Westcoast Measurement Policy

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Policy

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Westcoast Measurement Policy

1. Purpose

The purpose of this policy is to ensure custody transfer measurement facilities on the Westcoast Energy Inc. (Westcoast) pipeline system are designed, constructed, operated, and maintained in accordance with Westcoast requirements based on regulatory, contractual and industry best practices. The requirements in the main body of this document are supplemented through various measurement standard documents that are linked to from within this document and are subject to regular updating. It is the user's responsibility to ensure they are using the most recent version of this policy and the supplemental measurement standard documents.

Additional measurement and contractual requirements not covered within this policy may be found in the Westcoast Pipeline Tariff General Terms and Conditions - Service (GT&C) Articles 11 through 15. In the event of a conflict between this policy and the GT&C, the GT&C will prevail.

2. Scope

This policy applies to all natural gas custody transfer metering facilities connected to the Westcoast pipeline system. The requirements apply in whole to all new metering facilities, as well as deactivated metering facilities if they are to be reactivated. Existing metering facilities that have been active up to the date of this policy's publication may be granted minor exemptions upon review and approval by Westcoast Measurement Technical Services in consultation with Westcoast Measurement Engineering.

Measurement requirements are based on the Canadian *Electricity and Gas Inspection Act* (EGI Act) and associated Electricity and Gas Inspection Regulations (EGI Regulations), Measurement Canada (MC) policies, procedures and specifications, and Westcoast business needs. Regardless of ownership, the design and installation of metering facilities must adhere to the requirements of this policy and the latest edition (at the time of installation) of the standards, codes, or other documents referenced herein.

The following metering facilities are subject to this policy and must meet its requirements:

- Receipt point metering facilities
- Delivery point meter facilities
- Compressor fuel gas metering facilities
- Receipt point third party pressure control and overpressure protection (PCOPP) systems
- Delivery point PCOPP systems

The Westcoast pipeline is federally regulated however in some cases provincial regulatory requirements may dictate additional design, installation, operational or maintenance requirements. In such cases it is the responsibility of the metering facility owner to ensure the provincial requirements are being met.

3. Terms and Definitions

Table 1 lists the terms contained in this document and their definitions.

Table 1: Terms and Definitions

TERM	DEFINITION
Customer	Owner of the pipeline or facilities connecting to the Westcoast pipeline at a delivery or receipt point
Deactivation	Within the context of this policy means to close and lock the Westcoast tie-in valve to prevent the flow of gas from a receipt point onto the Westcoast pipeline, or from the pipeline to a delivery point
Delivery Point	Within the context of this policy means the point at which custody of the gas transfers from Westcoast to the receiving party, which may or may not be the same location as the delivery metering facility
High Intervention	A category, defined pursuant to the EGI Act and MC Bulletin G-14, that requires in-use custody transfer gas measurement equipment be verified and sealed by MC
IFC Drawings	Issued for construction drawings
Inspection	An inspection by Westcoast of a receipt or delivery metering facility to ensure it meets the requirements of this policy
Lateral Pipeline	A pipeline constructed, owned, maintained and operated by a customer that connects its meter station to the Westcoast pipeline tie-in
Low Intervention	A category, defined pursuant to the EGI Act and MC Bulletin G-14, that allows custody transfer gas measurement equipment to be put in-use without verification and sealing by MC
Measurement Canada	An agency of Innovation, Science and Economic Development Canada responsible for ensuring accuracy in the selling of measured goods, developing and enforcing the laws related to measurement accuracy, approving and inspecting measuring devices and investigating complaints of suspected inaccurate measurement
Metering Facility	A collection of piping and measurement equipment designed to account for the custody transfer of natural gas, which may be in the form of a receipt meter station, delivery meter station, pipeline interconnect, producer return fuel metering, dedicated producer fuel delivery metering, or compressor station fuel gas metering
Meter Station	A distinctive self-contained receipt or delivery point metering facility that may include, but is not limited to, buildings, piping, filtration, measurement and gas sampling devices, analyzers, utilities, communication and other associated ancillary equipment. Meter stations may be located adjacent to the Westcoast pipeline tie-in location, or at the customer's central facility and connected to the Westcoast pipeline tie-in by means of a customer owned and operated lateral pipeline
Metering Facility Operator	The party responsible for physically operating and maintaining the metering facility, which may differ from the owner
Metering Facility Owner	The owner of the metering facility, which may differ from the operator
Measurement Technical Services	Westcoast Measurement Technical Services department, or its successor departments
Primary Measurement Device	The metering element (e.g., orifice, turbine, etc.) used to measure gas flow
Reactivation	Within the context of this policy means to unlock and open the Westcoast tie-in valve to allow the flow of gas from a receipt point onto the Westcoast pipeline, or from the pipeline to a delivery point
Receipt Customer	An entity from which the Westcoast pipeline receives gas
Receipt Point	Within the context of this policy means the point at which custody of the gas transfers from the customer to Westcoast (i.e., the tie-in location) which may or may not be the same location as the receipt metering facility
Secondary Measurement Device	The pressure and temperature measurement devices used for correction of measured volume to standard volume at base conditions.

TERM	DEFINITION
Start-up Notice	A formal notice from Westcoast that allows the customer to flow gas at its receipt or delivery point
Tap	An assembly of a hot tap or tee with valving and piping that provides a flanged tie-in connection to the Westcoast pipeline at the edge of its right-of-way.
Tie-in	Location at the edge of Westcoast's right-of-way where a customer connects to a tap for service, it is the point at which custody of the gas transfers between the customer to Westcoast
Tertiary Measurement Device	The electronic flow computer (EFM) used to calculate volume and energy.

4. Acronyms

Table 2 lists the acronyms used in this document and their full terms.

Table 2: Acronyms

ACRONYM	FULL TERM
AGA	American Gas Association
ASTM	American Society for Testing and Materials
CSA	Canadian Standards Association
EFM	Electronic Flow Measurement
GC	Gas Chromatograph
GT&C	General Terms and Conditions – Service included as part of the Westcoast Pipeline tariff
HCDP	Hydrocarbon Dew Point
MC	Measurement Canada
PCOPP	Pressure Control and Overpressure Protection
RTD	Resistance Temperature Detector
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition

5. Gas Measurement Standards

The measurement of gas for all Westcoast custody transfer metering facilities must comply with the following regulations and standards:

- EGI Act and EGI Regulations
- American Gas Association (AGA) Reports No. 3, 7, 8, 9, 11
- Gas Processors Association (GPA) 2145, 2166, 2172, 2261, 2286
- Canadian Standards Association (CSA) Z662 latest revision
- American Society for Testing and Materials (ASTM) D5504

The standards and regulatory requirements that must be adhered to include, but are not limited to, the following:

1. Volume and energy must be determined and reported in the International System of Units (SI) at standard base conditions of 101.325 kilopascals (kPa) and 15 degrees Celsius (ºC).
2. All gas volumes must be determined and reported to the nearest tenth of a thousand cubic meters (0.1 E3m3).
3. All energy equivalents must be determined and reported to the nearest gigajoule (GJ).
4. The preferred units of measure for temperature and pressure are SI but they may be reported in Imperial so long as the units are consistent once selected. For differential pressures reported in inches of water column, the reference temperature of the water column must be 60 degrees Fahrenheit (ºF).
5. Atmospheric pressure (Pa) must be calculated using either of the following equations, based on the actual elevation of the meter above mean sea level as determined by a survey carried out by a registered surveyor or as determined from the most recent applicable topographical maps published by the BC Ministry of Energy, Mines and Low Carbon Innovation.
    - Pa (kPa) = 101.560 - (0.0113 x elevation in meters)
    - Pa (psia) = 14.73 - (0.0005 x elevation in feet)
6. Metered volumes of gas at flowing conditions must be corrected to base conditions and for deviations from the Ideal Gas Law by applying temperature, pressure and compressibility factors in accordance with the applicable provisions of the EGI Regulations.
7. Volumes of gas through orifice meters must be determined in accordance with the referenced edition of AGA Report No. 3, “Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids”, Part 3, “Natural Gas Applications” in Measurement Canada S-G-03–Specifications for the approval of type of gas metering devices–Part 5.
8. Volumes of gas through velocity and positive displacement meters must be determined in accordance with the referenced edition of AGA Report No. 7, “Measurement of Gas by Turbine Meters” in MC S-G-03–Specifications for the approval of type of gas metering devices–References.
9. Mass measurement of gas through mass meters must be determined in accordance with the referenced edition of AGA Report No. 11, “Measurement of Natural Gas by Coriolis Meter” in MC S-G-03–Specifications for the approval of type of gas metering devices–References.
10. Gas compressibility factors must be determined in accordance with the referenced editions of AGA Report No. 8 Part 1 “Thermodynamic Properties of Natural Gas and Related Gases, Detail and Gross Equations of State”, the Detailed Characterization Method only, or AGA Report No. 8 Part 2 “Thermodynamic Properties of Natural Gas and Related Gases, GERG-2008 Equations of State” in MC S-G-03–Specifications for the approval of type of gas metering devices–References. Exceptions to use the Gross Method of AGA Report No. 8 Part 1, or AGA NX-19, may be granted upon review by Westcoast Measurement Technical Services to metering sites flowing less than 28.33 103m3 per day (1.0 mmscf/day).
11. Heating values must be determined in accordance with the latest edition of GPA Standard 2172 “Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer”.

12. Physical constants must be based on the latest edition of GPA Standard 2145, “Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry”.

6. Facility Tie-In Application

Prospective or current customers requiring a connection to the Westcoast Pipeline must submit a written request to Westcoast, execute any necessary backstopping agreements, and provide required funding prior to the construction and installation of the facility. The following requirements apply.

1. The customer must contact Westcoast Commercial Services to discuss connection requirements.
2. The customer must complete and return a Tap Application Form ensuring that all required information is included. The location of the tap and metering facility is subject to approval by Westcoast. Year-round site access is a requirement. In some instances, Westcoast may require that a customer tie into an existing tap being used by another customer. The Tie-In Coordinator will, in consultation with Westcoast Operations and the Lands and Right-of-Way Department, contact the customer as to the approved location for the tap.
3. The customer must receive written approval by Westcoast of all facility designs prior to fabrication/construction.
4. The customer must provide to Westcoast a detailed site plan as well as piping plans and isometrics showing all related proposed equipment/facilities (e.g.,, pigging, metering, flaring, etc.) to be located adjacent to the Westcoast pipeline and/or at the customer’s central facility. Drawings should be provided to Westcoast as early as practicable, and in any event prior to fabrication/construction.
5. The customer should submit its completed Tap Application Form to Westcoast with as much notice as possible to allow Westcoast to properly plan and execute any work required. The time to approve the installation will depend on the type of tap and facilities required.
6. The customer should provide Westcoast with regular updates on the facilities installation progress so as not to delay installation of the tap and tie-in.
7. The customer must ensure its facilities comply with the requirements of this policy. Otherwise, a delay in issuing the Start-Up Notice may result.

7. Facility Ownership and Operation

Ownership of metering facilities and the responsibility for their operation is to be determined on a case-by-case basis by Westcoast Commercial Services.

Where it has been determined that a metering facility may be owned and operated by a third party, the requirements of this policy still apply to that facility.

Where it has been determined that a metering facility may be owned by a third party but operated by Westcoast, the metering facility owner must enter into an agreement with Westcoast for operation, maintenance, and any necessary upgrading of the facility.

8. Auditing

Westcoast or an independent auditor contracted by Westcoast will perform internal audits when business circumstances demand it. As per the GT&C, customers are also able to audit the system or contract an agent to do so on their behalf. In all cases, corrections to calculated or allocated amounts will be made as per the policy specified in the Shipper Handbook - Residue Gas and Product Allocations document.

9. Records Retention

Metering facility operators must maintain all measurement equipment and data records for a period of at least 12 months after the date the meter location ceased to be used. The records must include all data and information as prescribed in theEGI Act and EGI Regulations. This includes, but is not limited to:

- Hourly and daily volume and energy historical records for each billing period
- All information used in calculating the volume and energy for each historical record (e.g., orifice meter dimensions, linear meter output, differential pressure, static pressure, gas temperature, gas composition, etc.)
- Event and alarm logs
- Electronic Flow Measurement (EFM), transmitter and meter calibrations and MC verifications/reverifications
- Configurations and other changes affecting the meter operation

Metering facility operators must download and store electronically all data at a frequency that allows a continuous audit trail to be established. That is, the download period must be shorter than the storage capability of the EFM device to ensure no data is lost.

10. Measurement Canada Requirements

Equipment used for gas measurement-based trade use (i.e., custody transfer measurement) must meet certain legislative requirements under the EGI Act, administered through MC, which requirements must be met before devices can be legally used for custody transfer measurement.

10.1 Notice of Approval

All equipment used for custody transfer measurement of gas volume and energy must have a Notice of Approval issued by MC, which indicates the device has been tested and is approved for measurement-based trade use in Canada. Equipment must be sized to operate within the approved minimum to maximum flow rates indicated in the Notice of Approval. Measurement equipment that does not have a Notice of Approval cannot be legally used.

10.2 Equipment Numbering

All custody transfer measurement equipment must be tagged and identifiable with a unique and permanent equipment number (badge number) assigned by Westcoast's Asset Data Management (ADM) group using its computerized maintenance management system.

Equipment numbers should:

- Be obtained from ADM prior to ordering measurement equipment;
- Be specified on purchase orders;
- Be permanently attached by the manufacturer and/or fabricator to the delivered equipment, and
- Be indicated on all manufacturer, fabricator, and government inspection certificates.

All manufacturer, fabricator, and government inspection certificates must be forwarded to Westcoast in a timely manner as per 14.6 - Reporting and Notifications.

10.3 Inspection and Sealing

Generally, measurement equipment having a Notice of Approval must still be inspected in the field or shop and approved by a MC inspector or accredited service provider. Following a successful inspection, the inspector or accredited service provider will seal the measurement equipment with a stamp or wire seal and issue a site specific Inspection Certificate.

All measurement equipment categorized as High Intervention under MC Bulletin G-14 must be inspected, sealed, and issued a valid Inspection Certificate by MC prior to and/or as the equipment is being put into service.

Measurement equipment categorized as Low Intervention under MC Bulletin G-14 does not need to be inspected, sealed, or issued an inspection certificate by MC. Westcoast may perform its own inspection of Low Intervention measurement equipment.

Specific inspection and calibration requirements related to the various types of measurement equipment are outlined in the following sub-sections.

10.3.1 Orifice Meter Runs

For new meter installations, the orifice meter run should be inspected by MC at the manufacturer's shop prior to shipment. During the meter run inspection, the measurement of the inside diameter (ID) of the meter run should be completed by the manufacturer, witnessed by MC, and then stamped on the permanent meter run tag.

All orifice plates used with custody transfer approved orifice meters must be inspected, certified, and stamped by MC or an accredited meter verifier.

10.3.2 Linear and Mass Flow Meters

Turbine, ultrasonic, and Coriolis meters used in high pressure gas applications require a high pressure calibration to be completed at the time of certifying the meter. Typically, the high pressure calibration is completed at the average operating pressure that the meter will be measuring at.

10.3.3 Rotary and Diaphragm Meters

Rotary and diaphragm meters, regardless of average operating pressure, require atmospheric testing be completed at the time of certifying the meter.

11. Westcoast Inspection Requirements

All new and reactivated metering facilities must be inspected by Westcoast to ensure adherence with this policy prior to being issued a Start-Up Notice and allowed to flow gas. The metering facility owner and/or operator are responsible for ensuring the following items, where applicable, are prepared prior to inspection:

- Confirmation that metering facility piping, instrumentation and general construction matches the Westcoast Measurement Technical Services approved piping and instrumentation diagrams (P&IDs) and IFC drawings
- Main and UPS power are supplied to the metering facility
- EFM and RTU program loads have been installed and properly configured
- Communication with Westcoast's SCADA system has been established
- Primary, secondary, and tertiary measurement devices are calibrated
- Gas quality analyzers are calibrated and operating correctly
- Connecting lateral pipeline has been pressurized with natural gas and dried to less than or equal to 4 lbs/mmscf of water vapour
- PCOPP systems are installed, calibrated, tested and operating correctly

Once preparation of the items above is complete, Westcoast will perform an inspection and either conduct or witness equipment function testing to ensure compliance.

For equipment categorized as High Intervention under MC Bulletin G-14, the metering facility operator must arrange for the required MC inspection and sealing.

The Westcoast inspector will forward a copy of all internal inspection related documentation to Westcoast Measurement Technical Services.

Westcoast may from time to time perform an inspection of the metering facility and PCOPP equipment to ensure continued adherence with this policy and confirm no unauthorized changes have been made.

12. Metering Facility Design, Fabrication and Construction

The metering facility owner is responsible for designing, fabricating and constructing metering facilities as per the requirements of this section.

12.1 General Requirements

General requirements for the design and installation of all metering facilities are as follows:

- Meter stations must be located within 30 metres of the Westcoast right-of-way unless justification for another location is provided by the metering facility owner and approved by Westcoast, in which case a Lost Gas Indemnity Agreement covering the lateral pipeline must be signed by the metering facility owner.
- An anchor block or alternative mitigation must be installed on the customer's pipeline no farther than 15 m (50 ft) from the tie-in point at the edge of the Westcoast pipeline right-of-way to ensure no excessive loads are imposed on Westcoast piping.
- Unless located on Westcoast property, meter stations must be separately fenced from other third party facilities, and include an all weather access road, one vehicle gate and at least one separate person gate to allow alternate emergency egress.
- The design and installation of receipt meter station lateral pipelines must include provision(s) to prevent contaminants from being pigged directly into the meter station and Westcoast pipeline during initial commissioning and normal operation. The proposed provision(s) may include the

installation of a separator, specialized filtration, a shut down system or other controls at the receiving end of the lateral pipeline and must be approved by Westcoast Measurement Technical Services.

- All metering facilities must have a remote communications link installed between the EFM/RTU devices and the Westcoast SCADA system unless previously exempted or otherwise agreed to in writing by Westcoast Measurement Technical Services. Westcoast will supply, install, and maintain the required primary and secondary communications and network equipment.
- All devices used for custody transfer measurement must have a MC Notice of Approval and be approved by Westcoast for use on its system.
- Flow meters must be flow calibrated or proved at a recognized facility as per the requirements of the meter's MC Notice of Approval and calibration instructions issued by Westcoast Measurement Technical Services.
- Non fiscal measurement devices such as filter/separators, regulators, analyzers, valves, safety devices, uninterruptible power supplies, communication equipment, must be approved by Westcoast for use on its system.
- Check valve(s) must be installed downstream of receipt and delivery point metering to prevent unintended backflow of gas.
- PCOPP systems must be installed and maintained either upstream or downstream of receipt meter stations to prevent gas from being delivered into the Westcoast pipeline at a pressure exceeding the maximum pressure detailed in the GT&C.
- All electrical cabling and installations must conform to the Canadian Electrical Code and applicable provincial electrical code.
- All installed equipment/devices that vent gas must be tubed to discharge to a safe location outside the meter building.

12.2 Buildings

The building requirements for Westcoast metering facilities are as follows:

12.2.1 Meter Buildings

Metering equipment must be rated for and enclosed within a Class 1, Zone 1 rated prefabricated meter building of suitable size allowing unobstructed access to operate and maintain equipment (e.g., gas piping, metering, analyzers, gas chromatograph, ESD valve, auxiliary equipment) and provide proper emergency egress. The meter building must include gas detection installed with a strobe light both inside and outside the building.

Exceptions to this requirement may be considered only for delivery metering facilities flowing less than 28 10^3m^3/day (1 mmscfd), upon review and written approval by Westcoast Measurement Technical Services.

12.2.2 Instrument/MCC Buildings

Metering equipment rated for general purpose use only must be enclosed within a prefabricated general purpose instrument building of suitable size allowing unobstructed access to operate and maintain equipment (EFM, RTU, UPS, communication modems, etc.) and provide proper emergency egress.

Exceptions to this requirement may be considered only for delivery metering facilities flowing less than 28 10^3m^3/day (1 mmscfd), upon review and written approval from Westcoast Measurement Technical Services.

12.2.3 Prefabricated Buildings

Prefabricated buildings must be constructed of all metal and non-combustible materials with the floor, walls and roof being properly insulated. The building must include adequately sized heating (electric when practicable), interior and exterior lighting, louvered ventilation, proper emergency egress, and where necessary LEL gas detection connected to the meter station RTU and a powered exhaust fan.

12.3 Power

The power requirements for Westcoast metering facilities are as follows:

12.3.1 Receipt Metering Facilities

Receipt point customers must provide main AC power if the meter station is to be located on the customer's facility lease. Meter station instrument building must include a self-contained 120 VAC uninterruptible power supply (UPS) capable of providing 48 hours of full back up power to the meters, flow computers, gas chromatograph (GC), H2S & H2O analyzers, RTUs, gas detection and communications systems to allow for safety monitoring and accounting of any fuel gas pulled back by the customer during its facility power outage.

Upon complete failure of power from the customer's facility and the meter station UPS the meter station must fail safe and shut in.

12.3.2 Delivery Metering Facilities

Delivery metering facilities must include a UPS capable of providing a minimum of 15 days back up power to the EFM devices only.

12.4 Piping and Headers

The piping and header requirements for Westcoast metering facilities are as follows:

12.4.1 Piping

The maximum design gas velocity for piping in metering facilities is 24.4 m/sec (80 ft/sec) and must not be exceeded. Round edged piping components (e.g., elbows, extruded tees) must be used in the main gas piping for all directional changes in the gas flow.

12.4.2 Headers

Where required for parallel meter runs, headers must be designed such that the cross sectional area of the header is 1.5 times the sum of the meter run cross sectional areas.

Headers must be formed as a single extruded component or fabricated from multiple extruded tees with rounded edge branches.

12.5 Primary Flow Measurement Devices

The meter types acceptable for use in metering facilities on the Westcoast system are:

- Coriolis
- Diaphragm
- Orifice

- Rotary
- Turbine
- Ultrasonic

Refer to the Westcoast Measurement Equipment Listing for specific makes and models of meters approved for use at Westcoast metering facilities.

12.5.1 Coriolis Meters

Coriolis meters may be used for receipt, delivery or fuel gas applications depending on the required flow rate. The installation of Coriolis meters must meet the following requirements:

- Installation must comply with MC Notice of Approval installation requirements, AGA Report No. 11 requirements, and the manufacturer's recommended installation instructions.
- The meter must be installed in a horizontal position with the flow tubes orientated upward, or in a vertical position with the direction of flow downward.
- The meter must not be installed near electromagnetic fields or on vibrating piping.
- Meter piping must not induce stress on the meter body during and after its installation.
- A meter bypass must be installed with double block and bleed valves to safely bypass and isolate the meter.
- Pressure and temperature transmitters should be installed for the purpose of monitoring process conditions at the meter but are not required for custody transfer measurement.

12.5.2 Diaphragm Meters

Diaphragm meters may only be used for small volume, low pressure applications with appropriately designed pressure regulation and flow restrictors. The installation of diaphragm meters must meet the following requirements:

- Installation must comply with the MC Notice of Approval installation requirements and the manufacturer's recommended installation instructions.
- Stand-alone manual meters without connection to an EFM device must be of the temperature converting (TC) type with a base temperature of 60ºF.
- Meters connected to an EFM device must be of the standard non-compensating type.
- Static pressure must be taken from the pressure tap located on the diaphragm meter body.
- The thermowell must be installed within eighteen (18) inches of upstream side of the diaphragm meter body. The tip of the thermowell must be located within the center third of the inside pipe diameter.
- An appropriately sized flow restrictor must be installed downstream of the meter to prevent damage from over-speeding during high flow events such as a station ESD, piping blowdowns, and pressurizations.

12.5.3 Orifice Meters

Orifice meters may be used for receipt, delivery or fuel gas applications depending on the required flow rate. The installation of orifice meters must meet the following requirements:

- Installation must comply with the MC Notice of Approval installation requirements, AGA Report No. 3 requirements, and the manufacturer's recommended installation instructions.
- Meter sizing must be based on a maximum differential pressure of 50 kPa (200" WC).
- The meter fitting must be a dual chamber design enabling orifice plate removal without shutting in production.

- The meter run must be designed as per the provided Westcoast typical drawing and include a CPA 50E or CPA 55E flow conditioner as specified by Westcoast Measurement Technical Services.
- The meter run must be manufactured, inspected and certified as meeting the latest requirements of AGA Report No. 3 (API Chapter 14.3) at the time of its fabrication.
- At receipt metering facilities, a combination filter/separator must be installed upstream of the meter.
- The meter run must be installed with flow in a horizontal direction with the fitting oriented in an upright position.
- The downstream meter tube must include a minimum of four NPS ¾" threadolets to accommodate thermowells, venting and inspection.
- Two thermowells must be installed in the first two threadolets downstream of the orifice fitting, with their tips extending to the center third of the pipe.
- Static pressure must be taken from the upstream tap on the meter.
- The meter tube internal diameter (D_r - calculated at a reference temperature of 20°C (68°F)) to be used in flow calculations must be obtained from the most recent MC or approved Westcoast contractor orifice meter run inspection certificate/report or the original manufacturer's inspection certificate. This value is the average of a minimum of four equally spaced internal diameter measurements made in a plane 2.5 cm (1") upstream from the upstream face of the orifice plate corrected to the reference temperature.
- The orifice plate bore diameter must be no smaller than 12.7 mm (0.5 inches). In order to meet the uncertainty guidelines for AGA Report No. 3, the recommended allowable range of useable beta ratios is 0.2 - 0.6.
- The upstream facing edge of the orifice plate bore must be square and sharp (i.e., a beveled orifice plate must have the square edge facing upstream and the beveled edge facing downstream).
- The orifice plate bore diameter (d_r - calculated at a reference temperature of 20°C (68°F)) to be used in flow calculations must be obtained from the size stamping on an inspected and approved orifice plate.
- To minimize uncertainty in measurement accuracy, differential pressure operating ranges must be maintained within 10-90% of the calibrated range of the differential pressure transmitter. Operating below 10% should result in the orifice plate being decreased in size or if beyond the lower limit of meter capacity then the meter should be re-sized. Similarly, operating above 90% should result in the orifice plate being increased in size or if the meter is beyond the higher limit of the meter capacity, then the meter should be re-sized.

12.5.4 Rotary Meters

Low pressure and high pressure rotary meters may be used for delivery applications depending on the required flow rate. However, due to the high failure rate caused by station emergency shut down events, high pressure rotary meters should not be used in compressor fuel gas applications. The installation of rotary meters must meet the following requirements:

- Installation must comply with the MC Notice of Approval installation requirements and the manufacturer's recommended installation instructions.
- A dry gas strainer or filter with 100 mesh or smaller must be installed upstream of the meter.
- A thermowell, with its tip located within the center third of the inside pipe diameter, must be installed within 45.7 cm (18") from the upstream side of the meter.
- Static pressure must be taken from the inlet pressure tap on the meter body.
- The meter must have valving installed on its body to allow for differential pressure testing.

- A meter bypass must be installed with double block and bleed valves to safely bypass and isolate the rotary meter.
- In applications where meter over-speeding may occur (e.g., station emergency shutdown and venting, rapid re-pressurization, etc.) an appropriately sized flow restriction orifice or nozzle must be installed downstream of the rotary meter to prevent damage.

12.5.5 Turbine Meters

Turbine meters may be used for delivery or fuel gas applications depending on the required flow rate. However, they are less preferred than other modern meter types such as low and high pressure ultrasonic meters. The installation of turbine meters must meet the following requirements:

- Installation must comply with the MC Notice of Approval installation requirements, AGA Report No. 7 requirements, and the manufacturer's recommended installation instructions.
- At minimum, a dry gas filter specified to remove particles 10 microns and larger from the gas stream must be installed upstream of the meter. Sites with known gas quality liquid issues must have a combination filter/separator installed upstream of the meter.
- The meter must be installed in an upright position with flow in a horizontal direction.
- The meter run must include a CPA 50E or CPA 55E flow conditioner as specified by Westcoast Measurement Technical Services.
- Static pressure must be taken from the pressure tap on the turbine meter body.
- A thermowell, with its tip located within the center third of the inside pipe diameter, must be installed between one and five nominal pipe diameters from the meter outlet but upstream of any valve for flow restrictor.
- In applications where meter over-speeding may occur (e.g., station emergency shutdown and venting, rapid re-pressurization), an appropriately sized flow restriction orifice or nozzle must be installed downstream of the meter to prevent damage.
- A meter bypass must be installed with double block and bleed valves to safely bypass and isolate the meter.
- For NPS 2 and larger turbine meter runs, a flow restricted meter run blowdown valve, not larger than one-sixth the nominal size of the meter run piping, must be installed.
- For NPS 2 and larger turbine meter runs, a ¾" or smaller bypass must be installed around the upstream meter isolation valve to allow for slow pressurization and prevent meter overspeed during start-ups. The rate of pressurization and depressurization must not exceed the manufacturer's stated maximum.

12.5.6 High Pressure Ultrasonic Meters

High pressure ultrasonic meters may be used for receipt, delivery or fuel gas applications depending on the required flow rate. The installation of high pressure ultrasonic meters must meet the following requirements:

- Installation must comply with the MC Notice of Approval installation requirements, AGA Report No. 9 requirements, and the manufacturer's recommended installation instructions.
- Meter sizing must be based on a minimum velocity of 1.5 m/sec (5 ft/sec) and maximum velocity of 24.4 m/sec (80 ft/sec) through the meter body.
- At producer receipt points, a combination filter/separator must be installed upstream of the meter.

- The meter must be installed in an upright position with flow in a horizontal direction.
- The meter run must be designed as per the provided Westcoast typical drawing and include a CPA 50E or CPA 55E flow conditioner as specified by Westcoast Measurement Technical Services.
- Static pressure must be taken from the pressure tap on the ultrasonic meter body.
- A thermowell, with its tip located within the center third of the inside pipe diameter, must be installed between three and five nominal pipe diameters from the ultrasonic meter outlet flange face but upstream of any valve for flow restrictor. With bi-directional meters the thermowell must be located at least 3D from either meter body flange face.
- The meter manufacturer must be consulted if a source of ultrasonic noise is close to the meter. Ultrasonic transducers typically operate near the 100 to 150 kHz range. Due consideration should be given to equipping any valve in the piping system with noise reducing trim.

12.5.7 Low Pressure Ultrasonic Meters

Low pressure, or single body battery-operated ultrasonic meters may be used for delivery applications depending on the required flow rate. The installation of low pressure ultrasonic meters must meet the following requirements:

- Installation must comply with the MC Notice of Approval installation requirements and the manufacturer's recommended installation instructions.
- A dry gas strainer or filter with 100 mesh or smaller must be installed upstream of the meter.
- Thermowell and pressure ports are typically supplied on the meter body (consult with Westcoast Measurement Technical Services if no ports are available on the meter).
- A meter bypass must be installed with double block and bleed valves to safely bypass and isolate the meter.

12.6 Secondary Measurement Devices

Metering facilities must incorporate electronic flow measurement (EFM) using pressure and temperature transmitters and a flow computer(s) connected to the Westcoast SCADA system. Refer to the Westcoast Measurement Equipment Listing for specific makes and models of transmitters approved for use at Westcoast metering facilities.

12.6.1 Pressure Measurement

Pressure transmitters and multivariable pressure transducers used as inputs to flow computers must meet the following requirements:

- Installation must comply with the MC Notice of Approval for firmware versions, approved functions and installation requirements.
- Pressure measurement, whether an integral transducer or external transmitter, must have a specified uncertainty of +/- 0.1% or better.
- The maximum allowable range for a differential pressure transmitter must be 0 to 62.5 kPa (0 to 250"WC) with the maximum operational differential pressure must not exceed 50 kPa (200"WC).
- Pressure sensing taps must include a full port ball valve to isolate pressure sensing lines.
- Pressure sensing lines must be dedicated, short coupled and not exceed 1m in length, have a downward slope of greater than 10 cm/m toward the primary device sensing tap, and made of 12.5 mm stainless steel tubing with a minimum wall thickness of 1.5 mm.

- Direct mount two valve manifolds should be used for static pressure transmitters, and direct mount five valve manifolds should be used for differential pressure transmitters in order to minimize potential leak points and gauge line errors.
- Manifold valves must have large internal process bores and valve seat diameters that are relatively consistent with the sensing line's internal diameter to prevent plugging.

12.6.2 Temperature Measurement

Temperature transmitters and multi-variable transducers used as inputs to flow computers must meet the following requirements:

- Installation must comply with the MC Notice of Approval for firmware versions, approved functions and installation requirements.
- Temperature measurement, whether through a direct RTD input or an external transmitter, must have a specified uncertainty of +/-0.28ºC (0.5ºF) or better.
- Temperature transmitters must be installed using a remote RTD probe connected to the transmitter housing with flexible armored cable so the RTD can be easily removed from the thermowell for verification and calibration procedures.

12.7 Tertiary Flow Measurement Devices

Metering facilities must incorporate EFM using a flow computer(s) connected to the Westcoast SCADA system. Refer to the Westcoast Measurement Equipment Listing for specific makes and models of flow computers approved for use at Westcoast metering facilities.

12.7.1 Electronic Flow Computers

Electronic flow computers used as EFM devices must meet the following requirements:

- The flow computer must comply with the MC Notice of Approval for firmware and software versions, approved measurement functions, audit and event logging and installation requirements.
- The flow computer must be capable of storing 35 days of both hourly and daily measurement history as listed below, depending on the primary flow meter type, and include internal battery backup to maintain the storage of historical data in the event of a power supply failure.
    - hourly flow time
    - hourly K-factor
    - hourly number of pulses
    - hourly uncorrected volume
    - hourly mass
    - hourly orifice plate size
    - hourly average differential pressure
    - hourly average static pressure
    - hourly average flowing gas temperature
    - hourly average gas composition
    - hourly average heating value

  - hourly average relative density
  - hourly and daily corrected volume total
  - hourly and daily corrected energy total
- Access to the flow computer must be password protected.
- The flow computer must be compatible with Westcoast's SCADA and gas accounting systems.
- Use of the flow computer's control functionality must be limited to those controls essential for measurement accounting purposes (e.g., meter run switching). Non-measurement accounting related controls (e.g., H2S shut-in) must be assigned to a separate metering facility RTU.
- EFM/RTU card and input/output assignments must be assigned by Westcoast Measurement Technical Services.
- Communication ports on the device must be restricted to Westcoast use only unless otherwise reviewed and approved by Westcoast Measurement Technical Services.

12.8 Unmetered Taps

12.8.1 Receipt Points

Gas used at receipt metering facilities for fuel, operation, venting, or other purposes must be taken from taps located upstream of the custody receipt meter. Gas returned to the producing plant for fuel, pull back of off-spec gas, lateral line pack, or other purposes must be measured separately if taken from taps located downstream of the custody receipt meter. Unmetered downstream taps must be plugged or blinded and securely sealed unless otherwise agreed to by Westcoast Measurement Technical Services.

12.8.2 Delivery Points

Gas used at delivery metering facilities for fuel, operation, venting, or other purposes must be taken from taps located downstream of the custody delivery meter. Any gas taken from taps located upstream of the custody delivery meter must be measured separately. Unmetered upstream taps must be plugged or blinded and securely sealed unless otherwise agreed to by Westcoast Measurement Technical Services.

12.9 Gas Sampling and On-Line Analyzers

Metering facilities must incorporate the gas quality analysis methods outlined in this section. Where on-line analyzers are required as described in this section, they must be connected to the Westcoast SCADA system. Refer to the Westcoast Measurement Equipment Listing for specific makes and models of sample probes, sample system components, analyzers, GCs and automated samplers approved for use at Westcoast metering facilities.

12.9.1 Sampling Probes and Locations

A suitable number of gas sampling taps and probes must be installed in the metering facility piping to allow for the collection of spot samples and provide continuous samples to on-line analyzers. The installation must meet the following requirements:

- At least one ¾" threaded sample tap must be installed at receipt and delivery point metering facilities to provide for spot or grab sampling and manual dew point testing.
- At least two additional ¾" threaded sample taps must be installed at metering facilities requiring on-line analyzers.
- Sample taps must be located upstream of the meter and inside the meter building.

- Sample taps must be positioned on the top of horizontal pipe runs and located where there is a fully developed flow of gas. They should not be located within 5 pipe diameters downstream of piping disturbances such as filters, elbows, tees or headers, nor where phase changes could occur such as control valves, regulators, orifice plates or flow conditioners.
- Sample taps must be fitted with a straight/non-filtering/non-retractable sample probe with its tip extending to the center third of the inside pipe diameter, and an isolation valve on the probe outlet.
- A permanent pressure gauge indicating the process pressure should be located near the sampling point.

12.9.2 Gas Chromatographs & Samplers

An on-line GC must be installed at receipt and delivery metering facilities where the metered volume is equal to or greater than 570 10^3m^3/day (20 mmscfd), and must be installed at receipt metering facilities receiving gas from renewable natural gas production facilities (e.g., biomethane) regardless of metered volume.

A 31-day proportional sampler must be installed at receipt metering facilities where the receipt volume is less than 570 10^3m^3/day (20 mmscfd), unless an on-line GC is already installed. Spot sampling or other analysis methods are not acceptable in place of proportional samplers at receipt metering facilities.

An existing zone GC that accurately reflects the delivery gas composition and properties must be used at delivery metering facilities where the volume is less 570 10^3m^3/day (20 mmscfd), otherwise a 31-day proportional sampler must be installed. Spot sampling may be acceptable in place of continuous sampling at low volume delivery metering facilities upon review and written approval from Westcoast Measurement Technical Services.

The installation must meet the following requirements:

- Installation must comply with the MC Notice of Approval for firmware versions, approved functions and installation requirements.
- GC must be capable of performing a standard 10 component analysis (CO_2, N_2, C_1, C_2, C_3, iC_4, nC_4, iC_5, nC_5, C_6+) with an uncertainty no greater than +/- 1 Btu in 1000.
- Serial connection must be installed from the GC to the flow computer to provide live gas analysis data to the flow computer and Westcoast SCADA system.
- GC must use GPA 2172 to calculate gross heating value and relative density.
- GC sample probe/system must be dedicated to providing sample gas to the GC, it must not be shared with other analyzers.
- GC sample system must include a dual stage heated regulator and liquid shutoff valve installed at the sample probe location.
- GC sample line must be fabricated of 1/8” stainless steel tubing with a length no longer than 15 m (50 ft) from the sample probe to the GC.
- Sample line must be heat traced and insulated its full length, from the sample probe to the GC sample conditioning panel, and capable of maintaining the sample gas temperature at least 15ºC above the flowing gas temperature.
- All GC and sample conditioning exhaust vents must be individually tubed to a safe location outside the meter building. To prevent back pressure from affecting the GC operation, a common exhaust vent header for GCs or analyzers must not be used.

- GC carrier gas and calibration gas bottles must be located and firmly secured within the meter building, with the calibration gas bottle resting on an insulated floor pad and surrounded by an insulated heated blanket.

12.9.3 Water Analyzers

An on-line water analyzer must be installed at receipt metering facilities to monitor the moisture content in the receipt gas on a real time basis. The installation must meet the following requirements:

- The analyzer must send a hard wired 4-20 mA analog signal representing water content in pounds per million standard cubic feet (lbs/mmscf) to the meter station RTU for polling by the Westcoast SCADA system and monitoring by Westcoast Gas Control. If the water content in the receipt gas exceeds the Westcoast Pipeline Tariff limit on a consistent basis, the RTU may be reconfigured to automatically close the receipt meter station isolation/ESD valve on high water.
- Water analyzer sample probe/system may be shared with one H_2S analyzer if the system capacity is reviewed and determined suitable for both analyzers.
- Analyzer sample system must include a dual stage heated regulator installed at the sample probe location.
- Analyzer sample line must be fabricated of 1/8” stainless steel tubing with a length no longer than 15 m (50 ft) from the sample probe to the analyzer.
- Water analyzer sample line must be heat traced and insulated its full length, from the sample probe to the analyzer sample conditioning panel, and capable of maintaining the sample gas temperature at least 15ºC above the flowing gas temperature.
- Water analyzer sample conditioning panel must include a low pressure (18 psi falling) normally open switch after the 2nd stage regulator that is wired to the meter station RTU to warn of low sample pressure.
- All analyzer and sample conditioning exhaust vents must be individually tubed to a safe location outside the meter building. To prevent back pressure from affecting analyzer operations, a common exhaust vent header for analyzers or GCs must not be used.

12.9.4 Hydrogen Sulphide Analyzers

An on-line H_2S analyzer must be installed at receipt metering facilities to monitor the H_2S content in the receipt gas on a real time basis. The installation must meet the following requirements:

- The analyzer must send a hard wired 4-20 mA analog signal representing H_2S content in parts per million (ppm) to the meter station RTU for automatic monitoring, control, and polling by the Westcoast SCADA system. The RTU must be programmed to automatically close the receipt meter station isolation/ESD valve on H_2S levels higher than 4 ppm
- Sample gas for one H_2S analyzer may be taken from an existing water analyzer sample probe/system if the system capacity is reviewed and determined by Westcoast to be suitable for both analyzers.
- Analyzer sample system must include a dual stage heated regulator installed at the sample probe location.
- Analyzer sample line must be fabricated of 1/8 ″ stainless steel tubing with a length no longer than 15 m (50 ft) from the sample probe to the analyzer.

- All analyzer and sample conditioning exhaust vents must be individually tubed to a safe location outside the meter building. To prevent back pressure from affecting analyzer operations, a common exhaust vent header for analyzers or GCs must not be used.

12.9.5 Total Sulphur Analyzers

An on-line total sulphur analyzer may need to be installed at receipt metering facilities if the receipt gas exceeds the Westcoast Pipeline Tariff limit on a consistent basis. A written notice will be issued if Westcoast determines that an on-line total sulphur analyzer is required. The installation must meet the requirements provided at the time of notice.

12.9.6 Oxygen Analyzers

An on-line oxygen analyzer must be installed at receipt metering facilities receiving gas from renewable natural gas production facilities (e.g., biomethane) to monitor the oxygen content in the receipt gas on a real time basis. The installation must meet the following requirements:

- The analyzer must send a hard wired 4-20 mA analog signal representing oxygen content to the meter station RTU for polling by the Westcoast SCADA system and monitoring by Westcoast Gas Control.
- Analyzer sample line must be fabricated of 1/8” stainless steel tubing with a length no longer than 15 m (50 ft) from the sample probe to the analyzer.
- All analyzer and sample conditioning exhaust vents must be individually tubed to a safe location outside the meter building. To prevent back pressure from affecting analyzer operations, a common exhaust vent header for analyzers or GCs must not be used.

12.9.7 Hydrocarbon Dew Point Analyzers

Unless otherwise agreed by Westcoast, an on-line hydrocarbon dewpoint (HCDP) analyzer must be installed at receipt metering facilities to monitor the HCDP temperature. The installation must meet the following requirements:

- The analyzer must send a hard wired 4-20 mA analog signal representing dew point temperature to the meter station RTU for polling by the Westcoast SCADA system and monitoring by Westcoast Gas Control.
- HCDP analyzer sample probe/system must be dedicated to providing sample gas to the HCDP analyzer, and must not be shared with other analyzers.
- Analyzer sample line must be fabricated of 1/8” stainless steel tubing with a length no longer than 15 m (50 ft) from the sample probe to the analyzer.
- Sample line must be heat traced and insulated its full length, from the sample probe to the analyzer sample conditioning panel, and capable of maintaining the sample gas temperature at least 15ºC above the flowing gas temperature.
- All analyzer and sample conditioning exhaust vents must be individually tubed to a safe location outside the meter building. To prevent back pressure from affecting analyzer operations, a common exhaust vent header for analyzers or GCs must not be used.

12.10 Receipt Meter Station Isolation

Receipt metering facilities must include an actuated isolation valve(s) that allows the meter station to automatically or remotely be isolated from the Westcoast system in the event of off-specification gas or a pipeline emergency. The installation must meet the following requirements:

- Isolation valves must be fail closed and installed to fully isolate receipt point gas flow to the Westcoast system when closed.
- Emergency isolation functionality may be added to or shared with valves used for automated shut-in due to off specification gas quality, or valves designated for PCOPP of the Westcoast system, as long as close commands cannot be overridden or bypassed.
- Signals indicating the isolation valve's open/close status must be provided to the meter station RTU.

12.11. Pressure Control and Overpressure Protection

12.11.1. Receipt Metering Facilities

Unless otherwise agreed by Westcoast, receipt metering facilities must include customer owned and operated PCOPP systems that are located within the customer's facilities and designated for protection of the connected Westcoast pipeline by ensuring gas is not delivered at a pressure in excess of the maximum pressure specified in the GT&C. Refer to MES-400, "Westcoast Receipt Point Pressure Control and Overpressure Protection Standard," for allowable system designs and Westcoast approval requirements.

12.11.2. Delivery Metering Facilities

Delivery metering facilities must include customer owned and operated PCOPP systems that are located within and designated for protection of the customer's facilities from gas delivered by the connected Westcoast pipeline that may be in excess of the customer's facilities' maximum allowable operating pressure.

12.12. Receipt Point Pressure Indication

Receipt metering facilities must provide a live pressure signal for Westcoast Gas Control monitoring purposes that is sourced downstream of the pressure control system designated for protection of the Westcoast pipeline.

If the designated PCOPP systems are located upstream of the receipt meter station, the metering facility provides the necessary pressure signal.

If the designated PCOPP systems are located downstream of the receipt meter station, an additional live pressure signal must be sourced from downstream of the PC system and provided to the meter station RTU.

12.13. Communications

All metering facilities must have a remote communication link installed between the EFM/RTU devices and the Westcoast SCADA system unless otherwise agreed to in writing by Westcoast Measurement Technical Services. Westcoast must supply, install and maintain the primary and secondary communications and network equipment required to connect to its SCADA system.

Data signals from a meter station may be provided to the connected customer so long as the customer enters into a Signals Sharing Agreement with Westcoast that limits signal use to indication purposes only, and not for control purposes.

12.13.1. Polling Interval/Frequency

The polling frequency will depend on a number of design and installation limitations. The intent is for Westcoast to poll the EFM/RTU devices as frequently as possible for operational and measurement data.

Requirements for the measurement data are outlined in section 13.5. Requirements for the operational data are:

- Instantaneous gas volume flow rate
- Instantaneous static pressure
- Instantaneous flowing gas temperature

When determining the polling frequency, each of the following will be evaluated:

- Type of communication to the EFM device
- Type of power system
- Polling module capabilities

If there are no limitations due to the above, then operational data will be polled on a once per minute interval and measurement data on a once per 15 minute interval. If any limitations are identified, then the polling interval for both the operational and measurement data may be extended upon approval by Westcoast up to the limits shown in Table 3.

Table 3: Polling Intervals

DATA TYPE	DESIGN POLLING INTERVAL	MAXIMUM ALLOWABLE POLLING INTERVAL
Operational		
• Dedicated Circuit	1 minute	4 hours
• Dial-up Modem	1 hour	24 hours
Measurement		
• Dedicated Circuit	15 minutes	4 hours
• Dial-up Modem	1 hour	24 hours

13. Metering Facility Operation

The metering facility owner/operator is responsible for operating its metering facility as per the requirements of this section.

13.1 Metering Facility Changes

Changes to third party owned metering facilities must be reviewed and approved by Westcoast in writing prior to changes being made. The includes but is not limited to the following changes:

- Facility status – deactivations and reactivations
- Facility ownership
- Flow capacity
- Metering and analytical equipment
- PCOPP systems or set points
- Station piping

- Communication systems

Proposed changes must be submitted to Westcoast using the Receipt Point Change Form and will be reviewed and, if acceptable, approved in writing by Westcoast Measurement Technical Services.

13.2 Clock Settings and Gas Contract Hour

Configurable measurement devices must be permanently set to standard time, either Pacific Standard Time (PST) or Mountain Standard Time (MST), and must be configured with a gas day start time that is equivalent to 09:00 Central Standard Time (CST) as follows:

- If clock is set to PST, contract start time will be set to 07:00 PST.
- If clock is set to MST, contract start time will be set to 08:00 MST.

Once the time zone, clock and contract hour are set in standard times, the settings must not be changed throughout the year to account for Daylight Savings Time.

13.3 Time Syncronization

Devices must be time synchronized at a suitable frequency to ensure their accuracy remains within plus or minus one minute per day.

Westcoast will perform a daily time sync on all EFM devices that are polled through Westcoast's SCADA system. The system will sync according to the last known time zone each device was manually configured with. Therefore, Westcoast must immediately be notified as described in *14.6 - Reporting and Notifications* if the metering facility operator intends to change configuration of the EFM device time zone.

EFM devices that are not polled through Westcoast's SCADA system must have their clock settings updated by the metering facility operator using a recognized reference time standard on an as needed basis to ensure the clock remains accurate to within plus or minus one minute per day.

13.4 Gas Sampling and Analysis

The metering facility operator is responsible for determining and updating the gas composition entered into the flow computer at sites that do not utilize a GC. The composition must be based on a detailed analysis as required by GPA 2172.

Gas samples that are to be used for custody transfer applications must be collected, analyzed, reported and updated as follows.

13.4.1 Sampling Frequency

Metering facilities that require manual sampling as per 13.9.2 - *Gas Chromatographs & Samplers* must be sampled on a monthly basis unless otherwise approved by Westcoast.

13.4.2 Sample Collection

Sampling equipment and procedures used for the collection of gas samples must comply with the latest revision of API Chapter 14.1 - "Collecting and Handling of Natural Gas Samples for Custody Transfer" or GPA 2166 – "Obtaining Natural Gas Samples for Analysis by Gas Chromatography". Of particular note:

- The evacuated cylinder method is preferred for collecting gas samples.
- Samples must be taken from a fully developed, flowing stream to minimize the possibility of an unrepresentative sample from a stratified stream.

13.4.3 Sample Analysis

Only laboratories accredited, or in the process of being accredited, by the Standards Council of Canada (SCC) to perform the following methods may be allowed to analyze gas samples used for Westcoast custody transfer applications.

- GPA STD 2261 - Analysis for Natural Gas and Similar Gaseous Mixtures by Gas Chromatography, and
- GPA STD 2286 - Method for the Extended Analysis of Natural Gas and Similar Gaseous Mixtures by Temperature Program Gas Chromatography

The SCC accreditation ensures that laboratories meet the requirements set out in Standard CAN-P-4d, General Requirements for the Accreditation of Calibration and Testing Laboratories. Any accredited laboratory which is not in good standing with the SCC or a laboratory which is in the process of gaining accreditation but is not meeting the accreditation milestones as set out by the SCC assessors, must not be allowed to obtain samples nor perform tests detailed in this section.

Upon request, laboratories must be able to provide documentation showing:

- certification of gravimetrically prepared calibration standards,
- the quality control program used to obtain control samples for monitoring the method accuracy and precision, including duplicates, blanks and control samples,
- the quality control program used for ensuring uncontaminated sample containers are used to obtain samples, and
- The quality control process used to validate the test results.

13.4.4 Analysis Reporting

Gas samples must be analyzed on an air free and moisture free basis to determine the component mole fractions of He, H2, N2, CO2, C1, C2, C3, iC4, nC4, iC5, nC5, C6, C7, C8, C9, and C10+. Where an extended analysis is not required, the sample may be analyzed to C6+ with written approval from Westcoast Measurement Technical Services.

Gas properties must be determined on an air and moisture free basis at reference conditions of 101.325 kPa and 15 ºC using industry standard calculations and component physical properties that are acceptable to MC.

An electronic copy of the laboratory gas analysis report must be provided to Westcoast.

13.4.5 Updating EFM Device Composition

The metering facility operator must ensure the latest gas composition data is being used for volume calculations in the flow computer. To do so, the operator must update the EFM device as soon as possible with results from the latest analysis report.

13.5 EFM Reporting

The types, frequencies, and methods of required EFM reporting are listed in Table 4, with a further description of each report type provided in Sections 13.5.1 through 13.5.5. The metering facility operator must ensure the required reports are downloaded at the frequencies indicated, stored electronically, retained as per *Section 10 - Records Retention*, and where indicated submitted to Westcoast as per 14.6 - Reporting and Notifications.

Metering facilities that have measurement data polled in through Westcoast's communication system still require monthly manual download and retention of the Monthly Gas Volume/Energy, Alarm Log, and Event Log reports listed in Table 4. However, the Monthly Gas Volume/Energy report need not be submitted to Westcoast unless requested.

Table 4: EFM Reporting

REPORT TYPE	DOWNLOAD FREQUENCY	HANDLING METHOD
Gas Meter Snapshot	Following any configuration change, or upon request by Westcoast	• To be stored by facility operator • To be submitted to Westcoast upon request
Daily Gas Volume/Energy	Upon request by Westcoast	• To be submitted to Westcoast upon request
Monthly Gas Volume/Energy	Monthly	• To be stored by facility operator • To be submitted to Westcoast
Alarm Log	Monthly	• To be stored by facility operator • To be submitted to Westcoast
Event Log	As needed (based on log capacity)	• To be stored by facility operator • To be submitted to Westcoast upon request

13.5.1 Gas Meter Snapshot Report

The Gas Meter Snapshot Report (i.e., flow snapshot) lists all the information being used to calculate a flow volume/energy for each meter run. The following information, as applicable to the meter type, must be provided at minimum:

- Meter identification
- Instantaneous volume and energy flow rate
- Instantaneous differential pressure, static pressure and temperature
- K-factor(s)
- Transmitter ranges
- Line size
- Orifice size
- Pressure tap location (upstream/downstream)
- Orifice plate coefficient of discharge
- Velocity of approach
- Expansion factor
- Pipe Reynolds number
- Flowing fluid density
- Base fluid density
- Absolute viscosity

- Isentropic exponent
- Supercompressibility factor (F_{pv})
- Atmospheric pressure
- Base pressure
- Base temperature
- Relative density
- Heating value
- Gas analysis and analysis date

The Gas Meter Snapshot Report must be downloaded by the metering facility operator and submitted to Westcoast upon request, and it must be downloaded and stored electronically by the metering facility operator anytime it changes one or more of the metrological parameters.

13.5.2 Daily Gas Volume/Energy Report

The Daily Gas Volume/Energy Report lists all the measurement data and variables for a 24 hour period starting at 07:00 PST each day. Data and variables are either totals or averages that are listed in one hour increments (hourly). The following information, as applicable to the meter type, must be provided at minimum:

- Meter identification
- Date and time identifier
- Quantity (volume, mass and/or energy)
- Flow time
- Integral value/average extension
- Differential pressure average
- Meter output (accumulation or average)
- Static pressure average
- Temperature average
- Relative density
- Energy content (heating value)
- Composition
- Indication of flow parameter changes (e.g., split records)

The Daily Gas Volume Report must be downloaded by the metering facility operator and submitted to Westcoast upon request.

13.5.3 Monthly Gas Volume/Energy Report

The Monthly Gas Volume Report lists all measurement data and variables for a one month period starting at 07:00 PST on the first day of the month to the last day of the month. Data and variables are either totals or averages that are listed in 24 hour increments (daily). The following information, as applicable to the meter type, must be provided at minimum:

- Meter identification
- Date and time identifier
- Quantity (volume, mass and/or energy)
- Flow time
- Integral value/average extension
- Differential pressure average
- meter output (accumulation or average)
- Static pressure average
- Temperature average
- Relative density
- Energy content (heating value)
- Composition

The Monthly Gas Volume Report must be downloaded monthly by the metering facility operator and stored electronically. At metering sites without a communication link to the Westcoast SCADA system, the monthly report must be submitted to Westcoast.

Westcoast may require the Monthly Gas Volume Report to be submitted at a frequency greater than once per month if the site's lack of communication is impacting Westcoast pipeline system operations.

Sites having a communication link to the Westcoast SCADA system will have the required data brought through in the hourly and daily polling, therefore the Monthly Gas Volume report does not need to be submitted to Westcoast.

13.5.4 Alarm Log

The Alarm Log forms part of the audit trail and lists all operating exceptions and events that have occurred which may have an effect on the measurement accuracy of the system. Each alarm should be identified as to its type, date and time of occurrence, and date and time of clearing or acknowledgement. Alarm types may include:

- High/low differential pressure, static pressure or temperature values
- Over or out of range values
- Changes to data base
- Internal flow computer failures
- Communication failures
- Low power warning
- Authorized and unauthorized entry into the system

The Alarm Log must be downloaded monthly by the metering facility operator and stored electronically. The monthly log must be submitted to Westcoast.

13.5.5 Event Log

The Event Log forms part of the audit trail and lists all events and changes that have occurred to the constant flow parameters contained in the EFM configuration. Each time a parameter that can affect the

calculated measurement values is changed in the system, the old and new value, along with the date and time of the change, will be logged. The date and time of all events in the log must be identified and listed chronologically.

The Event Log must be downloaded at intervals frequent enough (considering the log capacity) by the metering facility operator and stored electronically to maintain a continuous record of events for the life of the meter. The Event Logs must be submitted to Westcoast upon request.

13.5.6 Report and Log Format

All reports generated from an EFM device that require submission to Westcoast must be submitted in one of the following formats, listed in order of preference:

1. Access to a third party database system through remote communication. Westcoast must be given a user access to a remote computer host for the purpose of electronic transfer of data from one or more EFM facilities. This may require some development on both ends of the system.
2. The daily and monthly volume/energy reports must be produced in Excel version 4.0 (or later) and emailed to Westcoast. The remaining reports and logs must be generated in the file format defined by the EFM device and emailed to Westcoast.
3. All meter reports and logs must be printed, scanned and emailed to Westcoast. This format will only be accepted if the two higher preference formats cannot be achieved.

13.6 Reporting and Notifications

When required, the metering facility operator must submit certificates, reports and notifications to Westcoast using the communication methods outlined in Table 5. Reports and notifications should be submitted to Westcoast by the next business day following the report download or event date. Measurement equipment inspection certificates should be submitted to Westcoast prior to the equipment going into service.

Table 5: Reporting and Notifications

REPORT/EVENT	COMMUNICATION METHOD
Measurement Equipment Inspection Certificates	• Email to meastechservices@enbridge.com
Gas Meter Snapshot	• Email to mvt@enbridge.com
Daily Gas Volume/Energy	• Email to mvt@enbridge.com
Monthly Gas Volume/Energy	• Email to mvt@enbridge.com
Alarm Log	• Email to mvt@enbridge.com
Event Log	• Email to mvt@enbridge.com
Change of an Orifice Plate Size	• Email to mvt@enbridge.com and • Record in Westcoast's Measurement Data Collection System (MDCS)
Verification/Calibration of a Measurement Device	• Record in Westcoast's Measurement Data Collection System (MDCS)

REPORT/EVENT	COMMUNICATION METHOD
Change of an AGA Parameter in EFM Device	• Email to mvt@enbridge.com and • Email to meastechservices@enbridge.com
Replacement of EFM Hardware/Firmware/Transmitters	• Submit Receipt Point Change Form to meastechservices@enbridge.com
Change of Time, Time Zone or Contract Hour in EFM Device	• Email to mvt@enbridge.com and • Email to CGTM_SCADA_Support@enbridge.com

13.6.1 Contact Information

The contact information for general questions are as follows:

Team Leader Measurement Data – for volume reporting and notification issues

Westcoast Energy Inc.

Enbridge Gas Transmission and Midstream

#200, 425 – 1st Street S.W.

Calgary, AB T2P 3L8

Email: mvt@enbridge.com – include "*To: TL Measurement Data*" in subject line

Supervisor Measurement Technical Services – for technical notifications and issues

Westcoast Energy Inc.

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14. Metering Facility Maintenance

All metering facilities must be maintained as prescribed by Westcoast's internal measurement operating and maintenance procedures, with the exception of the following third party owned and operated facilities:

- Delivery metering facilities that Westcoast approved to be owned and exclusively operated by a local distribution company (e.g., FortisBC, Pacific Northern Gas, Alberta Gas Co-ops) must be maintained as per the local distribution company's internal standards and must meet the requirements of MC.
- Pipeline interconnect metering facilities that Westcoast agreed be owned and exclusively operated by an interconnecting pipeline must be maintained as per the interconnecting pipeline's internal standards and must meet the requirements of MC.

Westcoast retains the right to witness and inspect all metering facility maintenance and operation activities related to the requirements of this policy. If requested, the metering facility owner/operator must provide Westcoast with reasonable notice of its maintenance schedule in order that Westcoast may have a representative present.

14.1 Pressure Control & Overpressure Protection Systems

Receipt point PCOPP systems that are designated for protection of the receiving Westcoast pipeline must be inspected, assessed, calibrated and function tested annually as prescribed in *MES-400 Westcoast Receipt Point Pressure Control and Overpressure Protection Standard*.

The owner/operator of the receipt point PCOPP systems must use the *Westcoast Pipeline Pressure Control/Overpressure Protection Calibration & Inspection Report* form to record and submit all inspection, assessment, calibration and function testing results to Westcoast within 12 months of the previous year's report, but in no case later than October 1st of each year. The form must be fully completed, with correct traceability to the PCOPP devices and tag numbers on the Westcoast approved PCOPP P&ID drawings, and must include all required signatures.

Delivery point PCOPP systems that are third-party owned and operated, and designated for protection of the third-party facilities, are the responsibility of the third-party.

15. Calibration Test Equipment

Test equipment used for the verification and calibration of custody transfer gas devices must have a resolution better than or equal to its specified uncertainty, and a range that is equal to or greater than the device being calibrated. All test equipment used for the calibration of gas measurement devices must meet the following requirements.

15.1 Uncertainty Requirements

The uncertainty requirements for calibration test equipment are as follows:

15.1.1 Laboratory Test Equipment

Laboratory calibration equipment must have a manufacturer specified uncertainty that is equal to or less than one half of that specified for the transducer, transmitter or associated device being calibrated. Laboratory conditions are defined as any calibration facility that provides a controlled environment in which to calibrate a transducer, transmitter, or associated device.

15.1.2 Field Test Equipment

Field calibration equipment must have a manufacturer specified uncertainty that is equal to or less than that specified for the transducer, transmitter or associated device being calibrated. When field calibrating devices the test equipment should be operated in a temperature controlled environment unless it is capable of ambient temperature compensation.

15.2 Certification

Laboratory and field calibration equipment must be certified prior to first use and re-certified annually thereafter by a standards laboratory that can demonstrate traceability to a relevant national standard. A certificate of accreditation to ISO/IEC 17025 by an accrediting body recognized by the National Research Council (NRC) or the SCC is deemed as proof of compliance.

The test equipment owner/operator must forward a copy of the certification to Westcoast upon request.

15.3 Pressure Source

A dry pressure source, such as nitrogen, must be used for the calibration of pressure measurement devices.

16. Document Control and Maintenance

This section details how this document will be controlled and maintained.

- Changes to this document and related documents will be conducted in accordance with GDM-81.201, "GTM IMS Document Management of Change Process."
- The archival, retention and disposition of this document and related documents will be conducted in accordance with the Records and Information Management (RIM) Governance Suite.

Table 6 outlines specific document control details.

Table 6: Document Controls

CONTROL	DESCRIPTION
Business Authority	Director, GTM Engineering & Reliability
Periodic Review Frequency	3 years
Effective Date*	1900-01-01
Controlled/Published Location	GTM Governance Document Library
GDL Document Number	8016
Referenced Documents	Tap Application Form Receipt Point Change Form Westcoast Measurement Equipment Listing MES-400 Westcoast Receipt Point Pressure Control and Overpressure Protection Standard Westcvoast Pipeline Pressure Control/Overpressure Protection Calibration & Inspection Report

**Effective Date is the date the document was initially put into service. If the date cannot be determined or is not known, it will be shown as 1900-01-01.*

17. History of Changes

Changes made to this document are tracked in Table 7.

Table 7: History of Changes

DATE	VERSION*	SUMMARY	DOCUMENT SME	APPROVED BY
2024-01-05	1.0	Rewrite of Residue Measurement Policy to remove RGT references and bring it up to date.	Kerry Checkwitch, Sr. Specialist Engineer, Measurement Engineering	Nathan Feldpausch, Manager, Measurement Engineering

**The initial posting of a document in the GTM Governance Document Library will be denoted as Version 1.0.*