Certification Requirements

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GS-ENG-09-01

Requirements for the certification by correlation of gas measuring apparatus—Working level bell provers

Canada

Record of changes

Version	Date	Description
1.0	2017-07-06	– Removed the unit for relative density in section 5.2.1. – Added a reference for the American Society for Testing Materials test method specifications in section 5.2.5. – Corrected the tolerance for pressure in sections 5.3.4.2, 5.3.5.2 and 5.3.6.2. - Changed the name of the senior engineer. - Corrected spelling and formatting.

Table of contents

1.0 Scope

1.1 This document outlines the requirements for the certification, recertification, calibration and use of working level gas measuring apparatus using bell provers up to 10 ft^3 capacity. These measuring apparatus are used for the verification, reverification and/or compliance sampling of gas meters. Bell provers with a volumetric capacity greater than 10 ft^3 must be processed for certification on an individual basis as determined by Measurement Canada.

1.2 This document is supported by the procedures set out in GS-ENG-09-01.1—Procedures and Worksheets for Calibrating and Certifying Gas Measuring Apparatus—Working Level Bell Provers pursuant to the Requirements of GS-ENG-09-01.

1.3 This certification document is considered as interim, as it does not fully incorporate the requirements of S-S-02—Measurement Uncertainty and Meter Conformity Evaluation Specifications. However, the determination of measurement uncertainty is subject to the guidelines in GS-ENG-09-04—Guidelines for the Determination of Measurement Uncertainty in Working Level Bell Provers—Correlation Method.

2.0 Authority

This document is issued pursuant to sections 7 and 8 of the *Electricity and Gas Inspection Regulations*. It has been produced under the delegated authority of the Senior Engineer, Gas Measurement, Measurement Canada for the purposes of setting out the requirements for the calibration, certification and use of gas measuring apparatus.

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3.0 Terminology

Calibration: Comparison between two instruments, measuring apparatus or standards, one of which is of known accuracy. Tests are performed to detect, correlate, report or eliminate by adjustment any variation in accuracy of the instrument or measuring apparatus of unknown accuracy.

Cardinal point: A major volume increment marking on the bell scale chosen as a point of reference for a selected test volume.

Certification: A process which ensures that a measuring apparatus has been properly calibrated and installed for its intended use, and that an acceptable accuracy correlation exists between it and a reference standard.

Certification testing: A specialized form of calibration performed according to fixed standards which must be met prior to the issuance of the certification certificate.

Designating authority: Individual delegated the authority to certify gas measuring apparatus under the *Electricity and Gas Inspection Act* and associated Measurement Canada policies.

Direct counting gas measuring apparatus: A gas measuring apparatus which determines the meter error using register revolutions of the meter under test.

High load flow rate: The flow rate corresponding to the specified high load test flow rate, i.e. 145 % ± 5 % of a diaphragm meter's rated capacity of air at 0.5 inches differential pressure.

Inferential gas measuring apparatus: A gas measuring apparatus which determines meter error by a method other than direct counting.

Initial certification: Certification of gas measuring apparatus for the first time.

Local volumetric standard: A master bell prover or certified transfer prover located at or near the site of the gas measuring apparatus.

Low load flow rate: The term used to describe the flow rate corresponding to the specified low load test flow rate, i.e. 45 % ± 5 % of a diaphragm meter's rated capacity of air at 0.5 inches differential pressure.

Master bell prover: The local volumetric standard which is traceable to a national volumetric reference standard.

Meter class: A general grouping of meter types having varied manufacturers and model designations, but having the same units of measure and similar rated capacities of air at 0.5 inches differential pressure. Class designations (shown in cubic feet/hour): 100 class (<140), 200 class (140 to 200), 300 class (201 to 300), 400 class (301 to 350), 500 class (351 to 450), 600 class (451 to 500), 700 class (501 to 550), 800 class (551 to 650), 900 class (651 to 700), 1000 class (701 to 800). All other meters must be grouped into classes based on 99 ft^3 intervals or the International System of Units equivalent.

Meter classification: A grouping of meters having the same manufacturer, meter class, and units of measure, formed from the listing of meters in the owner's statement of intended use.

Minimum range volume: The nominal volume range over which a gas measuring apparatus is to be calibrated.

Monitor: To observe, record or detect an operation or condition with instruments.

Non-converting meter: A meter that does not correct the registered volumes for pressure and/or temperature.

Owner: The owner of the gas measuring apparatus to be calibrated and certified or recertified.

Recertification: Certification of a gas measuring apparatus subsequent to the initial certification.

Relative error: The absolute error of measurement divided by the true (conventional) value of the measurand. The measurand is a quantity subjected to measurement.

Start point: The fully raised position of the bell prior to commencement of the test sequence.

Technical evaluator (inspector): Individual appointed by the designating authority and delegated under the *Electricity and Gas Inspection Act* and associated Measurement Canada policies to perform certification testing of a gas measuring apparatus.

Transfer meter: A non-converting meter supplied by the owner for the purposes of relating the volume measured by a gas measuring apparatus to a local volumetric standard.

Volume correlation: The process by which a specific volume registered by a transfer meter or measured by a gas measuring apparatus is related to or traceable to a local volumetric standard.

Working level gas measuring apparatus: A gas measuring apparatus intended for use in the verification, reverification and/or compliance test of gas meters.

X-bar: The arithmetic mean of the “n” results considered.

4.0 Administrative requirements

4.1 General

4.1.1 These requirements apply immediately upon issue to all gas measuring apparatus utilizing bell prover displacement technology.

4.2 Gas measuring apparatus requirements

4.2.1 For measuring apparatus to be certified, all the requirements of this document must be evaluated and the results must meet the applicable requirements.

4.2.2 Gas measuring apparatus may be certified for testing any or all types of approved gas meters at test flow rates within the flow rate capacity of the local volumetric standard and the gas measuring apparatus.

4.2.3 The certificate issued by the designating authority must be valid for a period established by regulations for the gas measuring apparatus at the location where the calibration was completed. Any relocation or software, equipment or component replacements or modifications which affect the performance of the gas measuring apparatus require recertification of the gas measuring apparatus. The extent of the recertification is to be determined by the designating authority upon receipt of the notice referred to in clause 4.5.2(g) of this document.

4.3 Statistics

Gas measuring apparatus or related accessories intended to perform statistical calculations of average error and standard deviation of a sample of gas meters for the purposes of verification, reverification or compliance sampling must do so pursuant to the requirements of a Measurement Canada-approved statistical sampling plan for the verification or reverification of gas meters.

4.4 Certification testing

The method of certification testing must be sufficient to ensure that the gas measuring apparatus will function accurately and reliably over the conditions to which it will be subjected. These conditions include, but are not limited to, ambient air temperature, meter proving air temperature, model of meter, condition of meter, test flow rates and modes of gas measuring apparatus operation. Where it has been determined analytically or empirically that the effect of a particular condition is not significant with respect to the accuracy of a specific type of gas measuring apparatus, the method of certification testing may, with the Senior Engineer's - Gas Measurement permission, be modified to take this evidence into account. If more than one method of meter proving is to be certified, the steps in sections 5.5.3, 5.5.4 and 5.5.5 must be performed using all meter proving methods requested.

4.5 Roles and responsibilities

4.5.1 Designating authority

The designating authority is responsible for:

(a) any certification ensuing from the certification testing procedure;
(b) all calibration testing procedures and worksheet completion relevant to this document.

4.5.2 Owner

The owner is responsible for:

(a) providing a statement of intended use together with a full set of completed worksheets demonstrating that the gas measuring apparatus is fully compliant with all applicable requirements set out in this document prior to certification testing of the gas measuring apparatus by the designating authority;
(b) making all adjustments and calibrations necessary to meet the requirements;
(c) providing the transfer meters required by this document;
(d) providing the leak test apparatus required to demonstrate the ability of the gas

measuring apparatus to detect the specified operational leak;

(e) using the gas measuring apparatus in the manner for which it was intended and in accordance with any conditions set out in the certificate;

(f) ensuring that the gas measuring apparatus is maintained in good repair and in the required operational order;

(g) giving the designating authority prior notification of proposed relocation, modification and/or need of repairs to the certified gas measuring apparatus. The need for recertification will be determined by the designating authority upon receipt of this notification;

(h) maintaining a log book or file which records the dates and details, including the identification of the person or persons performing accuracy checks, adjustments, maintenance, repairs and modifications to the gas measuring apparatus. The log book for each gas measuring apparatus must be made readily available to the designating authority upon request and must be retained for a period of six years;

(i) providing a stable temperature environment for the gas measuring apparatus. The prover room ambient air temperature, the meter outlet air temperature, the prover oil temperature and the gas measuring apparatus meter proving air temperature must be continuously monitored. Records of these temperatures must be maintained and reviewed prior to calibrating the gas measuring apparatus;

(j) making available to the designating authority operating instruction manuals which provide detailed information pertaining to the installation, maintenance, calibration and use of the gas measuring apparatus.

4.6 Statement of intended use of the gas measuring apparatus

4.6.1 Limitations

The owner must provide to the designating authority a detailed statement of intended use of the gas measuring apparatus. The documentation provided must be sufficient to determine the capabilities of the gas measuring apparatus, its intended uses and all installation requirements. The intended use of the gas measuring apparatus must:

(a) be within the specifications and limitations of the gas measuring apparatus published by the manufacturer; and

(b) be such that the gas measuring apparatus is capable of achieving and maintaining the required flow rates.

The minimum test volume must be as specified in Table 1 or the metric equivalent unless the owner or manufacturer can demonstrate that reducing the volume will not affect the performance of the apparatus.

Table 1: Minimum test volumes for bell provers

Bell capacity	Direct counting type	Inferential type
2 ft^3	2 ft^3	0.5 ft^3
5 ft^3	2 ft^3	0.5 ft^3
10 ft^3	5 ft^3	2 ft^3

4.6.2 Statement of intended use - Details

The statement of intended use of the gas measuring apparatus must include:

(a) a full description of the gas measuring apparatus to be certified, including the manufacturer(s), operating parameters, minimum and maximum test capacities, computer software and hardware revisions, model number(s) and serial number(s);
(b) a description of each class, type or design of meter to be tested with the gas measuring apparatus;
(c) a declaration of the categories of testing for which the gas measuring apparatus is to be utilized as set out in clause 5.5.3 and modes of operation as set out in clause 5.5.5 of this document;
(d) an identification of the minimum and maximum range of test capabilities (i.e. humidity, pressure temperature, flow rate) for which certification of the gas measuring apparatus is requested; and
(e) a declaration of the method(s) of meter proving, as set out in clauses 5.5.1 and 5.5.2.

5.0 Metrological requirements

5.1 Environment

5.1.1 Temperature

5.1.1.1 The prover room ambient air temperature must be continuously maintained and monitored at ± 1 °C of the temperature chosen by the owner. The owner may change the temperature at any time during the period of the certification, but it must fall within a range of 22 °C ± 4 °C and meet the requirement of section 5.1.1.3.

5.1.1.2 The temperature of the prover room ambient air, the meter outlet air, the gas measuring apparatus bell outlet air and the prover oil must be within 0.5 °C of each other during all testing procedures and during any subsequent verification, reverification or compliance sample testing during the certification period.

5.1.1.3 Prior to and during certification testing, the prover room ambient air temperature must not vary by more than ± 1 °C and ± 0.5 °C over the previous twenty-four hour and four-hour periods, respectively.

5.2 Prover oil

5.2.1 New prover oil, when acquired for use in bell provers, must have the following properties:

Viscosity at 40 °C: 3.0 cSt - 7.5 cSt
Relative density at 15 °C: 0.82 - 0.86

5.2.2 The owner must ensure that specifications of oil purchased are met. The documentation supplied with regards to the prover oil must clearly indicate the source, brand name and batch number of the oil being used.

5.2.3 Where more than one prover has been filled with new oil from the same batch, only one representative oil sample from one of the provers needs to be tested to ensure the oil meets the specifications.

5.2.4 Prover oil must be tested annually and at the time of certification, at an approved laboratory or by the use of authorized procedures. The sample is to be drawn from the top of the prover tank.

5.2.5 The following American Society for Testing Materials (ASTM) test method specifications are applicable to testing oil for the stated properties.

Table 2: **American Society for Testing Materials test methods applicable to testing oil**

Property	ASTM test method specifications
Viscosity	D445: Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity).
Relative density	D1298: Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method or D4052: Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

5.3 Mechanical requirements

The gas measuring apparatus installation and operation must be verified for compliance with the manufacturer's installation instructions and Measurement Canada requirements. Where auxiliary equipment is attached or is to be attached to the bell, the counterweight wheel or its shaft or any other movable component of the gas measuring apparatus installation not specifically mentioned, the bell balance calibrations must be performed with the auxiliary equipment attached.

5.3.1 Bell component installation

5.3.1.1 The components listed below must be checked to ensure that they are vertical. Installation of the components must be checked at least in two views spaced 90° from each other:

(a) prover tank
(b) support posts for the counterbalance wheel support frame
(c) counterbalance wheel support frame
(d) counterbalance wheel
(e) prover bell
(f) prover guide rods

5.3.1.2 The bell components must be aligned such that all components will operate in the same plane of motion throughout the entire operating range of the bell.

5.3.2 Prover oil level

5.3.2.1 The prover oil level must be checked at the start point and the maximum point of travel with the bell closed to atmosphere and the internal bell pressure adjusted to 2.00 ± 0.02 inches water column.

5.3.2.2 The sealant oil level must be measured and recorded when the bell is lowered to its maximum travel and open to atmosphere.

5.3.2.3 The prover oil level must be recorded and shown on the certificate issued by the designating authority together with the reference point.

5.3.3 Bell balance

5.3.3.1 The bell balance testing must commence at the start point used to start the proving operation and at points equal to 20, 40, 60 and 80 % of the intended range of travel of the bell and end at the maximum point of travel.

5.3.3.2 The bell must remain stationary at any and all points chosen for bell balance calibration.

5.3.4 Bell reference pressure

5.3.4.1 Upon completion of the procedure set out in clause 5.3.3, the bell pressure must be adjusted, if required.

5.3.4.2 With the bell positioned within the range of bell travel, the main counter weight must be adjusted to achieve a bell pressure of 2.00 ± 0.02 inches water column.

5.3.5 Bell static pressure

5.3.5.1 The bell static pressure calibrations must commence at the start point and at points equal to 20, 40, 60 and 80 % of the intended range of bell travel and end at the maximum point of bell travel.

5.3.5.2 The bell static pressure at all calibrated points must be equal to 2.00 ± 0.02 inches water column.

5.3.6 Bell dynamic pressure

5.3.6.1 The bell dynamic pressure calibrations must commence at the start point and at points equal to 20, 40, 60 and 80 % of the intended range of bell travel and end at the maximum point of bell travel.

5.3.6.2 The bell dynamic pressure at all calibrated points must be equal to 2.00 ± 0.02 inches water column as the bell descends at a rate not exceeding 8 inches per minute.

5.3.7 Leak test

5.3.7.1 System leak test

5.3.7.1.1 A system leak test must be conducted with all auxiliary equipment connected to the gas measuring apparatus. The piping of gas measuring apparatus must include a meter in the system leak test.
5.3.7.1.2 The system leak test must be conducted with the bell at a cardinal point near the bottom of the intended range of bell travel. The leak test time interval must be a minimum of 10 minutes during which the bell position must be monitored.
5.3.7.1.3 The position of the bell must not change during the system test.
5.3.7.1.4 When a gas measuring apparatus is equipped with an outlet control valve and the meter and associated piping up to the outlet control valve is pressurized, the entire system, including the outlet control valve, must be part of the system leak test.

5.3.7.2 Operational leak test

5.3.7.2.1 The operational leak test procedure must be incorporated into the use of the gas measuring apparatus process and must be tested for both leak detection capability and repeatability.
5.3.7.2.2 Operational leak test procedures must be capable of detecting a leak of 0.25 cubic feet per hour at 2 inches of water column or greater using a leak test duration and applied pressure/vacuum designated by the owner. The operational leak test must be initiated three consecutive times to verify the reliability and repeatability of the process.
5.3.7.2.3 The owner must provide the leak test apparatus, calibrated to the local volumetric standard or another certified reference standard, for the purpose of the operational leak test.

5.3.8 Flow rate tests

5.3.8.1 The flow rate setting mechanism of the gas measuring apparatus must be tested at both the high and low load verification test points for each meter listed in the statement of intended use.

5.3.8.2 The flow rate mechanism must be capable of setting the flow rates to within the specifications of the nominal high load and low load verification test points for each meter listed in the statement of intended use.

5.3.8.3 The flow rate setting mechanism must be tested on the gas measuring apparatus using:

(a) transfer meters of known accuracy, and/or
(b) production meters of known accuracy,
(c) designated transfer meters representing flow rates between 10 % to 150 % of rated air capacity,
(d) selected meter(s) that may use both metric and imperial units of measurement with identical flow rates.

5.3.8.4 In the case of an adjustable flow rate mechanism, the flow rate mechanism calibration must be repeated six times at the high load flow rate and six times at the low load flow rate for each meter. In the case of fixed flow rate caps, the flow rate tests must be repeated three times at the high load flow rate and three times at the low load flow rate.

5.3.8.5 Each calculated flow rate must be within ± 5 % of the designated low and high load flow rates for the meter being tested.

5.3.9 Register verification

If the gas measuring apparatus is equipped with a register ratio verification option, it must be verified. The register ratio option must be verified by utilizing both a correct and an incorrect model of register representing a metric and imperial meter designated in the statement of intended use to ensure that the system is capable of accurately detecting the correct register ratio.

Note: This optional equipment does not remove the dial test inspection requirement. Where an inspection is carried out using the direct counting method, the dial test is effectively addressed, since the proving is carried out directly off the test dial. Where an inspection is carried out using an inferential method, a dial test procedure must be developed by the contractor, and evaluated and approved by the Measurement Canada gas specialist.

5.4 Meter classifications and transfer meters

5.4.1 Meter classifications

Meters shown in the statement of intended use must be grouped according to either meter class or meter classification, depending on the method of counting used by the gas measuring apparatus. A transfer meter is chosen to represent each meter class or meter classification.

5.4.2 Transfer meters

5.4.2.1 Transfer meters representative of meters in the various meter classes or meter classifications must be used to determine the percent error of the gas measuring apparatus by comparison to the local volumetric standard.

5.4.2.2 Transfer meters must be non-converting positive displacement gas meters.

5.4.2.3 Each transfer meter must be calibrated to possess an error within the range of -2 % and -3 % at low and high load flow rates, and a maximum difference between the low load error and the high load error (spread) of 0.5 or less.

5.4.2.4 Transfer meters must be acclimatized in the area of the gas measuring apparatus for a minimum period of four hours.

5.4.2.5 It is the responsibility of the owner to ensure that selected transfer meters are proven repeatable prior to use as transfer meters. The suggested method is as follows:

(a) Exercise potential transfer meters for a minimum of five minutes at a flow rate not exceeding 50 % of the rated air capacity.
(b) Run the meter six times at both the low and high load flow rates on the local volumetric standard to determine the meter error.

The selected meter is considered acceptable for use as a transfer meter provided that the percent error of each of the runs at the specified test flow rate is within ± 0.2 of the X-bar of percent errors for all six runs (see Table 3 for example).

Table 2: Determination of meter repeatability

Run #1	Run #2	Run #3	Run #4	Run #5	Run #6	X-bar 6 runs	Acceptable limits
0.5	0.6	0.4	0.6	0.5	0.5	0.52	0.52 ± 0.2

5.4.2.6 The flow rate of the local volumetric standard must be set to within +/- 2 % of Q_{max} of the specified high and low load test points for the transfer meter to be tested. For example, the high load flow rate of a meter with a rated capacity of 180 cubic feet per hour would be within 257.4 cubic feet per hour to 264.6 cubic feet per hour and the low load flow rate would be 77.4 cubic feet per hour to 84.6 cubic feet per hour.

5.4.2.7 The flow rate of the gas measuring apparatus must be set to 145 % ± 5 % and 45 % ± 5 % of the badged flow rate of the transfer meter to be tested. The flow rate of the gas measuring apparatus must be set to within +/- 5 % of Q_{max} of the specified high and low load test points for the transfer meter to be tested. For example, the high load flow rate of a meter with a rated capacity of 180 cubic feet per hour would be within 252 cubic feet per hour to 270 cubic feet per hour, and the low load flow rate would be 72 cubic feet per hour to 90 cubic feet per hour.

5.5 Volume correlations

5.5.1 Direct counting gas measuring apparatus

In order to test a direct counting gas measuring apparatus for the purpose of certification or recertification, a transfer meter must be chosen from each meter class listed in the statement of intended use to act as representative of the class.

5.5.2 Inferential gas measuring apparatus

In order to test an inferential gas measuring apparatus for the purpose of certification, a transfer meter of each meter classification listed in the statement of intended use must be tested. In the case of a scheduled recertification of an inferential gas measuring apparatus, a transfer meter representative of each meter class listed in the statement of intended use is chosen.

5.5.3 Correlations

5.5.3.1 Volume correlation must be made to the local volumetric standard to determine whether the gas measuring apparatus may be certified for:

(a) verification,
(b) reverification, and/or
(c) compliance sampling.

5.5.3.2 Volume correlations must be conducted at the low and high load flow rates of each meter being tested.

5.5.3.3 Volume correlations must be conducted with the gas measuring apparatus in the non-converting mode.

5.5.3.4 Testing of a gas measuring apparatus using a transfer meter must be completed on the same day that the transfer meter acceptability and proof errors were established with the local volumetric standard.

5.5.3.5 Each transfer meter must be proven six times with the gas measuring apparatus at both the low and high load flow rates of that transfer meter.

5.5.3.6 The percent error for each of the six runs must be within ± 0.2 of the X-bar of the percent errors of the meter as determined with the local volumetric standard at each flow rate.

5.5.3.7 The requirements of sections 5.5.3, 5.5.4 and 5.5.5 must be satisfied for each method of meter proving, as designated by the owner.

5.5.4 Maximum error detection

5.5.4.1 Volume correlations to determine the maximum detectable error must be completed with non-converting transfer meters of any one meter class, type or design set out in the statement of intended use. Transfer meters must be adjusted by the owner to register the following errors:

(a) for the purposes set out in clause 5.5.3.1(a) and/or (b): + 2.5 % ± 0.5 %;
(b) for the purposes set out in clause 5.5.3.1(c) only or in addition to 5.5.3.1(a) and/or (b): + 9.0 % ± 0.5 % and - 9.0 % ± 0.5 %.

5.5.4.2 The transfer meters must be run six times with the gas measuring apparatus at the high load flow rates. The X-bar of the errors of the six runs must be used to determine compliance for maximum error detection. The gas measuring apparatus must be placed in non-converting mode.

5.5.4.3 The percent error of each transfer meter test, as determined with the gas measuring apparatus, must be within ± 0.2 of the X-bar of the percent errors as determined on the local volumetric standard.

5.5.5 Additional modes of operation

a) Where the owner's statement of intended use includes the operation of the gas measuring apparatus in different modes of operation, each mode of operation must be tested using one transfer meter.
b) The transfer meter must be proven six times with the gas measuring apparatus at the high load flow rate. The X-bar of the percent error of these six runs must be used to determine compliance for each additional mode of operation.
c) The percent error of each transfer meter test, as determined with the gas measuring apparatus, must be within ± 0.2 of the X-bar of the percent errors determined with the local volumetric standard.

5.5.5.1 Temperature differential mode correlations

(a) The gas measuring apparatus must be switched to and tested in the temperature differential mode. This mode is used for correlations and the verification/reverification of non-converting diaphragm gas meters. The temperature differential mode corrects for the difference in flowing air temperature between the bell outlet and meter outlet and applies a correction factor to determine the true meter relative error.
(b) During the test, the temperature sensors for the bell outlet air temperature and the meter outlet air temperature must be made to differ by a temperature of 1.0 $^{\circ}$C ± 0.5 °C by placing the meter outlet air temperature sensor in a temperature-controlled bath.

(c) With the temperature difference maintained, test the transfer meter six times at high load flow rate and calculate the X-bar.
(d) The high load flow rate, as indicated on the gas measuring apparatus, must be within ± 2 % of the high flow rate as indicated on the local volumetric standard. Calibration will be required if the indicated errors are outside requirements.
(e) The resulting X-bar is adjusted by calculation to compensate for the artificial temperature difference. See procedures section for applicable formula.
(f) The calculated X-bar of the errors, as determined by the gas measuring apparatus, must be within ± 0.3 of the X-bar of the percent errors of the transfer meter determined by the local volumetric standard.

5.5.5.2 Temperature converting mode correlations

(a) The gas measuring apparatus must be switched to and tested in the temperature converting mode.
(b) The resulting meter errors are adjusted by calculation to compensate for the correction applied by the gas measuring apparatus.
(c) The X-bar of the errors, determined by the gas measuring apparatus, must be within ± 0.3 of the X-bar of the percent errors of the transfer meter determined by the local volumetric standard.

6.0 Technical requirements

6.1 Use requirements

6.1.1 Weekly correlation - Transfer meter / local volumetric standard

6.1.1.1 The volume correlation of the transfer meters to the local volumetric standard must be performed:

(a) each week prior to the use of the gas measuring apparatus,
(b) using a non-converting transfer meter having an error of - 2.5 % ± 0.5 % at low and high load flow rates.
  (i) using transfer meters which have been acclimatized for a minimum of four hours.
  (ii) using transfer meters which have been constantly exercised at a rate equal to, or less than 15 % of the badged flow rate.

6.1.1.2 The transfer meters used for the weekly volume correlation must be representative of the metric or imperial meter classifications of those meters which are to be verified, reverified or compliance tested that week.

6.1.1.3 The transfer meter must be run six times with the local volumetric standard at both the low and high load flow rates. The flow rate of the local volumetric standard must be set to 145 % ± 2 % and 45 % ± 2.0 % of the badged air flow rate of the transfer meter to be tested. The X-bar of the percent errors of these runs must be used to determine the average true errors. These values must be utilized during correlation of the gas measuring apparatus over the course of the next week.

6.1.1.4 Transfer meter performance must be tracked to ensure reliability and repeatability. Weekly errors greater than ± 0.2 for either the high or low load flow rate from the previous correlation to the local volumetric standard must be investigated and noted in the designated prover log book.

6.1.2 Daily correlation - Transfer meter / gas measuring apparatus

6.1.2.1 Volume correlation of the gas measuring apparatus must be performed:

(a) each day prior to the use of the gas measuring apparatus;
(b) using designated non-converting transfer meters from 6.1.1;
(c) using transfer meters which have been acclimatized for a minimum of four hours;
(d) with the gas measuring apparatus in the
    (i) temperature differential mode if non-converting meters are to be verified or reverified; and/or
    (ii) temperature converting mode if temperature converting meters are to be verified or reverified.

6.1.2.2 For direct counting gas measuring apparatus, the transfer meters used must be representative of the metric or imperial meter class of those meters which are to be verified or reverified that day. For inferential gas measuring apparatus, the transfer meters used must be representative of the metric or imperial meter classification of those meters which are to be verified or reverified that day. Meters of any other classification must not be processed until the transfer meter representing that meter classification has been subjected to the daily volume correlation process. Daily volume correlations need not be performed if gas meters are not to be verified or reverified during that day.

6.1.2.3 Transfer meters must be run three times with the gas measuring apparatus at both the high load flow rate and low load flow rate. The low and high load flow rates of the gas measuring apparatus must be set to within 145 ± 5 % and 45 ± 5 % of the badged air rate of the transfer meter to be tested. The X-bars of the percent errors of these three runs must be used to determine the average true error, which must be within ± 0.2 of the percent error as established against the local volumetric standard within the previous one-week period.

6.1.2.4 Where the ± 0.2% allowable error tolerance has been exceeded, the steps below must be followed until the deficiency is resolved:

(a) repeat the correlation process shown in 6.1.2.3;
(b) repeat the weekly correlation process, pursuant to clause 6.1.1;
(c) perform a complete diagnostic analysis/check to ensure the integrity of the gas measuring apparatus; and/or
(d) where the ± 0.2 % allowable error tolerance is still not complied with, remove the gas measuring apparatus from service and initiate a nonconformance.

6.1.3 Operational leak detection

6.1.3.1 An operational leak detection sequence must be utilized prior to the final test sequence for all verification, reverification and compliance testing procedures.

6.1.3.2 The duration of the operational leak test must be as determined by the owner and specified for the test shown in section 5.3.7.2.

6.1.4 Prover oil

The owner of the gas measuring apparatus must have a sample of the prover oil tested annually and at the time of recertification for viscosity and relative density in accordance to the test methods requirement in section 5.2.5. Certificates of analysis must be made available to the designating authority upon request.

6.1.5 Temperature

6.1.5.1 The prover room ambient air temperature must be continuously maintained and monitored at ± 1 °C of the temperature chosen by the owner. The chosen temperature may be changed by the owner at any time during the period of the certification, but must fall within a range of 22 °C ± 4 °C and meet the requirement of section 5.1.1.3.

6.1.5.2 The prover room ambient air temperature, the meter outlet air, the gas measuring apparatus bell outlet air temperature and the prover oil temperature must be within 0.5 °C of each other during all testing procedures and during any subsequent verification, reverification or compliance sample testing during the certification period.

6.1.5.3 Prior to and during all verification, reverification or compliance sample testing, the prover room ambient air temperature must not vary by more than ± 1 °C and 0.5 °C over the previous twenty-four hour and four-hour periods, respectively.

6.1.5.4 Temperature records must be retained for a time period of not less than three years.

6.1.6 Maintenance

6.1.6.1 The owner must perform routine maintenance as specified in the manufacturer's and owner's manuals. As a minimum, the maintenance and/or calibration of components and sensors must be performed annually.

6.1.6.2 The calibration of pressure, temperature and other sensors must be performed with a traceable standard.

6.1.6.3 Records of maintenance and calibrations must be maintained as part of the prover log book as per section 4.5.2(h).