogen blends; and
- non-hydrogen-based fuels (biogas, biomethane, and synthetic methane); provided that the impurities and their levels are compatible with latest revision of AS 4564.

Table 5 Uncertainty limits for measuring volume (gas primarily composed of methane (e.g. natural gas and biomethane) along with gas blended with hydrogen (up to 10 mol%))

Category	Flow rate range (standard cubic metres per hour)	Uncertainty limits (volume)
A	>300,000	±0.7%
B	>40,000 and ≤ 300,000	±1.0%
C	>4,000 and ≤40,000	±1.5%
D	≤4,000	±2.5%

~~**Table 4**~~

~~Category~~	~~Flow rate range (standard cubic metres per hour)~~	~~Uncertainty limits (volume)~~
~~A~~	~~>300,000~~	~~±0.7%~~
~~B~~	~~>40,000 and ≤ 300,000~~	~~±1.0%~~
~~C~~	~~>4,000 and ≤40,000~~	~~±1.5%~~
~~D~~	~~≤4,000~~	~~±2.5%~~

The *metering* uncertainty limits detailed in Table 6 apply to *metering installations* used for the measurement of pure hydrogen. The hydrogen specified here is expected to be blended with natural gas within a *DDS*.

Table 6 Uncertainty limits for measuring volume (pure hydrogen)[1]

Category	Flow rate range (standard cubic metres per hour)	Uncertainty limits (volume)[2]
C	>400 and ≤4,000	±2.25%
D	≤400	±2.5%

These uncertainty limits for measuring volume remains valid for velocities below 4 m/s.

2.4. Metering installation calibration requirements

2.4.1. Overview of metering installation calibration requirements

This overview is provided for guidance only and does not for part of these Procedures.

Any *metering installation* including relevant instruments can change and fall out of calibration over time, which will cause measurement errors.

The *responsible person* must procure that its *metering installations* at *settlement metering points* meet the calibration uncertainty requirements and be recalibrated regularly to ensure precise measurement of *gas* as per their specifications and to mitigate the risk of an inaccurate measurement.

2.4.2. Requirements for the calibration procedure

(a) For the purpose of rule 299(4), the calibration procedures that must be established by a *responsible person* under rule 299(4) (Calibration Procedures) must specify:

(i) how the *responsible person* will ensure the *metering installations* meet the minimum calibration requirement in Table 7.

(ii) requirements for reporting metering installation calibrations to AEMO in section 2.4.3.

(iii) the process for a *Registered participant* to request a metering calibration of a *metering installation* as required by rule 299(12).

(iv) the process for cost recovery as allowed by rule 299(13).

(b) The *responsible person* must send a copy of its Calibration Procedures to AEMO by email to AEMO's Support Hub:

(i) by 3 months from the effective date of these Procedures; or

(ii) within 20 business days of any change being made to the Calibration Procedures.

(c) AEMO will review the Calibration Procedures submitted to it within 20 business days of receiving the Procedures, submitted under (b) above, and notify the *responsible person*

[1] As per the Wholesale Market Gas Quality Monitoring Procedures, the expected minimum purity of hydrogen is to be 98%.

[2] Calculated using a hydrogen purity of 98%.

of the result in writing; ~~If the Calibration Procedures, submitted under (b) above, do not meet the requirements in these Procedures, AEMO will notify the participant in writing.~~

(d) If AEMO determines the Calibration Procedures do not meet the requirements of these Procedures, ~~T~~the *responsible person* must resubmit the ~~Calibration~~ Procedures to AEMO within 20 business days of the notice, or such other date as agreed with AEMO.

(e) AEMO will review the Calibration Procedures submitted to it within 20 business days of receiving the Procedures, submitted under (d) above, and notify the *responsible person* of the result in writing.

(f) If AEMO determines the Calibration Procedures, submitted under (d), do not meet the requirements of these~~is p~~Procedures, AEMO may inform the AER.

2.4.3. Requirements for reporting metering installation calibration results

The requirements for reporting metering installation calibration results are defined in rule 293(5) and rule 293(6).

2.4.4. Calibration interval for a metering installation

~~The table below sets out the frequency with which the calibration must be carried out by the responsible person. Each time a calibration on a DWGM CTM is conducted, the results must be sent to AEMO.~~

The table below sets out the minimum frequency with which the calibration must be carried out by the *responsible person* on a *metering installation* at a *settlement metering point*.

Table 7 Calibration Requirements

Category	A	B	C	D
Peak flow rate (standard cubic metres per hour)	≥300,000	≥40,000 ≤300,000	≥4,000 ≤40,000	≤4,000
Minimum pressure and temperature transmitter calibration frequency	Quarterly	Six-monthly	Annually	Annually or as otherwise agreed with AEMO
Remote meter fault detection surveillance frequency	Daily by exception	Daily by exception	Daily by exception	Daily by exception
In situ meter proving frequency	Annually Note: for ultrasonic meters by electronic means	Annually Note: for ultrasonic meters by electronic means	Annually or as otherwise agreed with AEMO Note: for ultrasonic meters by electronic means	Annually or as otherwise agreed with AEMO

~~Table 5~~

~~Category~~	~~A~~	~~B~~	~~C~~	~~D~~
~~Peak flow rate (standard cubic metres per hour)~~	~~>300,000~~	~~>40,000~~ ~~≤300,000~~	~~>4,000~~ ~~≤40,000~~	~~≤4,000~~
~~Minimum pressure and temperature transmitter calibration frequency~~	~~Quarterly~~	~~Six-monthly~~	~~Annually~~	~~Annually or as otherwise agreed with AEMO~~

~~Category~~	~~A~~	~~B~~	~~C~~	~~D~~
~~Remote meter fault detection surveillance frequency~~	~~Daily by exception~~	~~Daily by exception~~	~~Daily by exception~~	~~Daily by exception~~
~~In situ meter proving frequency~~	~~Annually Note: for ultrasonic meters by electronic means~~	~~Annually Note: for ultrasonic meters by electronic means~~	~~Annually or as otherwise agreed with AEMO Note: for ultrasonic meters by electronic means~~	~~Annually or as otherwise agreed with AEMO~~

~~2.3.~~2.5. Uncertainty limits for energy calculations

~~The table below sets out the uncertainty limits required to be achieved in calculating energy values at transfer points on the DTS. These limits have been developed to be apply to the energy quantity measured across a gas day.~~

The table 8 below sets out the uncertainty limits required to be satisfied in calculating energy content of a quantity of *gas* at *metering installations*.

These limits have been developed to apply to the energy content of a quantity of *gas* measured across a *gas day*.

These uncertainty limits for *energy calculation* apply to:

(a) the heating values for all *metering installations* in the *Market*, as required by rule 303(12); and

(b) the *energy calculation* by a *metering installation* at a *settlement metering point*~~.~~.

For the avoidance of doubt, rule 298(2) requires that a *metering installation* at a *distribution delivery point* (excluding a distribution connected *settlement metering point* as per (b) above) and *heating values* (as per (a) above) must satisfy the *uncertainty* limits set out in the *declared metering requirement* over its entire range of *flow rates*.

The following table 8 applies to the *energy calculation* for the energy content of a quantity of *gas* measured across a *gas day* that is:

- natural gas;
- natural gas including up to 10 mol% hydrogen blends; and
- non-hydrogen-based fuels (biogas, biomethane, and synthetic methane); providing that the impurities and their levels are compatible with latest revision of AS 4564.

Table 8 Uncertainty limits for energy calculations (gas primarily composed of methane (e.g. natural gas and biomethane) along with gas blended with hydrogen (up to 10 mol%))

Category	Flow rate range (standard cubic metres per hour)	Uncertainty limits (energy)
A	>300,000	±1.0%
B	>40,000 and ≤ 300,000	±1.5%
C	>4,000 and ≤ 40,000	±2.0%
D	≤4,000	±3.0%

~~Table 6~~

~~Category~~	~~Flow rate range (standard cubic metres per hour)~~	~~Uncertainty limits (energy)~~
~~A~~	~~>300,000~~	~~±1.0%~~
~~B~~	~~>40,000 and ≤ 300,000~~	~~±1.5%~~
~~C~~	~~>4,000 and ≤ 40,000~~	~~±2.0%~~
~~D~~	~~≤4,000~~	~~±3.0%~~

The following table 9 applies to the *energy calculation* for the energy content of a quantity of *gas* measured across a *gas day* that is pure hydrogen.

Table 9 Uncertainty limits for energy calculations (pure hydrogen)

Category	Flow rate range (standard cubic metres per hour)	Uncertainty limits (energy)
C	>400 and ≤ 4000	±2.4%
D	≤400	±2.7%

3. Energy calculation procedures

3.1. Introduction

Consumer *meters* measure *gas* volume flow at the prevailing pressure and temperature of the *gas* flowing through the *meter*. This is the actual flow (sometimes called the uncorrected flow). This measured ~~volume~~ actual flow volume is converted to the volume the *gas* would occupy at standard (sometimes called reference or base) conditions (101.325 kPa absolute and 15°C). This is the corrected flow.

This corrected flow volume is then multiplied by the heating value of the *gas* (energy per unit standard volume) to obtain the energy content. *Meters* with higher flow rates or pressures require more sophisticated *energy calculation* methods and since consumer *metering installations* cover a wide range of flow rates and pressures, a number of different techniques are used.

Therefore, these *energy calculation procedures* specify how energy content will be calculated accounting for:

(a) gas flows;

(b) gas pressures;

(c) heating values; and

(d) gas composition data.

These *energy calculation procedures* contain the *energy calculation* methodology for the three *meter* types used at *distribution delivery points*.

3.2. Scope

~~The procedures in this chapter are made under rule 303(6) of the NGR and relate to the calculation of natural gas energy at distribution delivery points. These procedures do not cover metering installations directly connected to the AEMO-operated gas transmission system, as the "Gas Metering – CTM Data Requirements" document, covers these meters. Unless there is an agreement to the contrary, this procedure does not apply to either of the following:~~

- ~~meters in areas that have derogations under Part D of the Gas Distribution System Code~~
- ~~meters in areas that are not supplied from the AEMO-operated declared transmission system.~~

These *energy calculation procedures* are made under rule 303(6) of the NGR and relate to the calculation of:

(a) energy content for *meters* and *metering installations* at *distribution delivery points;* and

(b) specifying the industry standards to be used to calculate the energy content of *gas* flowing through a *metering point*.

These *energy calculation* procedures specify the Industry Standards that apply to all *metering installations* in the *Market*, along with how AEMO determines *heating values* for these *metering installations*.

The operational requirements of *metering installations* at *settlement metering points* are covered in the "Gas Metering – *CTM* Data Requirements" technical document.

3.3. Industry standards for energy calculation

For the purposes of the requirements of rule 303(5) and rule 303(6) of the NGR, the following Industry Standards, must be used to calculate the energy content of *gas* flowing through a *metering installation* at a *metering point*.

Table 10 Industry standards to calculate the energy content of gas

Standard No.	Title/Description
American Gas Association Report No. 7 (AGA 7)	Measurement of gas by turbine meters
American Gas Association Report No. 8 (AGA 8) – Part 1	Thermodynamic Properties of Natural Gas and Related Gases, Detail and Gross Equations of State
American Gas Association Report No. 8 (AGA 8) – Part 2	Thermodynamic Properties of Natural Gas and Related Gases, GERG-2008 Equations of State
American Gas Association Report No. 9 (AGA 9)	Measurement of gas by multi-path ultrasonic meters
American Gas Association Report No. 11 (AGA 11)	Measurement of gas by Coriolis meters
American Gas Association PAR Research Project (AGA NX-19)	Manual for Determination of Super compressibility Factors (excluding hydrogen blends)
ISO 6976	Natural gas calculation of calorific values, density, relative density and Wobbe indices from composition

~~Standard No.~~	~~Title/Description~~
~~American Gas Association Report No. 7 (AGA 7)~~	~~Measurement of gas by turbine meters~~
~~American Gas Association Report No. 8 (AGA 8) – Part 1~~	~~Thermodynamic Properties of Natural Gas and Related Gases, Detail and Gross Equations of State~~
~~American Gas Association Report No. 8 (AGA 8) – Part 2~~	~~Thermodynamic Properties of Natural Gas and Related Gases, GERG-2008 Equations of State~~
~~American Gas Association Report No. 9 (AGA 9)~~	~~Measurement of gas by multi-path ultrasonic meters~~
~~American Gas Association Report No. 11 (AGA 11)~~	~~Measurement of gas by Coriolis meters~~
~~American Gas Association PAR Research Project (AGA NX-19)~~	~~Manual for Determination of Super compressibility Factors (excluding hydrogen blends)~~
~~ISO 6976~~	~~Natural gas alculation of calorific values, density, relative density and Wobbe indices from composition~~

3.4. Heating values

AEMO determines *heating values*, as required by Rule 303(12), to be used to determine the energy content of *gas* that flows through a *metering installation* by using the heating value allocation model to calculate the heating value and gas composition data of *gas* at each heating value zone.

The determination of *heating value zones* and operation of the *heating value allocation model* is described below.

3.4.1. AEMO's determination of heating value zones

(a) AEMO determines the heating value zones within the *DTS* and *DDS* to meet the requirement of rule 303(12) of the NGR.

(b) In general, AEMO's approach to setting heating value zones is to:

(i) have a heating value zone for each *settlement metering point.*

(ii) in consultation with the *Distributor*, set one or more *heating value zone* for each *DDS connection point* where.

(A) each *heating value zone* is set on the basis of expected or actual *gas* flows through the *DDS*; and

(B) multiple *heating value zones* may be required due to the *DDS* network configuration.

(c) AEMO will review the heating value zones if:

(i) a CTM is added to (or removed from) the *DTS*; or

(ii) a new *distributed connected facility* is added to (or removed from) a *DDS*; or

(iii) sampling of the gas composition data by the *responsible gas quality monitoring provider* shows that the heating value for a group of *metering installations* in a *heating value zone* does not meet the uncertainty limits specified in the *metering uncertainty limits and calibration requirements procedures*.

(A) If the Distributor's sampling determines that the gas composition and heating value data for a meter or group of meters within the DDS is different from the gas composition and heating values published by AEMO for the heating value zone, the Distributor is to inform AEMO and provide the data.

(d) In the event sampling shows heating values are exceeding the *uncertainty* limits specified in the *metering uncertainty limits and calibration requirements procedures,* then AEMO will:

(i) consult with the *responsible gas quality monitoring provider* and *Distributor* in order to account for the impact of the *DDS* network configuration changes during the sampling period.

(ii) AEMO may determine a new heating value zone is required to ensure the *uncertainty* limits at *metering installations* in the DDS are met. This may result in AEMO requiring a new heating value zone for the gas blend, as required by section 3.4.2(b)(ii).

3.4.2. AEMO's determination of heating values

(a) AEMO's heating value allocation model will determine heating values for each heating value zone using the following data:

(b) Data provided on an hourly basis (including *gas* flows, pressures) by the *responsible person* for *metering installations* and the *responsible gas quality monitoring provider's gas quality monitoring system* data (including gas composition data and heating values). This data is provided to the heating value allocation model from:

(i) A *market injection point* (i.e. *receipt points*) is required to measure at the *connection point*:

(A) *gas* flow;

(B) *gas* pressure;

(C) *gas composition data;* and

(D) *heating value.*

(ii) AEMO may create a new heating value zone (and logical CTM) to determine the heating value and gas composition data from a blend of *gas* supply sources (e.g. in a meshed *DDS* network with multiple *supply points*). AEMO may require the Distributor to calculate the blended heating value for this heating value zone, as they control the distribution network configuration. This data will be supplied to the *heating value allocation model* and in turn would be published by AEMO for that heating value zone.

(iii) The *gas quality monitoring system* data from a *DTS monitoring point*.

(c) The *DTS SP*, *Distributor*, *responsible gas quality monitoring provider* and *responsible person* for *metering installations*, if requested by AEMO, must provide the following data, which includes:

(i) Pipeline details including pipeline length, external diameter, wall thickness, internal diameter, upstream elevation, downstream elevation, roughness.

(ii) *Pipeline equipment* including values, regulators and compressors.

(iii) Expected operating conditions including maximum pressure, normal inlet pressure, normal outlet pressure, maximum flow, normal flow, minimum flow, designed pressure, designed flow, designed temperature, maximum allowable operating pressure, minimum allowable operating pressure.

(iv) *Metering data* (real time operational data) to be provided including blending rate, flow, pressure and temperature.

(v) Other information, AEMO requests, that is required to calibrate and operate the *heating value allocation model* that is not included in (i) to (iv) above.

(d) The data provided in (a) and (b) is used in the heating value allocation model to determine a heating value and gas composition data for each heating value zone.

3.4.3. Meter assignment to a heating value zone

(a) AEMO will publish a CTM to heating value zone report which includes each CTM mapped to a heating value zone.

(b) The allocation of a heating value zone to a *metering installation*:

(i) is performed by AEMO for each metering installation at a transmission delivery point, receipt point or transfer point; and

(ii) is performed by AEMO, in consultation with the *Distributor*, for each *metering installation* that has a *meter* with a *data logger* (otherwise referred to as a Daily Meter); or

(iii) is performed by the *Distributor* for each DDS connected *metering installation* that has a *basic meter*.

(c) ~~Each metering installation is assigned to a heating value zone, based on the primary supply for the metering installation in the previous year, unless there has been a CTM added or removed, or a change in network configuration.~~The initial assignment of each *metering installation* to a heating value zone is based on the primary supply for the *metering installation* in the previous year or on the basis of pipeline modelling in the case of a new *metering installation*.

(d) The assignment of a *metering installation* to a heating value zone may change if:

(i) a CTM is added to (or removed from) the *DTS* or *DDS* altering the primary supply source to the *metering installation*, then the responsible party (either AEMO or the *Distributor* as defined above), must review the assignment of *metering installations* to the *heating value zone* and adjust the *metering installations* assignment to each heating value zones according to pipeline modelling.

(ii) a permanent change to a DDS network configuration is made by the Distributor altering the primary supply source to the *metering installation*, which requires the reassignment of each impacted *metering installation* to a different heating value zone.[3]

(iii) a new heating value zone is determined, via sampling, to be required in accordance with the process outlined in clause 3.4.1, and the *metering installation* is required to use the heating value zone to meet the uncertainty limits.

3.4.4. Metering uncertainty for heating values

AEMO is required, by rule 303(12), to assess all heating values under the *metering uncertainty limits and calibration requirements procedures* for *energy calculations* under section 2.5.

~~3.3.~~3.5. Pressure correction factors

The pressure correction factors (PCF) are only acceptable for volume conversion up to *metering* pressures of 450 kPa gauge. Above this pressure, the changes in *gas* compressibility with changes in pressure and temperature become significant and must be taken into account

[3] A permanent change in DDS network configuration is a change that is expected to apply for 6 months or more that will impact the supply to basic meters and data logger meters within the DDS network.

by use of flow-correctors. ~~A table of pressure correction factors is published by AEMO.~~ The PCF may account for multiple different primary *gas* blends.

The PCF applicable for a *heating value zone* will be determined on the basis of the *gas* blend supplied to the *heating value zone*. The calculation of a PCF is performed by AEMO. AEMO publishes the Pressure Correction Factors on its website.

The allocation of a PCF to a *metering installation*:

(a) is performed by AEMO, in consultation with the *Distributor*, for each *metering installation* that has a *meter* with a *data logger* (as required for section 3.6.2); or

(b) is performed by the *Distributor* for each DDS connected *metering installation* that has a *basic meter*.

~~AEMO will only change the basis on which pressure correction factors are calculated after consultation with participants. The implementation date of any changed pressure correction factors will be set after consultation with participants. Pressure correction factors for additional pressures within the pressure range of the existing table may be calculated on the same basis as the existing table and published by AEMO without consultation.~~

3.6. Distribution delivery point meter energy calculation ~~methodology~~

A *metering installation* at a *distribution delivery point*, that is not registered as a *settlement metering point*, must satisfy the *uncertainty* limits set out in a *declared metering requirement* over its entire range of *flow rates*.

This excludes the *metering uncertainty limits and calibration requirements procedures* which apply for *heating values*, which is subject to section 2.5.

The following three kinds of *meters* typically operate at *distribution delivery points*.

3.6.1. Data logger meters – flow corrected

For *metering installations* with *data logger* flow-correctors where the corrected volume is calculated from *metered* ~~volume~~ readings (as volume or mass), pressure and temperature measurements and *gas composition data* are *daily meters (DMs)*. The following applies to these *metering installations*:

At a metering installation measuring volume:

The volume of *gas* (in standard cubic *meters*) flowing through a *meter* each hour is calculated by the flow corrector according to the following formula each hour:

$$V_h = \sum_{i}^{h} \left[\frac{\left(U_{\sout{meas}a_i} \times P_{\sout{meas}m_i} \times T_{b_i\sout{base}_i} \times Z_{\sout{base}b_i} \right)}{\left(P_{b_i\sout{base}_i} \times T_{\sout{meas}m_i} \times Z_{\sout{meas}m_i} \right)} \right]$$

At a metering installation measuring mass:

For Coriolis *meters* in which the mass is measured, the density is determined from *gas composition data* sent to the flow computer by AEMO. The *uncorrected flow* (in cubic metres) calculated according to the following formula from mass readings:

$$U_{cal} = \frac{M_m}{\rho_b} \times F_p$$

The volume of *gas* (in standard cubic *meters*) flowing through a *meter* each hour is calculated using the *gas composition data* provided by AEMO according to the following formula each hour:

$$Vh = \sum_{i}^{h} \left[\frac{\left(U_{cal_i} \sout{U_{calculated}} \times P_{m_i} \sout{P_{meas_i}} \times T_{b_i} \sout{T_{base_i}} \times Z_{base b_i} \right)}{\left(P_{\sout{base} b_i} \times T_{\sout{meas} m_i} \times Z_{\sout{mea} \sout{ms}_i} \right)} \right]$$

Note: Individual measurements are usually converted to an hourly average value.

Energy calculation:

If the *meter* measures volume or mass, the resulting corrected volume (V_h) will be used in the ~~The~~ hourly energy flow (in GJ)~~is calculated according to the following formula for each hour.~~:

$$Q_h = HV_h \times V_h \div 1000$$

The *meter's heating value zone* is assigned based to the *CTM* primarily supplying the site. A mapping of *heating value zones* to each *CTM* is available in the *CTM* to *heating value zone* report. As the *meter* is read daily the *heating value zone* changes on the day the primary supply *CTM* changes.

The total quantity of *gas* (in GJ) for the *metered* period is calculated according to the following formula:

$$Q = \sum_{h}^{TotalHours} Q_h$$

Where:

Table 11 Flow corrected meter energy calculation terms

Values	Definition
$\sum_{i}^{h} x_i$	The summation of x over each interval (i) until all intervals in the hour (h) have been summed together.
X_i	An individual measurement of parameter *X* made by the *meter* within the hour.
$\sum_{h}^{TotalHours} x_h$	The summation of x over each hour (h) until all hours (h) in the *metering* period (TotalHours) have been summed together.
Q	Consumed energy, the total energy value of a quantity of *gas* (in GJ).
Q_h	The hourly quantity of *gas* measured in energy (GJ)
V_h	The hourly–corrected volume flow in standard cubic metres.
HV_h	The hourly zonal *heating value* of *gas* (in MJ per standard cubic metre) as published by AEMO for the appropriate *heating value zone*.
U_a	The uncorrected flow (also referred to as the actual flow) (in cubic metres) measured by the *meter*.
M_{meas}	Mass measured by a mass Coriolis *meter*
ρ_b	Relative density at base pressure (P_b) and base temperature (T_b)

Values	Definition
Fp	Flow pressure compensation effect factor
U_{cal}	Uncorrected flow (also referred to as the actual flow) calculated from measured mass
P_a	The actual *gas* pressure (in kPa absolute) being the gauge pressure plus 101.325kPa.
T_a	The actual *gas* temperature measured on site (in Kelvin)
Z_a	The compressibility at the actual pressure and temperature, as per the applicable Industry Standard listed in section 3.3.
P_b	The base pressure (in kPa absolute), being 101.325 kPa.
T_b	The base temperature (in Kelvin), being 288.15 Kelvin.
Z_b	The compressibility at base pressure and temperature, as per the applicable Industry Standard listed in section 3.3.
$TotalHours$	The Total number of hours for the *metered* period.

~~Table 7~~

~~Values~~	~~Definition~~
$\sum_{i}^{h} x_i$	~~The summation of x over each interval (i) until all intervals in the hour (h) have been summed together.~~
X_i	~~An individual measurement of parameter *X* made by the *meter* within the hour.~~
$\sum_{h}^{TotalHours} x_h$	~~The summation of x over each hour (h) until all hours (h) in the *metering* period (TotalHours) have been summed together.~~
Q	~~Consumed energy, the total energy value of a quantity of *gas* (in GJ).The total energy value of a quantity of gas (in GJ).~~
Q_h	~~The hourly quantity of *gas* measured in energy (GJ)The hourly quantity of gas measured in energy (GJ)~~
V_h	~~The hourly corrected volume flow in standard cubic metres.~~
HV_h	~~The hourly zonal *heating value* of *gas* (in MJ per standard cubic metre) as published by AEMO for the appropriate *heating value zone*.~~
$\overline{\quad}_{measa}$	~~The uncorrected flow (in cubic metres) measured by the *meter*.~~
P_{meaas}	~~The measured actual *gas* pressure (in kPa absolute) being the gauge pressure plus 101.325kPa.~~
T_{measa}	~~The measured actual *gas* temperature measured on site (in Kelvin), being the °Celsius temperature plus 273.15.~~
Z_{ameas}	~~The compressibility at the measured actual pressure and temperature, as per NX-19.~~
P_{base}	~~The base pressure (in kPa absolute), being 101.325 kPa.~~
T_{base}	~~The base temperature (in Kelvin), being 288.15 Kelvin.~~
Z_{base}	~~The compressibility at base pressure and temperature, as per NX-19.~~
$TotalHours$	~~The Total number of hours for the *metered* period.~~

For a metering installation ~~Where the installation~~ where ~~is such that~~ a temperature probe has not been installed, the actual temperature will be deemed to be 15°C and this figure will be used in calculations.

AEMO will publish the *gas composition data* (relative density, nitrogen and carbon dioxide concentration) to be applied in accordance with the applicable Industry Standard listed in section 3.3. ~~to be applied in the NX-19 algorithm.~~

~~3.3.1.~~3.6.2. Data logger meters – PCF energy calculation

For *metering installations* fitted with *data loggers* that record only the hourly *meter* readings in cubic metres and do not determine the corrected volume of *gas* are *DMs*, the following applies to these *metering installations*:

At the metering installation:

The *data logger* records the hourly *meter* readings, U_{ha}, as an actual volume of *gas*

Volume correction~~Energy calculation:~~

The calculation of the hourly–corrected volume of *gas* (in standard cubic *meters*) is according to the following formula each hour:

$$V_{hs} = U_{ha} \times PCF$$

Energy calculation:

The calculation of the hourly quantity of *gas* (in GJ) is according to the following formula for each hour:

$$Q_h = (V_{hs} \times HV_{~~h~~Z}) \div 1000$$

The *meter's* heating value zone is assigned based on the *CTM* primarily supplying the site. A mapping of heating value zones to each CTM is available in the CTM to heating value zone report. As the *meter* is read daily the heating value zone changes on the day the CTM primarily supplying the site changes.

The total quantity of *gas* (in GJ) for the *metered* period is calculated according to the following formula:

$$Q = \sum_{h}^{TotalHours} Q_h$$

Where:

Table 12 PCF energy calculation terms

Values	Definition
Q	Consumed energy, the total energy value of a quantity of *gas* (in GJ).
Q_h	The hourly quantity of *gas* measured in energy (GJ).
$\sum_{h}^{TotalHours} Q_h$	The summation of Q_h over each hour (h) until all hours (h) in the *metering* period (TotalHours) have been summed together.
U_{ha}	The hourly uncorrected flow (also called actual flow) (in cubic metres) measured by the *meter* for each hour of the billing period.
V_{hs}	The hourly-corrected volume flow in standard cubic metres.
HV_h	The hourly zonal *heating value* of *gas* (in MJ per standard cubic metre) as published by AEMO for the appropriate *heating value zone*.
$TotalHours$	The total number of hours for the *metered* period.

Values	Definition
PCF	The pressure correction factor applied to convert the *metered* volume of *gas* to standard cubic metres.

~~Table 8~~

~~Values~~	~~Definition~~
~~Q~~	~~Consumed energy, the total energy value of a quantity of *gas* (in GJ).~~
~~Q_h~~	~~The hourly quantity of *gas* measured in energy (GJ).~~
~~$\sum_{h}^{TotalHours} h$~~	~~The summation of over each hour (h) until all hours (h) in the *metering* period (TotalHours) have been summed together.~~
~~$\overline{\quad}_{ha}$~~	~~The hourly actual flow (in cubic metres) measured by the *meter* for each hour of the billing period.~~
~~V_{hs}~~	~~The hourly-corrected volume flow in standard cubic metres.~~
~~HV_h~~	~~The hourly zonal *heating value* of *gas* (in MJ per standard cubic metre) as published by AEMO for the appropriate *heating value zone*.~~
~~$TotalHours$~~	~~The total number of hours for the *metered* period.~~
~~PCF~~	~~The pressure correction factor applied to convert the *metered* volume of *gas* to standard cubic metres.~~

~~3.3.2.~~3.6.3. Basic meter energy calculation

For *metering installations* ~~not fitted with data loggers~~ that are a *basic meter* read at the start[4] and end[5] of each measurement period[6] will generally be a *tariff V withdrawal point*. The following applies to these *metering installations*:

At the metering installation:

The *meter* index is read at the start and end of the ~~metering~~ measurement period. The difference between the readings (in cubic metres) indicates the volume of *gas* passed by the *meter*.

Imperial measurement

All flows are to be reported to AEMO in metric units. Any *meter* measurements in imperial units are to be converted to metric units at the *metering installation* before being reported to AEMO.

[4] In the Retail Market Procedure (Victoria) the term "*base read*" is used as a reference to start read.

[5] In the Retail Market Procedure (Victoria) the term "*reference reading*" is used as a reference to end read.

[6] In the Retail Market Procedure (Victoria) the term "*reading period*" is used as a reference to measurement period.

~~Energy~~ Standard volume calculation:

The total corrected volume in standard cubic *meters* for the *metered* period is calculated according to the following formula:

$$V_s = U_a \times PCF$$

Energy calculation:

The quantity of *gas* (in MJ) for the *metered* period is calculated according to the following formula:

$$Q = Vs \times HV_{~~ave~~avg}$$

Where HV_{avg} is the average of the HV_D over the *meter* period:

$$HV_{avg} = \left(\sum_{Start\ Date}^{End\ Date} HV_D \right) \div (D)$$

Clause 2.6.1 of the *Retail Market Procedures* (Victoria) provided details on how *heating value zones* for the *basic meter* that changes during the measurement period are to be applied.

Where:

~~Table 9~~Table 13 Basic meter energy calculation terms

~~Values~~	~~Definition~~
~~Q~~	~~*Consumed energy*, the quantity of *gas* (in MJ) for the measurement metered period~~
~~U_a~~	~~the flow (in cubic metres) volume in actual cubic *meters*, measured by the meter for the measurement metered period, recorded from the *meter*~~
~~V_s~~V	~~the volume, in standard cubic metres, for the *metered* period~~
~~D~~	~~the number of days in the measurement metering period~~
~~PCF~~	~~the pressure correction factor applied to convert the *metered* volume of *gas* into the same pressure and temperature as the base pressure and base temperature used for *heating value*~~
~~HV_D~~	~~the daily average zonal *heating value*, contained in the published by AEMO in INT139a report that AEMO publishes on the market information bulletin board by 5pm on the *gas day* following the *gas day* to which daily average zonal *heating value* relates~~
~~HV_{avg}~~~~HVave~~	~~the average zonal *heating value* of *gas* for the measurement period (in MJ per standard cubic metre) calculated as described in the Retail Market Procedures (Victoria).~~ ~~Where the meter is in an area that has derogation under Part D of the Gas Distribution System Code or is not supplied from the AEMO operated transmission system but there is an agreement that this procedure applies, an appropriate heating value will be used.~~

Values	Definition
Q	*Consumed energy*, the quantity of *gas* (in MJ) for the measurement period
U_a	the volume in actual cubic *meters*, for the measurement period, recorded from the *meter*.
V_s	the volume, in standard cubic metres, for the *metered* period
D	the number of days in the measurement period.
PCF	the pressure correction factor applied to convert the *metered* volume of *gas* into the same pressure and temperature as the base pressure and base temperature used for *heating value*
HV_D	the daily average zonal *heating value*, contained in the INT139a report that AEMO publishes on the MIBB on the *gas day* following the *gas day* to which daily average zonal *heating value* relates.
HV_{avg}	the average zonal *heating value* of *gas* for the measurement period (in MJ per standard cubic metre).

4. Metering communications procedures

4.1. Introduction

Under rule 308(1) of the NGR, AEMO must collect *metering data* from all *metering installations* from which *metering data* is required for settlement purposes. The *responsible person* for each *metering installation* must ensure that the *metering data* is capable of being transmitted, or otherwise collected, from their *metering installation* and delivered to the *metering database*.

4.2. Scope

~~The procedures in this chapter are made under rule 308(4) of the NGR.~~

These are the *metering communications procedures* made under rule 308(4) of the NGR relating to the transfer of *energy data* from *metering installations* to the *metering database*.

These *metering communications procedures*:

(a) describe AEMO's communications and data requirements;

(b) set out the communication interfaces and associated parameters between the *metering installation* (maintained by the *responsible person*), and the *metering database* (maintained by AEMO or its appointed Metering Data Agent (MDA));

(c) cover both Custody Transfer Meters (CTMs) and Daily Meters (DMs);

~~(c)~~(d) define the communications requirements for the transfer of gas composition data (GCD), relative density and heating value from the *metering database* ~~(HV) from gas quality monitoring systems to the *metering database* and from there to other~~to *metering installations* to determine energy content; and

(e) defines the interface requirements between the AEMO SCADA host and third party Management and SCADA systems.

4.3. Communication and data requirements

4.3.1. Communication performance

Where a third party telecommunications network ~~(e.g. public switched telephone network (PSTN), packet switched radio or digital radio network)~~ is used to communicate between the MDA and each *metering installation*, or between the MDA and a *Market Participant*, as per ~~R~~rule 312(1)(a), the *Market Participant* ~~shall~~ must use their reasonable endeavours, working together with the MDA, to ensure the network continues to meet functional, performance and capacity requirements.

Custody Transfer Meters

The CTM RTUs ~~shall~~ must have provision for hourly electronic transfer of data between the *metering installation* and the MDA systems unless otherwise agreed by AEMO.

Daily meters

The ~~DMs~~ *data logger* ~~shall~~ for each DM must ~~provide~~ transfer ~~of~~the data between the *metering installation* and the MDA's systems either:

(a) ~~-~~electronically daily; or

(b) ~~via~~ manual collection of data twice a month; or

(c) an alternate duration as approved by AEMO.

4.3.2. ~~Timing~~Meter time

The clocks for~~Both~~ CTMs and DMs ~~clocks are to~~must be referenced to Australian Eastern Standard Time (AEST) with an accuracy of ± 5 secs.

Time must be recorded based on the Julian calendar as a numbered sequence.

4.3.3. Time stamping of data

(a) AEST must be used in data transfers for all *time stamping*.

(b) Hourly average data is required for a variety of data points and refers to "hour to hour", "on the hour" data.

(c) All readings require a "*time stamp*" as below:

(i) For daily *meters* and CTMs for averaged data, the *time stamp* relates the start time of a measurement period. For example, "hourly average" data for the 1300 to 1400 hrs period would be *time stamped* 13:00:00. "Daily average" readings are to be referenced to 6:00:00 am AEST.

(ii) For CTMs for "instantaneous" (i.e. single measurement) readings, the *time stamp* indicates the time of measurement.

(iii) For CTMs for the "Top of Hour" (TOH) readings, the *time stamp* relates to the instantaneous measurement at the end of the hour. Therefore, the 9:00:00 am *time stamped* TOH data is the data at close to 9:59:59 am. The TOH pressure and TOH temperature is the only data handled in this way.

~~All data transferred shall be time and date stamped as detailed in:~~

- ~~Gas Metering – CTM Data Requirements~~
- ~~Gas Metering – DM Data Requirements~~
- ~~Gas Quality Standard and Monitoring Guidelines~~

4.3.4. Communication link reliability

Communication links for CTMs and DMs must be of a reliable design so that at least 95% of the time data is downloaded or uploaded from the *metering installation* on the first attempt.

AEMO notes that communication links at *system injection points*, *DTS monitoring points*, DDS *transfer monitoring points* and *DDS injection points* are required to meet the continuous transmission of gas quality data in real time to the *metering database*, as required by rule ~~-~~289G and the *gas quality monitoring procedures*.

4.3.5. Communication link availability

Metering data in hourly intervals ~~shall~~ must be available for communication for~~from both~~ CTM~~s~~ and DM~~s~~ ~~*DMs* and CTM~~ *metering installations* for the total of the stored data.

The communications link ~~shall~~ must be available for transfer of data between the *metering installation* and the *metering database* for at least 95% of the year and within the time required for settlement as stated in the Division 2 Subdivision 6 of the NGR or as otherwise agreed between AEMO and the *responsible person*.

~~4.3.2.~~4.3.6. Security and confidentiality

Metering data ~~shall~~ must be secure from either local or remote unauthorised access by suitable electronic access controls. *Affected Participants* ~~shall~~must have, where practical, read only access.

Metering data and passwords are *confidential information*, and each Participant must ensure they are treated as confidential information.

Refer to the NGR for further details regarding security of *metering installation*s.

Metering installations will also need to meet relevant legislative security requirements.

~~4.3.3.~~4.3.7. Communication protocol

The communications protocol required to read *metering data* ~~shall~~ must be network independent and be supportable by AEMO or the MDA.

Metering installations at custody transfer meters

~~AEMO's SCADA system currently supports communication to Bristol 3305, 3310, 3330 and ControlWave RTUs as widely used at current CTM metering installations. This system makes use of the BSAP (Bristol Standard Asynchronous Protocol) communications protocol. Other communication protocols and RTUs will be considered provided the responsible person covers development and implementation costs.~~

AEMO's SCADA system currently supports communication with CTM RTUs via the BSAP (Bristol Standard Asynchronous Protocol) communications protocol.

The *responsible person* may propose an alternate communication protocol to AEMO. AEMO may agree to the alternate communication protocol. The *responsible person* must cover the costs of development and implementation of the alternate communication protocol, unless agreed otherwise by AEMO.

Metering installation at daily meters

A configuration file detailing how ~~the~~ a site is polled and any other information that may be required to read the *meter* must be supplied by the *responsible person* to the MDA.

4.3.8. Polling Frequency

Custody Transfer Meters

AEMO's SCADA system polls CTMs at least once every 30 minutes.

AEMO notes that polling frequencies at *system injection points*, *DTS monitoring points*, *DDS transfer points* and *DDS injection points* are required to meet the continuous transmission of *gas* quality data in real time to the *metering database*, as required by rule 289G and the *gas quality monitoring procedures*.

Daily meters

Refer to section 4.3.1 for DMs.

4.4. Data Requirements

4.4.1. Custody transfer meter data requirements

~~For CTM data requirements refer to "Gas Metering – CTM Data Requirements".~~

~~For DM data requirements refer to "Gas Metering – DM Data Requirements".~~

~~For gas quality requirements refer to "Gas Quality Standard and Monitoring Guidelines (Declared Transmission System)"~~

The data requirements for the *responsible person* for a CTM are detailed in the technical document "Gas Metering – CTM Data Requirements".

4.4.2. Daily meter data requirements

The following table provides a list of the DM "standard set" for *metering data*. The data listed provides sufficient information to recalculate consumption when combined with gas composition data.

The data is required to enable AEMO to check the validity of energy and volume readings supplied from the *metering installation*. The data assists in the development of data substitutions in the event of data corruptions.

The data arrays listed provide sufficient information to recalculate results in the event of a wide range of RTU failures and also provide sufficient data to enable the checking of calculations performed by the RTU.

The following DM data is required by AEMO and must be available in time for ~~m~~*Market settlement* in accordance with the Rules.

Field Name	Units	Data Type	Nullable	Description
MIRN		varchar(10)	Not null	Meter registration number
gas_date		datetime	Not null	gas date
ti		int	Not null	trading interval
Temperature	Deg C	int	Null	Temperature for ti
Pressure	kPag	int	Null	Pressure for ti
Uncorrected Flow	cm/h	double	Null	Uncorrected flow for ti
Corrected Flow	kscm/h	double	Null	Corrected flow for ti
Electronic Index		double	Null	Electronic Index from datalogger

At *metering installations* where the metering is performed by two or more *meters*, the data listed above where relevant, must be provided for each individual *meter*. The same data, where relevant, must be provided for the "station total".

The above table refers primarily to positive displacement and turbine meters. If orifice meters are used, the average differential pressures for each of the metering runs must also be provided, or as otherwise agreed with AEMO.

5. Installation database procedures

5.1. Introduction and scope

The *installation database procedures* ~~in this chapter~~ are made under rule 309 of the NGR. The rules specify that each *responsible person* must create, maintain and administer an *installation database* ~~with information about their~~for all its *metering installations*. The purpose of these *installation database procedures* is to set out the information that ~~is to~~must be contained in *installation databases* ~~for the DWGM in accordance with Part 19 of the Rules~~.

5.2. Requirements

Each *installation database* must contain the following information: ~~and such other information related to a *metering installation* as specified by AEMO~~:

(a) *Metering point* reference details, including:

(i) Locations and reference details (e.g. drawing numbers).

(ii) Site identification names.

(iii) Details of *affected Participants*. ~~associated with the system point.~~

(iv) The *responsible person*.

(v) *Metering installation registration number* (*MIRN*).

(vi) Base load.

(vii) Temperature sensitivity factor.

(viii) Customer characterisation.

(b) The identity and characteristics of *metering* equipment including:

(i) Serial numbers.

(ii) *Metering installation* identification name.

(iii) *Metering installation* types and models.

(iv) Current test and calibration programme details, test results and references to test certificates.

(v) Calibration tables, where applied to achieve *metering installation* accuracy, and data register coding details.

(c) Data communication details, including:

(i) Telephone number(s) (or frequency details in the case of telemetric equipment) for access to data.

(ii) Communication equipment type and serial numbers, communication protocol details or references.

(iii) Data conversion details.

(iv) User identifications and access rights.

(v) "Write" password (to be contained in a hidden or protected field).

(d) Other information for CTMs and DMs as required by AEMO's application for *metering installation* registration, which is available on AEMO's website.

6. Metering installation coordination procedures

6.1. Introduction

These *metering installation coordination procedures* are made under rule 292A of the NGR. The rules specify that AEMO must make Procedures that provide for the obligations of the *responsible person* with respect to specific matters relation to *metering installations* for to *settlement metering points*.

6.2. Scope

These *metering installation coordination procedures*, as required by rule 292A, must provide for the obligations of the *responsible person* with respect to the following matters relating to *metering installations* for *settlement metering points*:

(a) temporary changes to *metering installations* or facilities connected to *metering installations* that affect the accuracy of the *metering installations*;

(b) addressing the consequences of temporary *metering data* failures;

(c) monitoring of *metering installations*;

(d) audit requirements, and the cost of audits; and

(e) investigation and reporting in accordance with rule 293(6).

6.3. Settlement metering point's metering installations

6.3.1. Registration of a new metering installation at a settlement metering point

The *responsible person* must register with AEMO its *metering installations* at *settlement metering points*, which includes both *DTS connection points*, *DDS connection points* at each *distribution connected facility* and *DDS* to *DDS transfer points*. These *metering installations* must be registered as they impact the *settlement* of the *Market*.

This process requires a *responsible person*, or intending *responsible person*, to download from AEMO's website and submit the form for a CTM or DM called 'application for metering installation registration'.

(a) For a DM this means:

(i) When a *metering installation* is installed:

(A) the *responsible person* must provide to AEMO and the MDA a fully completed 'Application for Metering Installation Registration - Gas (Vic)' form at least 2 business days before the expected commissioning date of the *metering installation*, or such date as agreed with AEMO;

(B) AEMO and the MDA will setup the *metering installation* record in market systems with the status of 'commissioned' if all data is provided; and

(C) the *responsible person* must obtain the applicable heating value zone from the Distributor and include the zone in the 'Application for Metering Installation Registration - Gas (Vic)' form before it is submitted to AEMO.

(ii) When a metering installation is upgraded:

(A) the *responsible person* must provide to AEMO and the MDA a fully completed 'Meter Installation Parameter Change Notice – Gas (Vic)' form for upgrading of the *metering installation* record at least 2 business days before the date the *metering installation* is actually upgraded, or such date as agreed with AEMO;

(B) AEMO and the MDA will upgrade the *metering installation* record in market systems with the status of 'billing'; and

(C) the upgrade date for the *metering installation* record must be a minimum of two business days after the commissioning date of the upgrade, specified in (a)(i)(A) above.

(b) For a CTM, *market injection point, market withdrawal point, DTS monitoring point* and *DDS transfer monitoring point* this means:

(i) the *responsible person* and, if applicable, *responsible gas quality monitoring provider* must provide to AEMO a fully completed draft 'Application for Metering Installation Registration - Gas (Vic)' form at least 60 business days before the expected commissioning date of the metering installation, or such date as agreed with AEMO;

(A) AEMO will review all information provided in the draft 'Application for Metering Installation Registration - Gas (Vic)' form and setup the metering installation record in AEMO's market systems;

(B) AEMO will contact the *responsible person* and, if applicable, *responsible gas quality monitoring provider* to setup communication links from AEMO's market systems to the *metering installation* and, if applicable, *gas quality monitoring system*;

(C) AEMO will contact the *responsible person* and, if applicable, *responsible gas quality monitoring provider* to setup any *market injection point* or *market withdrawal point* in AEMO's market systems, including data validation parameters;

(D) AEMO will determine a new heating value zone for each new CTM, *market injection point* and *market withdrawal point* as required by clause 3.4.1; and

(E) AEMO may request any additional information that is reasonably required to complete the setup in (b)(i)(A), (b)(i)(B), (b)(i)(C) and (b)(i)(D) above and the *responsible person* and the *responsible gas quality monitoring provider* as applicable must provide to AEMO the information requested as soon as possible.

(ii) The *responsible person* and, if applicable, *responsible gas quality monitoring provider* must provide to AEMO the fully completed final 'Application for Metering Installation Registration - Gas (Vic)' form at least 20 business days before the expected commissioning date of the *metering installation*, or such date as agreed with AEMO:

(A) AEMO will setup the *metering installation* record and change the status from 'received' to 'registered' if all data in the 'Application for Metering Installation Registration - Gas (Vic)' form is provided as requested in (b)(i) above.

(iii) The *responsible person* and, if applicable, *responsible gas quality monitoring provider* must provide to AEMO the fully completed 'Meter Installation Parameter Change Notice – Gas (Vic)' form for changing the meter status from 'registered' to 'commissioned' at least 5 business days before the actual commissioning date of the *metering installation,* or such date as agreed with AEMO:

(A) AEMO will set the *metering installation* record status to commissioned, after confirming the communication links to the *meter installation* and, if applicable, *gas quality monitoring system* are functioning;

(B) AEMO may change the *metering installation* commissioning date, in consultation with the *responsible person* and, if applicable, *responsible gas quality monitoring provider*, if the communication links are not functional; and

(C) AEMO will implement the new heating value zone determined under (b)(i)(D) above; and

(iv) A *Market Participant* must complete the accreditation application process detailed in the *accreditation procedure* for any *market injection points* or *market withdrawal points* as follows:

(A) each Market Participant must have a billing meter associated with the accreditation; and

(B) the accreditation process can only be completed after the CTM *metering installation* record has the status of commissioned.

6.3.2. Approval of an alternate *metering installation* at a *settlement metering point*

AEMO may approve an alternate metering installation at a *market injection point*, that may include:[7]

(a) *gas quality specifications* determined an appropriate distance from the *metering installation* at the *market injection point*, as agreed with AEMO, especially in regard to a *primary gas* (e.g. hydrogen) *gas production facility* utilising in-pipe blending;

(b) the use of an appropriate analyser for a *primary gas* (e.g. hydrogen) that is being injected by a *primary gas production facility* or a *blend processing facility*;

If any other alternate *metering installation* is proposed at an existing, or proposed, *settlement metering point*, by an existing or intending *responsible person*:

(c) AEMO will consider the proposal against the requirements of the Law, Rules, Wholesale Market Metering Procedures including meeting *metering uncertainty* limits.

(d) AEMO may also consider whether the proposal:

(i) is not feasible to implement for AEMO's systems;

(ii) would impose unreasonable costs for AEMO to implement or apply; or

(iii) is otherwise not consistent with the efficient operation of the *Market*.

[7] AEMO does not expect that a biomethane facility will require an alternate *metering installation* to a natural gas facility.

(e) AEMO may consult the *jurisdictional regulators*, *DTS_SP*, *Distributors* and other impacted *Registered participants* on the proposal.

(f) Subject to (g) below, AEMO will inform the relevant consultative forum of an alternate *metering installation* and AEMO's expectation on the impact to the *Market*.

(g) If an AEMO approved alternate *metering installation* is used at additional sites, then AEMO is not required to inform the consultative forum after the first alternate *metering installation* is approved.

(h) Subject to this clause 6.5.2, AEMO will approve or not approve an alternate *metering installation* based on AEMO's reasonable opinion on the impact of the alternate *metering installations* compliance with the Law, Rules and the Wholesale Market Metering Procedures.

6.3.3. Modification of a *metering installation* at a *settlement metering point*

The *responsible person* for a *metering installation*, prior to making any change (including temporary or permanent modifications, adjustment, repair or replacement) to the *metering installation* which may impact *metering* accuracy or integrity of a *settlement metering point,* must:

(a) minimise the amount of time a *metering installation* is unavailable;

(b) notify AEMO of the proposed change to a *metering installation* in accordance with the *maintenance planning procedures* and in relation to any proposed change;

(i) the responsible person must comply with the *maintenance planning procedures* in relation to the information, data submission and timing requirements for information about the modification of a *metering installation* by a *responsible person;*

(ii) AEMO will assess any planned proposed change to a *metering installation* using the maintenance planning process specified in the *maintenance planning procedures*; and

(iii) AEMO will assess any works undertaken using the undertaking maintenance process specified in the *maintenance planning procedures;*

(c) The *responsible person* must send notifications to *Registered participants* of any change (including for planned or unplanned maintenance), in regard to a *metering installation*, including the following information:

(i) the start and proposed end date of the planned maintenance on the *metering installation*;

(ii) include information to inform the *Market* on the impact to the facility connected to the *settlement metering point*.

(iii) a *meter* data substitution methodology proposal, if unmetered *gas* will flow for the duration of the work (e.g. via a *meter* bypass valve) at the *settlement metering point*;

(iv) the actual end date and time of the *maintenance* on the *metering installation* that confirms the *metering installation* is active and that any *meter* bypass has been closed

(d) The *responsible person* may request AEMO send notifications to all *Registered participant* via SWN concerning the maintenance.

AEMO will assess the meter data substitution, provided in (b)(iii) above, against other *meter* data substitution methodologies outlined in section 6.3.4, to determine the best method for estimating *meter* flows during the modification to the metering installation.

6.3.4. Meter data substitution due to temporary *meter installation* failures

When AEMO or the *responsible person* identify a *meter* data failure, or the *meter* is unavailable due to change (including temporary or permanent modifications, adjustment, repair or replacement) to *metering installations*, AEMO will determine the most accurate *meter* substitution data which should be used, including:

(a) request an estimate of the actual quantity of *gas* transferred through the affected *metering installation* from the *responsible person*. This data must be provided to AEMO within 2 business days after receiving the request from AEMO as per rule 293(6).

(b) substitute the actual quantity of *gas* transferred through the affected *metering installation* utilising a range of sources, including real time data, *gas* usage at *basic meters* and daily *meters* supplied by the failed *meter*, incorporate the DUAFG benchmark rate to determine the *metering data* for the failed *metering installation*.

(c) modelling may be used determine an estimated flow for a *metering installation*.

(d) substitute the actual quantity of *gas* transferred through the affected *metering installation* using the *data validation procedures* outlined in section 8.4.

If AEMO is provided with new *meter* data as part of the *settlement* revision process, AEMO may re-evaluate the *meter* substitution data and provide updated data.

6.3.5. Responsible person's monitoring of a metering installation

The *responsible person* must periodically monitor its *metering installation*s in order to ensure that the *metering installations* are operating properly in accordance with the Rules and Procedures, including monitoring:

(a) Temperature and pressure instruments and probes;

(b) *Meter* flow monitoring, for abnormal flows or unexpected zero flows;

(c) Communications status, including GCD failures;

(d) RTU and array data monitoring; and

(e) Any other components relevant to the accuracy of the *meter* or integrity of the data not listed above.

6.4. Investigation and reporting

The *responsible person* must, in accordance with rule 293(6), within 2 business days after receiving a notice from AEMO under subrule 293(4) or otherwise becoming aware of any matter described in subrule 293(5), provide a report to the AEMO.

the *responsible person* may request AEMO send a notification, as per the *electronic communication procedures*, on behalf of the *responsible person* to notify *Registered participants* for the purpose of rule 293(5)(a).

6.5. Audit requirements

AEMO may by notice require a *responsible person* to undertake an audit of *metering installations* for *settlement metering points* if in AEMO's reasonable opinion a report provided to AEMO under rule 293(6), or any information available to AEMO indicates:

(a) There is a systemic issue identified at a *metering installation*(s) operated by a responsible person after an investigation and report;

(b) Metering data provided to AEMO by the *responsible person,* shows a statistically higher likelihood of meter data issues on the basis of a historical, or other reasonable, benchmark; or

(c) Other recurrent issues identified for a metering installation, that after an investigation and report, cannot identify and rectify the cause of the issue.

A *responsible person* must arrange for completion of an audit as soon as practicable after notice from AEMO.

The audit must be completed by an independent third party that, in AEMO's reasonable opinion, has the technical expertise to carry out the audit.

The audit is to assess the *responsible persons* compliance with the requirements for *metering installations* for *settlement metering points* in the Rules and the *Wholesale Market Procedures*.

The *responsible person* must provide AEMO with a report from the auditor engaged to complete an audit as soon as practicable after completion of the audit.

Costs associated with an audit, including the costs of the auditor, are to be borne by the *responsible person*.

7. Metering Register Procedures

7.1. Introduction

These *metering register procedures* ~~in this Chapter~~ are made under rule 311 of the NGR. The Rules specify that AEMO must maintain a *metering register* of all *metering installations* that provide data used for settlement purposes.

The ~~purpose of these~~ *metering register procedures* ~~is~~ are to set out the purpose of, and the ~~*metering*~~ information that is to be contained in the *metering register* ~~for the DWGM in accordance with Part 19 of the Rules~~.

7.2. ~~General~~ Purpose of Metering Register

The *metering register* forms part of the *metering database* and holds metering information relating to *metering installations*. The purpose of the *metering register* is to facilitate:

(a) Registration of ~~*system points*~~*settlement metering points*, *distribution delivery points*~~, metering points~~ and *affected Participants*.

(b) Verification of compliance with the ~~*R*~~*rules*.

(c) Audit of changes to registered information.

7.3. Metering Register Information

Metering information to be contained in the *metering register* ~~should~~must include such information as AEMO considers reasonably necessary and by way of example, may include the following:

(a) Meter identification:

(i) *Metering installation registration number* (*MIRN*).

(ii) Logical meter identification - if a logical meter.

(iii) Logical meter algorithm - if a logical meter.

(b) Location in *Market*:

(i) Custody Transfer Meter (CTM) ~~group identification *custody transfer meter* is defined in the Retail Market Procedures (Victoria)~~.

~~(i)~~*(ii)* Heating value zone as determined by AEMO in the *energy calculation procedures*~~. *Heating value zone is defined in the Retail Market Procedures (Victoria).~~

~~(ii)~~(iii) Unaccounted for gas (UAFG) for each distribution area as per ~~zone. See~~ Attachment 6 of the *Retail Market Procedures* (Victoria).

(iv) *System withdrawal zone*.

~~(iii)~~*(v) settlement metering point* ~~System Injection point.~~

~~(iv)~~(vi) Transmission zone (TUoS zone).

~~(v) *Hub identification.*~~

~~(vi) *Hub flow direction.*~~

(vii) ~~*Transmission*~~*DTS* or ~~*distribution*~~ *DDS connection point* identification.

~~(vii)~~(A) For the avoidance of doubt, AEMO's *metering register* contains CTMs, DMs and basic *meters* that have churned from the *declared host retailer* for the DDS.

(viii) Base load~~; Base load is~~ as defined in the *Retail Market Procedures* (Victoria).

(ix) Temperature sensitivity factor as defined in the *Retail Market Procedures* (Victoria).

(c) Parties identification:

(i) *Meter~~ing~~ data ~~agency~~ agent* (MDA) identification.

(ii) *Responsible person* identification.

~~(ii)~~(iii) *Responsible gas quality monitoring provider* identification.

~~(iii)~~(iv) *Market Participant* settling account identification.

~~(iv)~~(v) Declared host *Retailer* identification.

~~(v)~~(vi) Supplying *Retailer* identification.

~~(vi)~~(vii) *Distributor* identification.

~~(vii)~~(viii) Identification of the energy values provider[8].

~~(viii)~~(ix) Supplier of last resort identification[9].

(d) Data validation and substitution processes agreed between *affected Participants*, including:

(i) Algorithms.

(ii) Data comparison techniques.

(iii) Processing and alarms.

(iv) Alternate data sources.

(e) Meter information:

(i) Meter type.

(ii) Meter size.

(iii) Meter maximum capacity.

[8] Being the party who has either a contractual or regulatory obligation to provide AEMO with data to support settlement.

[9] See Clause 6.1.3 of the *Retail Market Procedures* (Victoria) and section 51D of the Gas Industry Act 2001 (Vic)

8. Data Validation Procedures

8.1. Introduction

Before *metering data* is sent to ~~the~~ AEMO's settlements system, it undergoes two separate stages of data cleaning. The first is a set of automatic checks (validation) that identify either missing data or data that has a value outside its expected range. The second is a set of manual checks and data substitution.

8.2. Scope

These *data validation procedures* ~~in this chapter~~ are made under rule 314(2) of the NGR, which is to ~~They~~ cover the automated validation and substitution parameters to be applied to CTMs ~~DMs~~ and *gas quality monitoring systems*~~Gas Chromatographs~~ for which AEMO is the MDA.

8.3. Policy

The validation and substitution parameters are chosen to ensure that only valid data passes through the Metering Data Agent application (MDA application) and that invalid or missing data is substituted in a manner that gives the greatest probability of being representative of the actual flows.

Note that all data points that have failed validation receive an automatic substitution and are also reviewed manually on a monthly basis.

8.4. Data Validation Process

8.4.1. Choice of Validation Parameters

The validation rules currently used in the MDA application are:

Table 14 Validation Parameters

Rule	Description
Missing Record	Check for missing data
Tolerance	Checks the array data is within acceptable tolerance limits
High Low	Check for data outside specified (upper and lower) limits

~~Table 10~~

~~Rule~~	~~Description~~
~~Missing Record~~	~~Check for missing data~~
~~High Low~~	~~Check for data outside specified (upper and lower) limits~~

No parameters are required for the "Missing Record" validation rule.

The "Tolerance" Rule is outlined in the equation below. The rule utilises a comparison between the metering array data received~~,~~ and a calculated average based on real-time data. The tolerance is calculated as per the below equation:

$$Tolerance = \frac{ABS(Metering\ Data - Real\ Time\ Average)}{Max(Real\ Time\ Average, C)} \times 100\%$$

Where C = 40 GJ or 1 kscm

The calculated real time average of periodic instantaneous data over the same interval as the *metering data*. *Metering data* refers to the array data which AEMO receives from the on-site flow computer. AEMO will then set a tolerance limit for each meter, which will vary based on meter class, type and flow variability. If the Tolerance is outside these limits, the *metering data* will be flagged for substitution.

The "High Low" validation rule requires the setting of both a low and a high limit. The low limit should always be set to zero. All meters can show valid zero flow albeit during abnormal transmission system operation.

The high limit should be set to represent the *maximum valid capacity* of the metering site. The *maximum valid capacity* will be the lower of the *maximum physical capacity* of the site and the maximum *gas* consumption that the metering site feeds. In determining the *maximum valid capacity*, the calibrated range of the metering device also needs to be taken into account.

The determination of the *maximum physical capacity* will depend on the nature of the site:

- (a) Turbine meters are usually fitted with a critical flow nozzle ("sonic nozzle") down-stream, which limits the maximum actual volume flow through the meter to less than 120% of the design capacity of the meter. The *maximum valid capacity* can thus be calculated from the maximum *actual flow* through the meter/nozzle combination at the maximum expected supply pressure.
- (b) Rotary meters will have a nominated maximum actual design capacity (and may be fitted with a critical nozzle). The *maximum valid capacity* can thus be calculated from the maximum *actual flow* through the meter at the maximum expected supply pressure.
- (c) Coriolis meters do not have a sharply defined physical limit on flow capacity. They are capable of measuring flows even when the pressure drop becomes unacceptably high from a supply perspective. The *maximum valid capacity* is more closely aligned to the calibrated range and could be set at values up to twice the calibrated range, as the change in meter factor is small at high flows.
- (d) Ultrasonic meters are usually limited by a maximum *gas* velocity, which equates to a maximum actual volume flow through the meter. The *maximum valid capacity* can thus be calculated from the maximum *actual flow* through the meter at the maximum expected supply pressure.
- ~~Orifice meters are usually limited by the maximum range of associated differential pressure transducers. The maximum actual volume flow rate is determined by the meter design.~~

The determination of the maximum *gas* consumption at a metering site depends on the facilities downstream of the *metering installation*.

For some sites, the maximum flow may be much smaller than the design capacity of the site. For these sites an upper limit between the design capacity of the site and normal maximum flows would be appropriate.

8.4.2. Choice of Substitution Parameters

The automated substitution rules currently used in the MDA application are:

Table 15 Substitution Parameter Values

Substitution rule	Description – Replace invalid (or missing) data as indicated
Calculation	Calculated substitution.
Default	Fixed site specific figure
Prev. Valid	Use last previous valid data (for set number of hours)
Like site	Use data from similar site (with appropriate scaling)
Prev. Week	Use data from a similar day of the week (at same time of day)
Prev. Next	Not used for automated validation
Energy	Not used for automated validation
Like Day	Not used for automated validation
Week Average	Use the average of data from a week of valid data
Month Average	Use the average of data from a month of valid data

~~Table 11~~

~~Rule~~	~~Description – Replace invalid (or missing) data as indicated~~
~~Default~~	~~Fixed site specific figure~~
~~Prev. Valid~~	~~Use last previous valid data (for set number of hours)~~
~~Like site~~	~~Use data from similar site (with appropriate scaling)~~
~~Prev. Week~~	~~Use data from a similar day of the week (at same time of day)~~
~~Prev. Next~~	~~Not used for automated validation~~
~~Energy~~	~~Not used for automated validation~~
~~Like Day~~	~~Not used for automated validation~~
~~Week Average~~	~~Use the average of data from a week of valid data~~
~~Month Average~~	~~Use the average of data from a month of valid data~~

The choice of which of the above rules are used and the order in which they are used depends on the nature of *gas* flows through the *metering installation*. It is best to consider the likely flow behaviour (load) of the site over a full year in determining the substitution parameters for any particular site. ~~Note that each rule can be applied only once, and that no rule after the "DefaultCalculation" rule will be applied.~~

The "Calculation" rule will be used as the final substitution for all meters managed by the MDA application. The Calculation rule is a time-weighted average of periodic instantaneous values over the hour.

The next rule is the "Default", which is a fixed site specific value determined for the *metering installation*.

The ~~general scheme~~next step, in general, is to use "Prev. Valid" for a number of hours depending on the hour-to-hour volatility of the load. If the load is likely to undergo significant changes between consecutive hours (for example *gas* fired power ~~power~~ generation or predominantly domestic loads), then one or two hours would probably be the most appropriate. The shorter period would be used for sites that change more rapidly. If the load is relatively constant (for example chemical plants using *gas* as a feedstock) then four () hours would

probably be the most appropriate. ~~-~~The length of time that "Prev. Valid" should be used depends on judgement and past experience, and longer times may be appropriate.

The next rule is based on the yearly flow behaviour. ~~-~~This could be a "Default" value for a site with a near constant load or could be "Prev. Week" for sites that show a weekly cycle and which probably also show a season-to-season cycle. AEMO has found that some sites show similar weekly and season-to-season cycles, only differing from each other in the scale of the flows. For these sites, the "Like Site" substitution can be used, where substitution is based on a site with similar flow behaviour and an appropriate scaling factor. ~~-~~These sites are often sites with significant (temperature dependant) domestic load and similar percentages of industrial (temperature independent) base~~-~~ load.

The "Week Average" rule used in situations where the load may be erratic and show no regular weekly cyclic behaviour and "Month Average" rules is used in situations where the site may show significant week-to-week variations.

The final rule applied is usually the "Default" rule to capture the remote possibility of system fault where previous rules cannot be applied. The default value for sites that show season-to-season variations should be based on the midpoint between the summer and winter flows.

8.4.3. Special Cases

During field commissioning and testing of new metering sites, it would be usual to set the validation rules to zero to force a substitution and set the substitution to default zero so that any spurious test signals are replaced by zero in the *market* systems. The more appropriate validation and substitution rules are then implemented when the field commissioning is completed.

Gas quality monitoring systems (measuring ~~H~~heating values and gas composition) ~~from *gas chromatographs* generally~~ have a similar set of validation and substitution rules unless specific situations require particular rules. The validation rules are "Missing Record" and then "High Low" with upper and lower parameters 44.2 and 34.9 (MJ/m^3) respectively. The substitution rules are previous valid (typically for 24 hours) and then "Default" with a reading of 38.66 (MJ/m^3).

Gas quality monitoring systems~~Gas chromatographs~~ that are monitoring *primary gases* (other than methane), such as at Hydrogen or Biogas facilities, may have altered upper and lower parameters. These parameters will be determined on an individual basis by AEMO and may include the use of a *primary gas* (i.e. Hydrogen) analyser.

Where a *meter*ing installation or *gas quality monitoring systems*~~*gas chromatograph*~~ is known to be likely to be giving false readings, substitutions can be forced to occur by setting the validation limits to fail all readings, for example by setting the upper parameter to the same as the lower parameter.

AEMO may utilise the heating value allocation model to determine the heating value and gas composition data at these monitoring points.

8.4.4. Recording Parameter Approval and Changes

Validation and substitution parameters are recorded in AEMO's *MDA application*. When changes are made to these parameters, they are reviewed, recorded as part of a change process and in the *MDA application*, and published on the *MIBB*.

8.4.5. Review of Validation and Substitution Parameters

Validation and substitution parameters are reviewed as necessary when installations are brought on-line or significantly modified. Ad hoc reviews are conducted when inappropriate validations or substitutions are detected during the review of meter substitutions carried out each month. Complete review of substitutions parameters at all sites should be carried out at 5 yearly intervals. Validation limits should be reviewed when meters are upgraded or replaced and whenever validation limits are breeched during abnormal periods of high flow.

9. Election of Responsible Person

9.1. Introduction

The election of a *responsible person*, as allowed by Part 19, Division 3 Technical Matters, Subdivision 4 Metering, requires the *responsible person* to undertake a number of obligation in regards to metering.

This section allows for the election of a *responsible person* for metering.

9.2. Scope

The purpose of this document is to identify and confirm the Authorisation of the *responsible person* whose responsibilities are stated in the Rules, -Technical Matters, Part 19 Division 3, subdivision 4 or the election of an Authorised Person who is a known representative of a Participant Organisation in the Victorian DWGM.

Additions/additional authorisations of *responsible persons* require this form to be updated by the Participant Organisation and signed by a known signatory.

This Procedure only applies to the *market* (including *DTS metering installations* and *DTS* connected *DDS metering installations*)~~,~~ unless there is an agreement or regulatory instrument specifying otherwise.

9.3. Process to Election a Responsible Person

The process requires:

(a) The participant must be a *Registered participant* under Part 19 of the Rules.

(b) The participant downloads the form 'Election of Responsible Person' from AEMO's website.

(c) The participant submits the form to AEMO's Support Hub.

(d) The participant is required to provide the 'Election of Responsible Person' form to AEMO, and the DTS SP, or Distributor, as required by the connection agreement for which the connection has a *metering installation*.

(e) AEMO will inform the *responsible person* of the date from which they are responsible for metering obligations.

Version release history

Version	Effective date	Summary of changes
1.0	9 January 2017	First Issue of procedures replacing separate procedures and includes a summary of the release history for each separate procedure: 1. Wholesale Market Metering Uncertainty Limits and Calibration Requirements Procedures (Victoria) 2. Wholesale Market Energy Calculation Procedures (Victoria) 3. Wholesale Market Metering Communications Procedures (Victoria) 4. Wholesale Market Installation Database Procedures (Victoria) 5. Wholesale Market Metering Register Procedures (Victoria) 6. Wholesale Market Data Validation Procedures (Victoria)