

## 4 **Measurement Requirements**

This section details the **Customer** measurement requirements for all **acceptance points** entering a system or plant operated by SemCAMS. The standards provided shall be met for all new facilities. Where practical, existing facilities should be upgraded to comply with these standards.

### 4.1 **Design and Installation**

This section provides SemCAMS specifications for the appropriate design and installation of measurement equipment. The standards defined meet or exceed regulatory and industry standards.

#### 4.1.1 **General Requirements**

The policy requirements to be adhered to are as follows:

1. All measurement installations and procedures will meet or exceed EUB Directive 17, Measurement Requirements for Upstream Oil and Gas Operations,
2. The measurement system must have the capability of providing automated daily volumes to SemCAMS, either via a secure website or via connection to the SemCAMS SCADA system,
3. Volumes and energy will be reported in SI units,
4. Gas volumes will be calculated at base conditions of 101.325 kPa and 15 °C. Liquid volumes will be calculated at base conditions of zero kPa gauge or the equilibrium vapour pressure (whichever is higher) and 15 °C,
5. The assumed atmospheric pressure used in the volume calculation will be as per the applicable agreement, regardless of actual atmospheric pressure,
6. All fuel and continuous flare volumes that are greater than 500 m<sup>3</sup> per day will be metered. Where estimates are used for determining fuel or flare volumes, the methodology including all calculations must be provided to SemCAMS prior to startup and when any changes are made.

## 4.1.2 Gas Measurement

Gas measurement at **acceptance points** into a system or plant operated by SemCAMS are to be designed and installed according to the following standards. Where fuel or flare/vent volumes are consumed or removed at a point downstream of the **acceptance point** gas measurement then these volumes will be deducted from the measured **acceptance point** volume to provide a **gathered volume** for the purpose of allocation.

### 4.1.2.1 Meter Specifications

The following details the specifications for gas measurement equipment:

1. All gas **acceptance points** will require EFM (Electronic Flow Measurement). Chart recorders are not acceptable,
2. All gas **acceptance points** will be measured with orifice meters equipped with senior fittings. Other technologies may be acceptable, but, will require prior approval from SemCAMS,
3. Orifice meter runs should be installed in the vertical position to reduce errors caused by liquid buildup upstream of the orifice plate,
4. No connection or equipment can be installed within the required piping straight lengths that can cause a flow disturbance such as fuel gas take-off or methanol injection,
5. The beta ratio should be maintained within a range of 0.2 to 0.6 but will not violate beta ratio restrictions as defined by the manufacturer of the meter run/flow conditioner,
6. All installations shall be designed so that each sensor will operate at a point greater than 10% of the calibrated span under normal operating conditions.

#### 4.1.2.2 Volume Calculations

The following details the expectations for gas volume calculations:

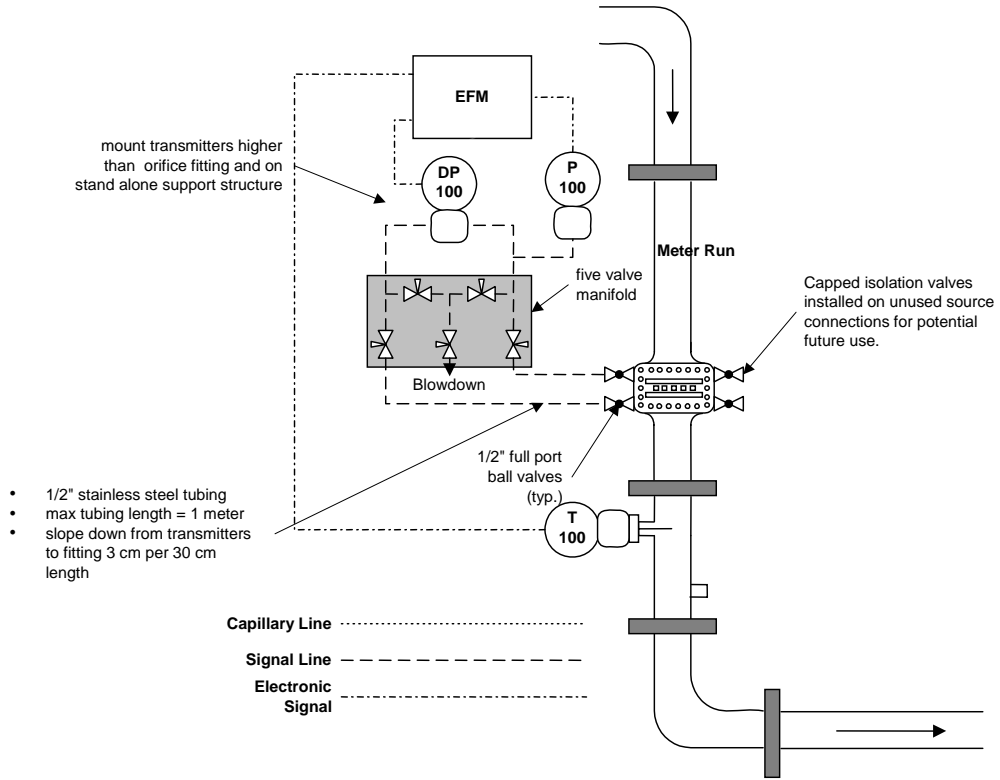
1. Gas volumes measured by orifice meter will be calculated in accordance with the American Gas Association Report No. 3, Third Edition 1990, Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids,
2. Compressibility factors will be calculated using the detailed method of American Gas Association, Transmission Committee Report No. 8, Second Edition 1992, Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases.

#### 4.1.2.3 Device Installation

Transmitter installation requirements are identified as follows and in Figure 4-1:

1. All sensing lines should be dedicated and short coupled, not exceeding one meter (1 m) in length,
2. All sensing lines will be sloped toward the primary device, the recommended minimum slope is 3 cm per 30 cm of length (1:10 slope),
3. The manifold will be a five (5) valve manifold,
4. The sensing lines should have a minimum nominal diameter of 1/2 inch,
5. The main line isolation valves to the manifold should be fully ported with a nominal diameter consistent with the sensing lines,
6. Temperature transmitters/RTD probes should be installed with flexible armored cable enabling the RTD to be easily removed from the thermowell for calibration procedures,

Figure 4-1 Gas Meter Installation



#### 4.1.2.4 Fuel Gas

1. Fuel gas measurement requirements are identified as follows (see also 4.1.1):
2. Where fuel gas is taken from a point downstream of the **acceptance point** gas meter and the volume is greater than 500 m<sup>3</sup>/day, the fuel will be metered.
3. Fuel gas will be measured with either an orifice or positive displacement meter. For orifice meters, refer to sections 4.1.2.1, 4.1.2.2, 4.1.2.3. For positive displacement meters, the following standards will apply:
  - i. Temperature and pressure compensation may be done either automatically or manually, using average readings for each variable taken from devices installed within the fuel gas meters piping. Minimum temperature reading frequency will be as per EUB Directive 17.
  - ii. Manual calculations will be performed using the following equation:

$$Q_b = Q_f \left( \frac{P_f}{P_b} \right) \left( \frac{T_b}{T_f} \right) \left( \frac{Z_b}{Z_f} \right)^{\text{Note}}$$

Where:

$Q_b$  = Volume at base conditions

$Q_f$  = Volume at flowing conditions

$P_f$  = Absolute flowing pressure (kPa) (gauge pressure + atmospheric pressure)

$P_b$  = Absolute base pressure (101.325 kPa)

$T_f$  = Absolute flowing temperature (K) (°C + 273.15)

$T_b$  = Absolute base temperature (288.15 K)

$Z_b$  = Compressibility at base conditions

$Z_f$  = Compressibility at flowing conditions

Note:

The compressibility portion of the above equation is not required where the flowing gauge pressure is less than 500 kPa.

- iii. The pressure and temperature devices will be installed as per Directive 17.

#### 4.1.2.5 Sampling

The following details the expectations for gas sample points:

1. Sample probes shall be installed at each **acceptance point**,
2. The sample point must be located where a sample representative of the gas flowing through the acceptance point meter can be obtained,
3. The sample probe shall be installed into the center third of the pipe,
4. The sample probe should be installed vertically at the top of a straight run of horizontal pipe,
5. Where the gas is at or near its hydrocarbon dew point, the sample point should be located upstream of the orifice meter run and at least 5 pipe diameters downstream of any flow disturbing elements (such as elbows, tees, valves etc.),
6. Where the gas is not near its hydrocarbon dew point the sample point can be either upstream or downstream of the meter run and avoidance of flow disturbing devices is less critical,
7. The sample point should be indoors and not make use of excessive tubing to make sample point accessible,
8. A gas chromatograph will be installed at all **Custody Group Allocation Points**<sup>1</sup>.

#### 4.1.3 Liquid Measurement

SemCAMS requires measurement of all liquids recombined with the gas stream at an **acceptance point** and delivered to a SemCAMS plant.

##### 4.1.3.1 Meter Specifications

The following details the specifications for liquid measurement equipment:

1. All liquids will be measured with turbine, vortex or coriolis mass flow meters,
2. Liquid meters will be installed in accordance with EUB and manufacturers specifications,
3. A strainer will be located upstream of turbine meters,
4. Where condensate volumes exceed 2 m<sup>3</sup>/day, proving taps will be installed to allow for inline proving.

##### 4.1.3.2 Volume Calculations

The following details the requirements for liquid volume calculations:

1. All liquid volumes will be corrected to 15 °C using one of the 3 methods listed below and the applicable temperature compensation method listed in Table 4-1,
  - Temperature is measured continuously and CTL (Correction for the effect of Temperature on Liquid) calculated by EFM or;

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<sup>1</sup> SemCAMS is prepared to allow the use of a calculated analysis for **group acceptance points** provided the calculation method is accepted by SemCAMS prior to use and the Customer provides the details of the calculation on a monthly basis (not just the end result).

- Determine a temperature compensated meter factor / k-factor at time of proving by temperature compensating the prover volume or;
  - Take temperature reading at time of manual meter reading and apply CTL.
2. Most hydrocarbon liquids in the gathering system are at or near the equilibrium vapour pressure. Therefore, CPL (Correction for the effect of Pressure on Liquid) is not required. Each installation shall be reviewed to determine if CPL is required.

**Table 4-1 Standards for Calculating CTL and CPL**

Standard	Product and Density Range
<b>CTL</b>	
<i>IP Table 54</i>	Light Hydrocarbon Liquids 500.0 – 653.0 kg/m <sup>3</sup>
<i>API MPMS 11.1</i>	Crude Oil, Refined Products and Lubricating Oils 611.6 – 1163.85 kg/m <sup>3</sup>
<b>CPL</b>	
<i>API MPMS 11.2.2M</i>	Light Hydrocarbon Liquids 350.0 – 637.0 kg/m <sup>3</sup>
<i>API MPMS 11.1</i>	Crude Oil, Refined Products and Lubricating Oils 611.6 – 1163.85 kg/m <sup>3</sup>

#### 4.1.3.3 Sampling

The following details the expectations for liquid sampling:

1. Sample probes shall be installed at each **acceptance point**,
2. The sample point must be located where a sample representative of the liquid flowing through the acceptance point meter can be obtained,
3. The sample probe shall be installed into the center third of the pipe,
4. The sample probe should be installed horizontally, on the side of a straight run of horizontal pipe,
5. Sample points must not be located where vapour breakout is likely, such as downstream of pressure reducing components (such as orifice plates, flow conditioners, turbine, PD or Coriolis mass meters, control valves etc.) or where the stream temperature has increased,
6. For separator applications, the sample point must be located between the separator outlet and the level control valve, upstream of the meter.
7. A flow proportional sampler will be installed at all **Custody Group Allocation Points**<sup>2</sup>.

<sup>2</sup> SemCAMS may allow the use of a calculated analysis for **group acceptance points**, provided the calculation method is accepted by SemCAMS prior to use and the Customer provides the details of the calculation on a monthly basis.

## 4.2 **Commissioning and Startup**

This section provides the Customer with the details of what information is required and what actions must be complete prior to SemCAMS allowing activation of an **acceptance point**.

### 4.2.1 **Information Required Prior to Startup**

The following information must be submitted to the SemCAMS Field Business Development Supervisor (refer to Section 2 of this document) prior to activation of the **acceptance point**:

1. Gas and condensate (if condensate recombined with gas) analysis<sup>3</sup>,
2. Calibration/inspection forms for the primary meter, secondary and tertiary devices including the orifice plate where applicable,
3. Process flow diagram (or measurement schematic) of each **acceptance point**,
4. EFM performance evaluation documentation as per EUB Directive 17,
5. Details of estimations used for fuel gas consumption.

### 4.2.2 **Site Acceptance Inspection**

SemCAMS personnel will perform an initial inspection of each Customer's **acceptance point** prior to commissioning the measurement point. The Customer will be provided a copy of the completed inspection report. Facilities, which do not meet the SemCAMS **acceptance point** specifications, will not be allowed entry into the SemCAMS system until the deficiencies are corrected and the **acceptance point** has been re-inspected.

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<sup>3</sup> For effluent measured wells a 'typical' analysis can be provided until a well test is completed and individual gas and condensate samples can be taken.

### 4.3 Normal Operations

This section provides the Customer with the details of ongoing responsibilities pertaining to measurement at an **acceptance point**.

SemCAMS reserves the right to inspect the *acceptance point* measurement equipment at any reasonable time and with prior notice to the Customer. This is done to ensure general compliance with SemCAMS measurement requirements and to ensure the data being used in our allocation system is current. Where a Customer's facility is not in compliance with SemCAMS expectations or current regulatory requirements and the non-compliance may result in the miss-allocation of products, SemCAMS will take appropriate actions.

**IMPORTANT:** Copies of completed calibration reports, proving reports and analysis data for all **acceptance points** and **tie-in points** are to be sent to:

SemCAMS, West Whitecourt gas plant  
Bag 600, Whitecourt, Alberta, T7S 1P9  
Attention: Measurement Administrator  
Phone: 780-778-7811  
Fax: 780-778-7819  
measurement@semcams.com

### 4.3.1 Gas Meter Calibration

SemCAMS expectations pertaining to gas meter calibration are as follows:

1. For group points, provide SemCAMS a schedule for calibration to allow SemCAMS the opportunity to witness calibrations,
2. Calibration will include validation of signals from transmitters to the flow computation device,
3. Calibration will include validation of all fixed meter data configured in the device performing the volumetric calculations,
4. Calibration of **acceptance point** meters is to be performed prior to startup and then at the frequencies listed in Table 4-2:

**Table 4-2 Calibration Frequency Requirements**

Acceptance Point Type	Frequency
<i>Well Head</i>	Every 12 months
<i>Group Acceptance Point (Prorated or Custody)</i>	Every six months

### 4.3.2 Meter Proving

SemCAMS expectations pertaining to liquid meter proving are as follows:

1. For group points, provide SemCAMS a schedule for meter proving to allow SemCAMS the opportunity to witness,
2. Meter proving to be done in situ unless average daily volume is less than or equal to 2 m<sup>3</sup>/day,
3. Proving of **acceptance point** meters is to be performed within 30 days after commissioning and then at the frequencies listed in Table 4-3.

**Table 4-3 Meter Proving Frequency Requirements**

Service	Frequency
Condensate	Every 12 months
Water	Every 12 months

### 4.3.3 Sampling and Analysis

SemCAMS requires accurate analysis data for all production streams to ensure product allocation is accurate and equitable.

SemCAMS expectations of the Customer for ongoing sampling and analysis are as follows:

1. Samples are to be taken by qualified laboratory technicians,
2. The gas sampling equipment and procedures must follow the requirements in API MPMS 14.1 (February 2006) and GPA 2166-05,
3. The hydrocarbon liquid sampling equipment and procedures must follow the requirements in GPA 2174-93 or the evacuated cylinder method referenced in GPA 2166-05,
4. For gas analysis, if H<sub>2</sub>S (hydrogen sulfide) is present, an on-site tutweiller or stain tube test, depending on concentration, shall be conducted to obtain the H<sub>2</sub>S content,
5. Where condensate is recombined with the gas, both gas and liquid samples should be taken on the same day and during normal flowing conditions,
6. Where condensate is recombined with the gas, separate gas and condensate volumes must be provided with the analysis for the purpose of calculating the recombined analysis. Total monthly gas (10<sup>3</sup>m<sup>3</sup>) and liquid (m<sup>3</sup>) volumes for the month in which the samples were taken are required.
7. For effluent metered wells, gas and liquid samples are to be collected during the effluent test. Copies of the lab analysis reports and the completed effluent test results are to be provided to SemCAMS,
8. Samples are to be analyzed by a recognized, third party laboratory,
9. Gas and liquid must be analyzed to a minimum of C7+,
10. SemCAMS will review all supplied analysis to ensure that the following acceptance criteria is met. If the analysis data does not meet the acceptance criteria then the analysis will be rejected and the Customer will be asked to provide new analysis data.

Acceptance Criteria:

- Analysis received within 365 days of the sample date on the analysis report,
- For gas analysis, “as received” pressure of sample must be within 20% of the “as sampled” pressure,
- Must be less than 30 days between “date sampled” and “date reported”,
- For acceptance points that deliver both gas and condensate, gas and condensate analysis along with daily volumes as per section 4.3.3 item 7 must be received,
- Gas and liquid samples must be taken within two days of each other,
- Analysis report includes the full and correct UWI of well being sampled,
- Reports must be legible,
- Must not be rejected by the lab performing the analysis.

11. Samples are to be taken at the frequencies provided in Table 4-4.

**Table 4-4 Gas and Condensate Sampling Frequency Requirements**

Acceptance Point Type	Initial Production Period	Ongoing Production Period
<b>Well</b>	<ul style="list-style-type: none"> <li>• Within first calendar month of production. SemCAMS must receive an analysis by the 5<sup>th</sup> working day of the month following initial production</li> <li>• Second sample required after 6 months of production</li> </ul> <p>Note: These initial requirements will also apply to any wells that are recompleted to a different zone, where multiple zones are commingled downhole, or where any other changes occur that would have a significant impact on the well composition.</p>	<ul style="list-style-type: none"> <li>• Annually</li> </ul>
<b>Custody Group Allocation Point</b>	<ul style="list-style-type: none"> <li>• Gas - Online gas chromatograph</li> <li>• Liquid – Flow proportional sampler</li> </ul>	<ul style="list-style-type: none"> <li>• Gas - Online gas chromatograph</li> <li>• Liquid – Flow proportional sampler</li> </ul>
<b>Prorated Group Allocation Point</b>	<ul style="list-style-type: none"> <li>• As per EUB Directive 17</li> </ul>	<ul style="list-style-type: none"> <li>• As per EUB Directive 17</li> </ul>
<b>Flow Splitter</b>	<ul style="list-style-type: none"> <li>• Same as Custody Group Allocation Point</li> </ul>	<ul style="list-style-type: none"> <li>• Same as Custody Group Allocation Point</li> </ul>

### 4.3.4 Changes Impacting Measurement and Allocation

Within the course of operations of the **acceptance point**, modifications will be required to the equipment or the data being used to calculate volumes. In most cases it is up to the Customer to ensure adequate records are retained to satisfy EUB requirements with regard to these changes. SemCAMS needs to be made aware of changes that impact product allocation immediately following the change and in some cases prior to the change being made.

The key areas requiring notification to SemCAMS include:

1. Modification to condensate handling at site. At **acceptance points** where condensate can be either recombined with the gas or diverted to tank by the operation of a valve, SemCAMS must be advised in advance when this valve will be operated<sup>4</sup>. The Customer is asked to contact the appropriate Field Business Development Supervisor (as listed in section 2 of this document) when a change is made.
2. Modification to water handling at site. At **acceptance points** where water can be either recombined with the gas or diverted to tank by the operation of a valve, SemCAMS must be advised in advance when this valve will be operated. The Customer is asked to contact the appropriate Field Business Development Supervisor (as listed in section 2 of this document) when a change is made.

#### 4.3.4.1 EFM Information Updates

Although no notification is required to SemCAMS, the following data must be updated in the EFM as required and audit logs retained as per EUB Directive 17.

**Table 4-5 EFM Update Timing**

Data	Update
Orifice plate size	Immediately following change
Transmitter range	Immediately following change
Meter/K Factor	Immediately following prove
Gas Composition	As soon as possible following receipt of analysis
Liquid Density (where EFM is performing CTL and CPL calculations)	As soon as possible following receipt of analysis

<sup>4</sup> Prior written approval must be in place from time of initial tie-in allowing recombination of liquids.