



Measurement
Canada

An Agency of
Industry Canada

Mesures
Canada

Un organisme
d'Industrie Canada

Certification Requirement

Category: GAS	Requirement: GS-ENG-10-02	Page: 1 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

GS-ENG-10-02

Requirements for Certification through Correlation of Gas Measuring Apparatus -

Working Level Sonic Nozzle Provers Used for the Purpose of Calibrating Diaphragm Meters

Patrick (Pat) J. Hardock, P.Eng.
Senior Engineer - Natural Gas Measurement
Engineering and Laboratory Services Directorate
Measurement Canada

Category: GAS	Specification: GS-ENG-10-2	Page: 2 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

GS-ENG-10-02: Summary of Amendments to S-G-01-E	
Section	Description
All	Reformatted to new formatting requirements.
5.4.2.5	Revised errors in table 1, to reflect range for calibrating transfer meters in subsection 5.4.2.3.
5.5.4.1	Removed requirements identified under the burden reduction initiative. Reworded to remove test points below the maximum errors expected for the intended use of the measuring apparatus.
Previous 5.7	Removed requirements identified under the burden reduction initiative. These requirements were necessary until the measuring apparatus certified had proven to be repeatable. No repeatability issues have been reported for the measuring apparatus that have been presented for certification.
6.2	Reworded to permit for weekly correlation, as identified under the burden reduction initiative. Added the conditions that must be met to permit weekly correlation.
6.2.5	Moved a) from 6.2 to avoid confusion. This is a requirement not an option and therefore should not have been under a list of options. Added the requirements that must be addressed to ensure suspect meters are identified and dealt with.
6.3	Changed specification to certification requirements; Introduced definitions for Designated Authority and Technical Evaluator. Made more consistent with GS-ENG-04-02 Name change to reflect correlation method.
1.1	Changed title and converted to word format.

Category: GAS	Specification: GS-ENG-10-2	Page: 3 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

Table of Contents

1.0 Scope	4
2.0 Authority	4
3.0 Definitions	4
4.0 Administrative Requirements	6
4.1 General	6
4.2 Gas Measuring Apparatus Requirements	6
4.3 Statistics	6
4.4 Certification Testing	6
4.5 Roles and Responsibilities	7
4.5.1 Designating Authority	7
4.5.2 Owner	7
4.6 Statement of Intended Use of the Gas Measuring Apparatus	8
4.6.1 Limitations	8
4.6.2 Statement of Intended Use - Details	8
5.0 Metrological Requirements	8
5.1 Temperature	8
5.2 Humidity	9
5.3 Mechanical Requirements	9
5.3.1 Operational Leak Test	9
5.3.2 Flow Rate Tests	9
5.3.3 Register Verification	10
5.4 Meter Classifications and Transfer Meters	10
5.4.1 Meter Classifications	10
5.4.2 Transfer Meters	10
5.5 Volume Correlation	11
5.5.1 Direct Counting Gas Measuring Apparatus	11
5.5.2 Inferential Gas Measuring Apparatus	11
5.5.3 Correlation	11
5.5.4 Maximum Error Detection	12
5.6 Additional Modes of Operation	12
5.7 Temperature Converting Mode Correlations	13
6.0 Technical Requirements	13
6.1 Weekly Correlation - Transfer Meter / Local Volumetric Standard	13
6.2 Daily/Weekly Correlation - Transfer Meter / Gas Measuring Apparatus	13
6.3 Operational Leak Detection	14
6.4 Temperature	15
6.5 Maintenance	15

Category: GAS	Specification: GS-ENG-10-2	Page: 4 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

1.0 Scope

This certification requirement outlines the requirements for the certification, recertification, calibration and use of working level gas measuring apparatus consisting of sonic nozzles and any associated readout devices. These measuring apparatus are used for the verification, reverification and/or compliance sampling of gas meters.

This document is supported by procedures set out in GS-ENG-10-02.1: Procedures and worksheets for Calibrating and Certifying Gas Measuring Apparatus - Sonic Nozzle Provers Pursuant to the Requirements of GS-ENG-10-02.

2.0 Authority

This document is issued under the authority designated to Measurement Canada's Senior Engineer - Natural Gas Measurement Engineering and Laboratory Services Directorate.

3.0 Definitions

Calibration

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

Certification

A process which ensures that a measuring apparatus has been properly calibrated, properly 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 Measurement Canada proving system certificate.

Designating Authority

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

Direct counting gas measuring apparatus

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

High load rate

The term used to describe the flow rate corresponding to $145 \pm 5.0\%$ of the meter's rated capacity of air at 0.5 inches differential pressure. For example, the high load 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.

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.

Category: GAS	Specification: GS-ENG-10-2	Page: 5 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

Low load rate

The term used to describe the flow rate corresponding to $45 \pm 5.0\%$ of the meter's rated capacity of air at 0.5 inches differential pressure. For example, the low load rate of a meter with a rated capacity of 180 cubic feet per hour would be within 72 cubic feet per hour to 90 cubic feet per hour.

Master bell prover

The volumetric standard which is traceable to a national volumetric reference standard.

Mean Value \bar{x}

The arithmetic mean of the "n" results considered

Meter Class

A general grouping of meter types having varied manufacturers and model designations but having similar rated capacities of air at 0.5 inches differential pressure. Class Designations (shown in ft³/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 shall be formed into classes based on 99.0 ft³ intervals or S.I 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.

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.

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 volume correlations on the gas measuring apparatus.

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.

Category: GAS	Specification: GS-ENG-10-2	Page: 6 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

4.0 Administrative Requirements

4.1 General

These specifications shall apply immediately upon issue to all gas measuring apparatus utilizing sonic nozzle mass flow technology.

4.2 Gas Measuring Apparatus Requirements

4.2.1 Certification will be considered for gas measuring apparatus that:

- a) has been installed in a temperature controlled and monitored environment;
- b) has been installed in accordance with the manufacturer's installation specifications;
- c) has been identified with a legible, readily accessible nameplate showing, as a minimum, a unique identifying number, the serial number, manufacturer, and capacity;
- d) will be used for its designed application and intended purpose; and
- e) meets the tolerances and other specifications set out in this document.

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 shall conditionally valid for the gas measuring apparatus at the location where the calibration was completed for a period of 5 years. Any relocation, equipment, software or component replacements or modifications which affect the performance of the gas measuring apparatus shall require recertification of the gas measuring apparatus. The extent of the recertification shall be determined by the Designating Authority upon receipt of the notice referred to in clause 4.5.2 herewith.

4.3 Statistics

Gas measuring apparatus or accessories thereto 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 shall do so pursuant to the requirements of a Measurement Canada approved statistical sampling plan for the verification and reverification of gas meters.

4.4 Certification Testing

The method of certification testing shall 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 may include, but are not limited to, ambient air temperature, meter proving air temperature and humidity, 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 Measurement Canada's Senior Engineer - Gas Measurement's permission, be modified to take this evidence into account. If more than one method of meter proving is to be certified, sections 5.5 herewith must be performed using all meter proving methods requested.

Category: GAS	Specification: GS-ENG-10-2	Page: 7 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

4.5 Roles and Responsibilities

4.5.1 Designating Authority

4.5.1.1

The Designating Authority shall be responsible for:

- a) Any certification ensuing from the certification testing procedure.
- b) All certification testing procedures and worksheet completion relevant to this requirement.

4.5.2 Owner

4.5.2.1

The owner shall be 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 these specifications prior to certification testing of the gas measuring apparatus by Measurement Canada.
- b) Making all adjustments and calibrations necessary to meet the requirements.
- c) Providing the transfer meters required by these specifications.
- 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 Measurement Canada prior notification of proposed relocation, modification and/or need of repair to the certified gas measuring apparatus. The need for recertification will be determined by Measurement Canada 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 shall be made readily available to Measurement Canada upon request and shall 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 and the gas measuring apparatus meter proving air temperature shall be continuously monitored. Records of these temperatures shall be maintained and reviewed prior to calibrating the gas measuring apparatus.
- j) Making available to Measurement Canada operating instruction manuals which provide detailed information pertaining to the installation, maintenance, calibration and use of the gas measuring apparatus.

Category: GAS	Specification: GS-ENG-10-2	Page: 8 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

4.6 Statement of Intended Use of the Gas Measuring Apparatus

4.6.1 Limitations

4.6.1.1

The owner shall provide to Measurement Canada a detailed statement of intended use of the gas measuring apparatus. The documentation provided shall 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 shall:

- 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.

4.6.2 Statement of Intended Use - Details

4.6.2.1

The statement of intended use of the gas measuring apparatus shall 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 on 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 5.6,
- d) an identification of the minimum and maximum range of test capabilities (ie humidity, pressure, temperature, flowrate) for which certification of the gas measuring apparatus is requested,
- e) a declaration of the method(s) of meter proving, as set out in clauses 5.5.1 and 5.5.2 herewith,
- f) a declaration of the minimum test volumes and/or meter cycles for the purposes of certification and use requirements.

5.0 Metrological Requirements

5.1 Temperature

5.1.1 The prover room ambient air temperature shall be continuously maintained and monitored at $\pm 1.0^{\circ}\text{C}$ of a 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 $22^{\circ}\text{C} \pm 4^{\circ}\text{C}$ and meet all the requirements under section 5.0 herewith.

5.1.2 The prover room ambient air temperature, the meter outlet air and the gas measuring apparatus meter proving air temperature shall 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.

5.1.3 Prior to and during certification testing, the prover room ambient air temperature shall not vary by more than $\pm 1.0^{\circ}\text{C}$ and $\pm 0.5^{\circ}\text{C}$ over the previous 24 hour and 4 hour periods, respectively.

Category: GAS	Specification: GS-ENG-10-2	Page: 9 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

5.2 Humidity

5.2.1 The owner shall ensure that the relative humidity of the air passing through the nozzles is within the manufacturer's specification for the measuring apparatus.

5.2.2 The owner may either:

- a) Monitor the relative humidity utilizing the gas measuring apparatus sensors and alarm system and/or shut down the meter proving process if the manufacturer's specification is exceeded or,
- b) Condition the meter proving air prior to delivery to the nozzles to ensure that the manufacturer's specification is not exceeded.

5.2.3 Whichever method is utilized an external relative humidity monitor shall be installed to act as an independent record of the status of the meter proving air. The relative humidity reading shown by the gas measuring apparatus must be within $\pm 10\%$ of the relative humidity recorded by the humidity monitor.

5.3 Mechanical Requirements

The sonic nozzle prover installation and operation shall be verified for compliance with the manufacturer's installation instructions and Measurement Canada specifications.

5.3.1 Operational Leak Test

5.3.1.1

The operational leak test procedure shall be incorporated into the use of the gas measuring apparatus and shall be tested for both leak detection capability and repeatability.

5.3.1.2

Operational leak test procedures shall be capable of detecting a leak of 0.25 cubic foot per hour at 2.0 inches of water column or greater using a leak test duration and applied pressure/vacuum designated by the owner. The operational leak test shall be initiated, three consecutive times to verify the reliability and repeatability of the process.

5.3.1.3

The owner shall provide the leak test apparatus, calibrated to the local volumetric standard or another certified reference standard, for the purpose of the operational leak test.

5.3.2 Flow Rate Tests

5.3.2.1

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

5.3.2.2

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

5.3.2.3

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

- a) transfer meters of known accuracy,
- b) production meters of known accuracy,

Category: GAS	Specification: GS-ENG-10-2	Page: 10 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

c) designated transfer meters representing flow rates between 10% to 150% of rated air capacity, and/or

d) selected meter(s) may represent both metric and imperial units of measure with identical flow rates

5.3.2.4

The flow rate test shall be repeated three times at the high load rate and three times at the low load rate to ensure capability and repeatability.

5.3.2.5

Each individual calculated flow rate shall be within $\pm 5\%$ of the designated low and high load rates for the meter being tested.

5.3.3 Register Verification

If the gas measuring apparatus is equipped with a register ratio verification option, and the apparatus is to be certified in inferential mode, it shall be verified. The register ratio option shall 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.

5.4 Meter Classifications and Transfer Meters

5.4.1 Meter Classifications

Meters shown in the statement of intended use shall 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 shall 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 shall be non-converting positive displacement gas meters.

5.4.2.3

Each transfer meter shall be calibrated to possess an error within the range of -2.0% and -3.0% at low and high load rates, and possess a maximum difference between the low load error and the high load error (spread) of 0.3 or less.

5.4.2.4

Transfer meters shall be acclimatized in the area of the gas measuring apparatus for a minimum period of 4 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) Potential transfer meters are exercised for a minimum of 5 minutes at a flow rate not exceeding 50% of the rated air capacity.

Category: GAS	Specification: GS-ENG-10-2	Page: 11 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

b) The meter is to be run six times at both the low and high load rates on the local volumetric standard to determine the meter error.

c) Meters are 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 \bar{x} of percent errors for all six runs (see Table 1 for example).

TABLE 1 - Determination of Meter Repeatability							
Run # 1	Run #2	Run #3	Run #4	Run #5	Run #6	\bar{x} 6 Runs	Acceptable Limits
-2.5	-2.65	-2.47	-2.52	-2.63	-2.48	-2.5	-2.5 ± 0.2

5.4.2.6

The flow rate on the local volumetric standard shall be set to $145 \pm 2.0\%$ and $45 \pm 2.0\%$ of the badged air flow rate of the transfer meter to be tested. For example, the high load 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 rate would be 77.4 cubic feet per hour to 84.6 cubic feet per hour.

5.4.2.7

The flow rate on the gas measuring apparatus shall be set to $145 \pm 5.0\%$ and $45 \pm 5.0\%$ of the badged air flow rate of the transfer meter to be tested. For example, the high load 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 rate would be 72 cubic feet per hour to 90 cubic feet per hour.

5.5 Volume Correlation

5.5.1 Direct Counting Gas Measuring Apparatus

In order to test a direct counting gas measuring apparatus for the purpose of initial certification or recertification, a transfer meter shall 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 and recertification, a transfer meter representing each meter classification listed in the statement of intended use shall be tested.

5.5.3 Correlation

5.5.3.1

Volume correlation shall 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 shall be conducted at the low and high load rates of each meter being tested.

5.5.3.3

Category: GAS	Specification: GS-ENG-10-2	Page: 12 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

Volume correlations shall 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 shall be completed on the same day that the transfer meter acceptability and proof errors were established on the local volumetric standard.

5.5.3.5

Each transfer meter shall be proven six times on the gas measuring apparatus at both the low and high load rates of that transfer meter.

5.5.3.6

For each transfer meter, the percent error for all runs shall be within ± 0.2 the \bar{x} of the percent error of that meter as determined on the local volumetric standard at each flow rate.

5.5.3.7

The requirements of sections 5.5.3, 5.5.4, and 5.6 shall be completed 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 shall 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 shall be adjusted by the owner to register the following errors:

- a) for the purposes set out in clause 5.5.3 a) and b) Only;
 $+2.5 \pm 0.5\%$ and $-2.5 \pm 0.5\%$
- b) for the purposes set out in clause 5.5.3 c);
 $+9.0 \pm 0.5\%$ and $-9.0 \pm 0.5\%$.

5.5.4.2

The transfer meters shall be run six times on the gas measuring apparatus at the high load rates. The \bar{x} of the errors of these six runs shall be used to determine compliance for maximum error detection. The gas measuring apparatus shall be placed in non-converting mode.

5.5.4.3

The percent error of each transfer meter test, as determined on the gas measuring apparatus, shall be within ± 0.2 of the \bar{x} of the percent errors as determined on the local volumetric standard.

5.6 Additional Modes of Operation

5.6.1 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 shall be tested using one transfer meter.

5.6.2 The transfer meter shall be proven six times on the gas measuring apparatus at the high load rate. The \bar{x} of the percent errors of these six runs shall be used to determine compliance for each additional mode of operation.

5.6.3 The percent error of each transfer meter test, as determined on the gas measuring apparatus, shall be within ± 0.2 of the \bar{x} of the percent errors as determined on the local volumetric standard

Category: GAS	Specification: GS-ENG-10-2	Page: 13 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

5.7 Temperature Converting Mode Correlations

5.7.1 The gas measuring apparatus shall be switched to and tested in the temperature converting mode.

5.7.2 The resulting meter errors are adjusted by calculation to compensate for the correction applied by the gas measuring apparatus.

5.7.3 The \bar{x} of the errors, as determined on the gas measuring apparatus, shall be within ± 0.3 of the \bar{x} of the percent errors of the transfer meter determined on the local volumetric standard.

6.0 Technical Requirements

6.1 Weekly Correlation - Transfer Meter / Local Volumetric Standard

6.1.1 Volume correlation of the transfer meter to the local volumetric standard shall 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 $-2.5 \pm 0.5\%$ at a low and high load rates.
- c) using transfer meters which have been acclimatized for a minimum of 4 hours.
- d) using transfer meters which have been constantly exercised at a rate equal to, or less than 15% of the badged flow rate.

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

6.1.3 The transfer meter shall be run six times on the local volumetric standard at both the low and high load rates. The flow rate on the local volumetric standard shall be set to $145 \pm 2.0\%$ and $45 \pm 2.0\%$ of the badged air flow rate of the transfer meter to be tested. The \bar{x} of the percent errors of these runs shall be used to determine the average true errors. These values shall be utilized during correlation of the gas measuring apparatus during the next weekly period.

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

6.2 Daily/Weekly Correlation - Transfer Meter / Gas Measuring Apparatus

To conduct the correlation testing on a weekly basis organizations shall have a system in place to continuously monitor the delta temperature across the meter under test and provide for a notification/indication to operators where the delta T exceeds 0.5 degrees C or 0.9 degrees F. Where the tolerance for delta T has been exceeded, inspection shall be discontinued until the cause has been determined, corrective action developed and implemented.

6.2.1 Volume correlation of the gas measuring apparatus shall be performed:

- a) Once daily/weekly,
- b) using designated non-converting transfer meters from 6.1,
- c) using transfer meters which have been acclimatized for a minimum of 4 hours and,

Category: GAS	Specification: GS-ENG-10-2	Page: 14 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

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.

6.2.2 For direct counting gas measuring apparatus, the transfer meters used shall be representative of the metric or imperial meter class of those meters which have been or are to be verified or reverified that day/week. For inferential gas measuring apparatus, the transfer meters used shall be representative of the metric or imperial meter classification of those meters which have been or are to be verified or reverified that day/week. Daily/Weekly volume correlations need not be performed if gas meters are not to be verified or reverified during that day/week.

6.2.3 Transfer meters shall be run three times on the gas measuring apparatus at both the low and high load rate. The low and high load rates of the gas measuring apparatus shall be set to within $145 \pm 5.0\%$ and $45 \pm 5.0\%$ of the badged air rate of the transfer meter to be tested. The \bar{x} of the percent errors of these three runs shall be used to determine the average true errors, and which shall be within ± 0.2 of the percent error as established against the local volumetric standard within the previous one week period.

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

- a) repeat the correlation process shown in 6.2;
- b) repeat the weekly correlation process, pursuant to clause 6.1;
- c) perform a complete diagnostic analysis/check to ensure the integrity of the gas measuring apparatus.

6.2.5 Where the ± 0.2 allowable tolerance is still being exceeded the following actions shall be taken:

- a) the gas measuring apparatus shall be removed from service and a nonconformance initiated;
- b) the inspection records for meters inspected since the last correlations shall be evaluated to determine if any of the meters inspected during this period could be outside the applicable tolerances;
- c) maintain records of the evaluation
- d) recall meters that are potential outside the tolerance;
- e) re-inspect meters identified

6.3 Operational Leak Detection

6.3.1 An operational leak detection sequence, shall be utilized prior to the final test sequence on all verification, reverification and compliance testing procedures.

6.3.2 The duration of the operational leak test shall be as determined by the owner and specified for the test shown in section 5.3.1 b).

Category: GAS	Specification: GS-ENG-10-2	Page: 15 of 15
Document(s):	Distribution Date: 2010-04-22	Effective Date: 2010-04-22
	Supersedes: S-G-01-E	

6.4 Temperature

6.4.1 The prover room ambient air temperature shall be continuously maintained and monitored at ± 1.0 °C of a 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 $22^{\circ}\text{C} \pm 4$ °C and meet the requirement of section 5.1.

6.4.2 The prover room ambient air temperature, the meter outlet air and the gas measuring apparatus meter proving air temperature shall be within 0.5°C of each other during all verification, reverification or compliance sample testing during the certification period.

6.4.3 Prior to and during all verification, reverification or compliance sample testing, the prover room ambient air temperature shall not vary by more than $\pm 1.0^{\circ}\text{C}$ and $\pm 0.5^{\circ}\text{C}$ over the previous 24 hour and 4 hour periods, respectively.

6.4.4 Temperature records shall be retained for a period of not less than three years.

6.5 Maintenance

6.5.1 The owner shall perform routine maintenance as specified in the manufacturer's and owner's manual. As a minimum, the maintenance and/or calibration of component and sensors shall be performed annually.

6.5.2 Calibration of pressure, temperature and relative humidity sensors shall be performed and referenced to a traceable standard.

6.5.3 Records of maintenance and calibrations shall be maintained as part of the prover log book as per section 4.5.2 g).