Provisional specifications for the in situ verification, reverification, installation and use of pressure factor metering installations

1.0 Scope

These provisional specifications apply to gas metering installations using a pressure factor metering (PFM) regulator to supply gas through a single meter at a fixed pressure value that exceeds the mean atmospheric pressure or the atmospheric pressure calculated, declared or measured, as the case may be, by more than 3.5 kPa in the International System of Units or 0.5 psi in the Imperial system of units.

These provisional specifications consolidate all applicable previously issued rules and requirements applicable to such PFM installations.

2.0 Authority

These provisional specifications are issued under the authority of subsection 12(2) and section 18 of the Electricity and Gas Inspection Regulations.

3.0 References

3.1 Electricity and Gas Inspection Regulations[^1] (SOR/86-131), Part III

3.2 LMB-EG-08—Specifications for Approval of Type of Gas Meters and Auxiliary Devices

3.3 S-G-03—Specifications for the approval of type of gas meters, ancillary devices and associated measuring instruments[^2]

3.4 G-18—Reverification periods for gas meters, ancillary devices and metering installations[^3]
4.0 Terminology

Absolute pressure scale
The pressure measuring scale the zero of which represents the pressure exerted by a total vacuum.

Calculated atmospheric pressure
The atmospheric pressure calculated for the meter location pursuant to subsection 37(1) of the Electricity and Gas Inspection Regulations.

Contract meter pressure
The fixed metering pressure, expressed on the gauge pressure scale, agreed upon by the contractor and purchaser for the purpose of billing.

Declared atmospheric pressure
The atmospheric pressure declared for the meter location pursuant to subsection 37(2) of the Electricity and Gas Inspection Regulations.

Gauge pressure scale
The pressure measuring scale the zero of which represents the pressure exerted by atmospheric pressure.

Meter
Any apparatus used for the purpose of making measurements of, or obtaining the basis of a charge for gas supplied to a purchaser.

Pressure factor metering installation
A gas metering installation that uses a pressure factor metering regulator to supply gas through a meter at a fixed pressure value, as agreed upon by the contractor and purchaser, that exceeds the mean atmospheric pressure or the atmospheric pressure calculated, declared or measured, as the case may be, by more than 3.5 kPa in the International System of Units or 0.5 psi in the Imperial system of units.

Lock-up
The condition of the pressure factor metering regulator that occurs at tight shut-off of the regulator during no flow conditions.

Set flow rate
The flow rate established by the manufacturer or as stated in the Notice of Approval for the setting of the pressure factor metering regulator’s outlet pressure.

Standard pressure
An absolute pressure of 101.325 kPa in the International System of Units and either 14.73 psi or 30 inches of mercury at 32 °F in the Imperial system of units.
**Standard temperature**
A temperature of 15 °C in the International System of Units or 60 °F in the Imperial system of units.

5.0 General

5.1 All PFM installations shall be subject to initial verification.

5.2 Any verified PFM installation that has been significantly modified shall be subject to reverification. Modifications considered to be significant are listed under section 6.1.3.

5.3 Any PFM installation that fails to meet all applicable requirements of these specifications or that possesses a defect which could affect its ability to meet specified requirements shall be classified as nonconforming and shall not be accepted for use in trade. Non-conforming PFM installations shall be corrected and re-inspected or be removed from service.

6.0 Administrative requirements

6.1 Registration of pressure factor metering installations

6.1.1 Subject to 6.1.2, a contractor shall register each new PFM installation with the local Measurement Canada (MC) district or regional office and shall include:

a) gas contractor name and contact information (e.g. name, telephone number, email address);
b) contractor’s PFM installation number;
c) customer name and address;
d) PFM installation location, if different than c);
e) date of installation;
f) date put into service;
g) contract meter pressure;
h) declared atmospheric pressure;
i) base pressure;
j) contract pressure multiplier;
k) if supercompressibility correction is applied, the following information:

   i) fixed supercompressibility factor
   ii) gas composition used for calculation
   iii) temperature used for calculation
   iv) algorithm used for calculation
   v) frequency of re-calculation;
The following information is required:

- i) expected range of PFM regulator inlet pressures;
- m) the following PFM regulator information:
  - i) make, model and type
  - ii) contractor and serial number
  - iii) spring and orifice in use
  - iv) inlet and outlet sizes;
- n) the following meter information:
  - i) make and model
  - ii) contractor and serial numbers
  - iii) maximum rated operating pressure
  - iv) rated flow rate capacity
  - v) indication as to whether the meter is temperature converting (TC) or non-TC
  - vi) seal date;
- o) the following load information:
  - i) type of load (e.g. residential, commercial, farm, industrial)
  - ii) nature of load (e.g. variable, fixed)
  - iii) connected gas equipment (e.g. corn dryer, hot water heater, furnace, boilers, gas stove, etc.)
  - iv) total connected load in units of standard volume flow rate.

### 6.1.2 New PFM installations

New PFM installations shall be registered in paper or electronic format and on an annual basis or as requested by the local MC district or regional office.

### 6.1.3 Contractor Notification

The contractor shall inform the local MC district or regional office of any of the following significant changes to existing PFM installations:

- a) PFM regulator's verification seal broken
- b) new PFM regulator
- c) new spring and/or orifice
- d) new contract meter pressure
- e) PFM regulator calibration adjustment
- f) new piping configuration
- g) new meter type
- h) same meter type but change in meter size
6.2 Nameplate markings and information

6.2.1 General

All required markings shall be capable of withstanding the effects of the environment for the service life of the installation and shall be readily accessible and legible in order that they can be read in a convenient manner.

6.2.2 Pressure factor metering regulator nameplate markings

The PFM regulator’s nameplate shall be marked with the following information:

a) manufacturer’s name or registered trademark
b) model or type designation
c) serial number
d) departmental approval number (PFM regulators manufactured prior to July 1987 are exempt from this requirement)
e) maximum allowable operating pressure

6.2.3 Pressure factor metering regulator operating information

The PFM regulator shall include a nameplate, tag or other suitable means marked with the following operating information:

a) spring range
b) orifice size
c) outlet pressure set point
d) contract pressure multiplier

6.2.4 Pressure factor metering regulator body markings

The PFM regulator shall be marked showing the direction of gas flow (e.g. with an arrow) or shall have the inlet connection identified.

6.2.5 Meter markings

The following information shall be recorded to identify the meter used in the PFM installation as well as its legal status:

a) manufacturer’s name
b) inspection number
c) type or model designation
d) serial number
e) indication as to whether the meter is TC or non-TC
f) rated flow rate capacity  
g) rated maximum working pressure  
h) departmental approval number  
i) seal date

7.0 Technical requirements

7.1 Pressure factor metering regulator installation and use

7.1.1 The PFM regulator shall be:

a) of a type approved by MC and shall conform to the applicable Notice of Approval (NOA);  
b) installed and oriented as required by the NOA or as recommended by the manufacturer, as applicable;  
c) used within its approved operating ranges for inlet pressure, outlet pressure and flow rate as stated in the NOA.

7.1.2 The PFM regulator’s spring and orifice size shall be appropriately selected to ensure the connected load is sufficiently supplied and the meter inlet pressure will be maintained within the tolerances specified in section 8.4.5 at all applicable flowing conditions.

7.2 Meter installation and use

7.2.1 The meter and any attached non-integral temperature conversion device used in a PFM installation shall:

a) be of a type approved by MC and shall conform to the applicable NOA(s);  
b) have been verified and affixed with one or more valid seals;  
c) be of a type with flow rate and operating pressure capacities that ensure the connected load is sufficiently supplied and accurately metered at all applicable flowing conditions;  
d) be used within its approved operating ranges.

7.2.2 Diaphragm meters shall be connected as close as possible to the PFM regulator outlet.

7.2.3 Subject to 7.2.4, the piping configuration between the PFM regulator outlet and the meter inlet shall not result in a pressure drop exceeding 0.2% of the absolute contract meter pressure at the installation’s maximum gas flow rate. This requirement is intended to encourage close connection of the meter to the PFM regulator with minimal use of pressure reducing fittings in the installation configuration design. This requirement is also intended to ensure the pressure requirements of the connected load are not compromised due to excessive pressure drop across the PFM installation.
7.2.4 Where pilot-operated PFM regulators are used and their pressure sensing control line is connected to the inlet tap of a diaphragm or turbine meter or to the outlet tap of a rotary meter, the requirements of section 7.2.3 shall not apply.

7.2.5 PFM installations with turbine meters shall be subject to installation configuration requirements given in the meter’s NOA or as recommended by the manufacturer.

7.3 Change of pipe diameter

Any change in the diameter of pipe connecting the PFM regulator outlet to the meter inlet shall occur immediately downstream of the regulator and shall be followed by at least five diameters of straight pipe wherever:

a) the meter pressure is measured at a tap located on the piping preceding the meter; and/or
b) a turbine meter is used without internal flow straighteners.

7.4 Pressure taps

7.4.1 A pressure tap shall be located within 18 inches of the PFM regulator inlet.

7.4.2 A pressure tap may be located on any meter bypass connections upstream of the PFM regulator provided the requirement of section 7.4.1 is met. There shall be no flow through the meter bypass during the determination of the PFM regulator inlet pressure.

7.4.3 A pressure tap shall be located within 12 inches of the meter inlet except where the meter has a provision on its case for connection of a pressure gauge.

7.4.4 Pressure taps are permitted on the following pipe fittings leading to the inlet of the meter:

a) pipe nipples with welded 1/4 inch internal diameter taps. The edges of the tap hole on the inner surface of the pipe nipple must be free from burrs and smooth with the inner nipple wall;
b) pipe tees with straight through gas flow and the tap located at a right angle to the flow;
c) pipe crosses, as in (b) above;
d) relief valves, if their connection meets the requirements of (a), (b) and (c).

7.4.5 Pressure taps are not permitted on the following pipe fittings leading to the inlet of the meter:

a) pipe elbows, regardless of the position of tap with relation to the direction of flow;
b) pipe reducers;
c) preformed cast meter connectors where the tap is effectively located on an elbow.
7.4.6 All pressure taps shall be permanently equipped with a suitable isolation provision to allow for the connection of a pressure gauge without having to bleed down the line and interrupt the supply of gas to the customer.

8.0 Metrological requirements

8.1 Contract pressure multiplier

8.1.1 The contract pressure multiplier for a PFM installation shall be calculated and rounded to no less than four significant figures using the following equation:

\[ P_m = \left( \frac{P_c + P_a}{P_b} \right) \]

Where:

- \( P_c \) is the contract meter pressure expressed on the gauge pressure scale in psig or kPag
- \( P_a \) is the contractor's declared atmospheric pressure in psi or kPa
- \( P_b \) is the base pressure selected by the contractor in psi or kPa

8.1.2 Where the contractor selects a base pressure differing from standard pressure, they shall ensure the volume registered by the meter is converted to standard volume prior to billing.

8.2 Supercompressibility correction

Where a gas contractor opts to apply supercompressibility correction to the volume registered by a meter used in a PFM installation, the requirements of section 35 and paragraph 40(b) of the Regulations shall be adhered to.

8.3 Calculated and declared atmospheric pressure

8.3.1 Subject to 8.3.2, the calculated atmospheric pressure for a PFM installation’s meter location shall be determined using the following equation:

a) in the International System of Units

\[ P_a = 101.56 - (0.0113 \times M) \text{ kPa} \]

or

b) in the Imperial system of units

\[ P_a = 14.73 - (0.0005 \times F) \text{ psia} \]

Where \( M \) and \( F \) are the elevation above sea level in metres and feet respectively as determined by a registered surveyor or from the most recent applicable topographical maps.
8.3.2 The elevation above sea level for a PFM installation’s meter location may be determined from the readings taken from a certified barometer, on the same day, at the meter location and a reference location of known elevation (e.g. airport or weather station) using the following equation:

a) in the International System of Units,

\[ EL_M = EL_{REF} - \left( \frac{Pa_M - Pa_{REF}}{0.0113} \right) \text{metres,or} \]

b) in the Imperial system of units,

\[ EL_M = EL_{REF} - \left( \frac{Pa_M - Pa_{REF}}{0.0005} \right) \text{feet} \]

Where:

- \( EL_M \) is the calculated elevation at the meter location
- \( EL_{REF} \) is the known elevation at the reference location in metres or feet
- \( Pa_M \) is the measured atmospheric (or barometric) pressure at the meter location in kPa or psi
- \( Pa_{REF} \) is the measured atmospheric (or barometric) pressure at the reference location in kPa or psi

8.3.3 The contractor’s declared atmospheric pressure for a PFM installation’s meter location shall not differ from the calculated atmospheric pressure for that same location by more than:

a) in the International System of Units,

\[ 0.621 + (0.001 \times Pc) \text{ kPa, or} \]

b) in the Imperial system of units,

\[ 0.090 + (0.001 \times Pc) \text{ psi} \]

Where \( Pc \) is the contract meter pressure expressed on the gauge pressure scale in psig or kPag.

8.4 Meter inlet pressure

8.4.1 Subject to 8.4.2, the actual meter inlet pressure, as set by the PFM regulator, shall be determined in the same units as the contract meter pressure using a certified pressure standard at each of the following:

a) the PFM regulator’s set flow rate;

b) a flow rate as close as practical to the maximum expected load;

c) a flow rate as close as practical to 50% of the maximum expected load.
8.4.2 Where it is not possible to establish any or all flow rates stipulated under section 8.4.1, the meter inlet pressure shall be determined at other flow rates that are representative of the connected load. However, meter inlet pressures at lock-up or pilot loads shall be inadmissible for verification purposes.

8.4.3 The test flow rates stipulated in sections 8.4.1 and/or 8.4.2 shall be established using the meter’s registered actual volume flow rate, unconverted volume register or temperature converted volume register as available. The standard volume flow rate shall be calculated for each applicable test flow rate to provide for compliance assessment with sections 7.1 and 7.2.

8.4.4 The PFM regulator inlet pressure, expressed on the gauge pressure scale, shall be monitored and determined using a certified pressure standard at each applicable test flow rate to provide for compliance assessment with section 7.1.

8.4.5 The PFM regulator shall be capable of maintaining an absolute pressure at the inlet of the meter within -1.0% to +2.0% of the absolute pressure used by the contractor to calculate their contract pressure multiplier.

8.4.6 Compliance with 8.4.5 shall be assessed on the basis of the % error calculated for each test flow rate using the following equation:

\[
\% \text{Error (meter absolute pressure)} = \left( \frac{P_{ga} + P_a}{P_c + P_a} - 1 \right) \times 100\%
\]

Where:

- \( P_{ga} \) is the measured meter inlet pressure expressed on the gauge pressure scale in psig or kPag
- \( P_c \) is the contract meter pressure expressed on the gauge pressure scale in psig or kPag
- \( P_a \) is the atmospheric pressure declared by the contractor in psi or kPa
9.0 Sealing of pressure factor metering regulators

9.3.1 PFM regulators put into service prior to initial verification shall be sealed by the contractor using a contractor’s seal until such time as the installation is verified.

9.3.2 Where a PFM installation has met all the applicable requirements of these specifications, the PFM regulator shall be sealed in accordance with the provisions stated in the applicable NOA.

10.0 Reverification period

The initial and subsequent reverification periods for PFM installations shall be as stipulated in bulletin G-18.